FROST SCIENCE

NEEF

Greening STEM Biodiversity Series

Grades 6-8

SUPPORTED BY
Royal Caribbean Group

Overview

In this project, students will engage in a mini BioBlitz by surveying their local surroundings to determine species richness and whether there are native or invasive plant species in their area. Students will document this information and evaluate the possibility of invasive plant removal to improve the biodiversity in the area. Based on their experience, students will share findings with fellow classmates and try to identify similarities, differences and patterns in data collected.

Lesson Objectives

- Students will be able to identify different plants species and the possible consequences of invasive species to a particular area.
- Students will become familiarized with common biological surveying methods.
- Students will be able to apply mathematics concepts to measure and analyze data.

Key Ideas and NGSS (Grades 6-8)

- Biodiversity is the variety of life in an ecosystem or habitat. (MS-LS2-1, MS-LS2-5, MS-ESS3-3)
- Invasive species are those which do not belong in a certain ecosystem but have been introduced and flourished, crowding out native species, and sometimes changing the natural environment. (MS-ESS3-3, MS-LS2-2)

Additional Standards: *Mathematics - 6.RP.A.3.C, 7.RP.A.1, ELA/Literacy – CCRA.L.6, WHST.6-8.2, WHST.6-8.7, WHST.6-8.8*

Scientists survey a quadrant during a BioBlitz.

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.

Native versus Non-Native versus Invasive

Native species are those which occur naturally in the environment. Native species have adapted, over time, to thrive in the conditions where they are found. They help to preserve the biodiversity of an area as the birds, insects, and other organisms that evolved with them in an ecosystem often rely on them for food and shelter. Plus, they support the sustainability and ongoing survival of their environment. For example, think of a mangrove tree *(Rhizophora)*, one of Florida's true native plants; it lives along the coastline thriving off of ample sunlight, a tropical/subtropical climate, and salty water serving as a nursery to marine life while also protecting the coast from storm surge and erosion. Native plants help the local environment flourish by attracting the 'right' bugs and other organisms which oftentimes play a role in reproduction, eat pests, and work to keep the ecosystem in balance.

Mangrove trees *(Rhizophora)*

Non-native species include plants, animals, reptiles, and insects that are found in an area that is not their original, or native, habitat. Non-native species may enter the new environment in a variety of ways including as escaped or released pets, in ballast water discharged by ships, by 'hitch hiking' a ride hidden in cargo on planes, trains, and ships, and are even introduced on purpose by humans to solve a problem. Some non-native species can be introduced and not cause problems for the native environment. However, other non-native species can become invasive.

Invasive species are species that once introduced to an area, overtake the native flora and fauna as they reproduce by outcompeting or even killing native species altering natural ecosystems. Native species often cannot compete with aggressive invasive species who have no natural predators to keep them in balance within the ecosystem. When an invasive species takes over an area, the biodiversity of the ecosystem is threatened. Greater biodiversity increases the sustainability, and the resiliency of an ecosystem. Thus invasive species can do a lot of harm if allowed to spread out of control.

Florida's Invasive Species Challenge

Invasive plants often enter Florida for ornamental or horticultural purposes, agricultural purposes, and accidental introduction. Florida serves as the entry point for three-fourths of the plants imported into the United States, making it no surprise that Florida boasts an incredible number of non-native plant species. Of the over 1,400 species of non-native plants that have been introduced into Florida, around 11% have become established in the environment and about 6% (around 79 species) are considered invasive. Those plants that are invasive are characterized by being adaptable to new habitats, growing aggressively, and have a high reproductive capability which allow them to quickly spread and crowd out native species. The resulting impacts are also economic with Florida alone spending over $500 million a year managing its invasive species problem.

Biological Surveying Methods: BioBlitz

Scientists use a variety of methods to gather data. A BioBlitz is a type of event that presents an opportunity for scientists and the general public to work together to find, record and identify different species. Data recorded can help build species lists and distribution maps helping scientist better understand the level of biodiversity present in a particular area. Digital tools such as mobile applications (SEEK or LeafSnap) or web platforms (iNaturalist) are a very helpful tool to share and make data available so that participants from all around the world can contribute and connect on their findings and shared interests.

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

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 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

Melaleuca trees (*Melaleuca quinquenervia*), originally from Australia, were intentionally introduced to the Everglades in the 1930's to naturally dry out the swampy landscapes in order to decrease the mosquito population as well as aid with further development of the land for agricultural purposes. Over time however, the trees became invasive, flourishing in the tropical environment and displacing native cypress trees and sawgrass. Native wildlife was not adapted to living in a habitat full of melaleuca trees, and thus these forests have displaced them. Further exasperating the problem, melaleuca trees are easily flammable, which can result in forest fires and are very hard to remove once they become rooted in an area.

Melaleuca tree

Melaleuca tree flower

Materials (per student)

- Identification Guides (see first two listings in additional resources)
- Measuring Tape or Ruler
- Data Collection Worksheet(page 9)
- Writing Utensil
- *Optional: Disposal bag or location*
- *Optional: Face cloth covering (for COVID-19 safety and possible allergies)*
- *Optional: Field work attire (closed toe shoes, socks and long pants)*
- *Optional: Gloves*
- *Optional: Small shovel or trowel*
- *Optional: Smartphone, tablet and/or computer with camera and SEEK or LeafSnap apps*

Project Procedure

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

1. **Introduction to Native versus Invasive:** Begin lesson with discussion about invasive versus native species by asking the following:
   - What is a native species? What is an invasive species?
   - How do invasive species typically enter an ecosystem?
   - Why could invasive species be a problem?

Continue discussion of native vs invasive but focusing on South Florida:

- What are some key characteristics that plants native to South Florida may have?
- Can you name any native South Florida plants?
- What might happen if those native plants were replaced with other plants? How about invasive plants?

2. **Mini BioBlitz Project:** Students will conduct a plant survey in their neighborhood or around their school, seeking to identify both native and non-native plants found in their community using the following tools:
   - Recognized identification web-based guides such as Florida Invasive Plant Species (FLIP) mobile field guide: http://www.plantatlas.usf.edu/flip/ and Florida Native Plant Society Online Guide: https://www.fnps.org/plants
   - Technology applications such as SEEK or LeafSnap on a smartphone, tablet or computer *(Optional)*

Discuss the purpose of a plant biodiversity survey:

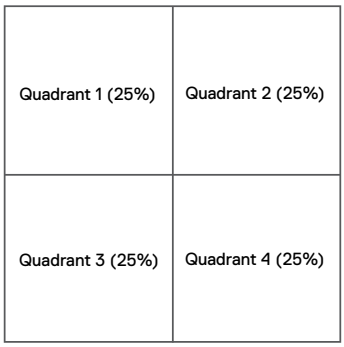
- Why would scientists want to sample how many different plant species are present in an area?
- What do you expect to find in your sample area?
- How will you be calculating species abundance?

3. **Choosing a Sampling Site:**
   a. Though natural areas are preferred, any local public area (home, park or school) will work for this project. Even a vacant lot with weeds could be a potential site!
      i. Tips for choosing a sampling site:
         1. The sample site will ideally consist of at least five different plants.
         2. The sample site should have no more than 25% blank space/grass.
         3. The sample site should be at least 2 ft x 2 ft and no larger than 10 ft x 10 ft.
   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. Students will establish a set perimeter for the surveying area, they may use measuring tape or a ruler to record the size of their plot. It is recommended that students draw their plot and subdivide it into smaller even quadrants that all add up to 100%.

d. Students need to record sampling site information (Site Name, Date, Habitat Type and any other descriptive information) on the Data Collection Worksheet.

e. Students may use measuring tape, sticks, rocks or other temporary markers to establish the plot boundaries. Taking a photo of the plot is suggested.
Optional: Including a ruler or meter stick for scale is a best practice.



Sample site quadrant plot example.

4. Data Collection:

a. Using identification guides or applications, students are to identify plants within their sampling site.
Optional: Take photos of each plant species within a plot.

b. Findings need to be documented. Students are to keep a tally of each different species they find. Use the Data Collection Worksheet for this step as a tool for aggregating the data. Remind students of the importance of using consistent units of measurement (e.g. centimeters, meters, inches, or feet). Data entries could look like the following:

Plant Number	Location(s)	Notes and Possible Identification	Frequency	Plant Area (length x wide)	Plant Abundance ((frequency x area)/total area) x 100%
Plant #1	Quadrant 1	Yellow Daisy			
Plant #2	Quadrant 2	Fern			
Plant #3	Quadrant 3	Mango Tree			

c. To calculate plant abundance at their sample site, students need to note the frequency of a given plant and then calculate the surface area the plant occupies.
   i. Students may use measuring tape or a ruler to record actual size for the area calculation. Remember consistent units of measurement matter!
   ii. Students need to also calculate the total surface area of the sample site.
   iii. Students will then calculate the plant abundance at the site as a percentage of the surface area and note it on the worksheet. Percentages are to be rounded to the nearest one tenth (i.e. 0.1) of a percent.
   iv. Estimates should all add up to about 100% after all calculations have been made, including the percentage of the sample site without any plants.

5. **Data Analysis:**
    a. After surveying has been completed students should take a look at their data (recordings and any photos) and review the following questions:
        i. How many different types of plants did they find?
        ii. What kind of plants did they find? Can they specify their species and scientific name?
        iii. Are those plants classified as invasive or native in South Florida?
        iv. What is a possible consequence of invasive plants in the area that they are surveying?
        v. What percentage of their sampling site is covered by native plants? What percentage is covered by invasive plants? Why would that be?
        vi. Was their sample site located in a landscaped or naturally occurring area?
        vii. How do they think the species they found became established at their sample site?

Example of sample site.

6. *Optional: If they have parental permission and access students may upload any photos taken to SEEK, LeapSnap, or Instagram (for example). They can crosscheck any plants that are identified using the digital tools with their entries. If posting on social media, recommend that they use #BLANK to compare their findings with other students across the county.*
7. ***Biodiversity Action Plan:*** Students are then empowered to design a plan to remove invasive plants from their local area or school property.
    a. Students can evaluate and confirm based on findings whether there are any invasive plants in their sampling site or nearby. Students may use the guides under Additional Resources for this step.
    b. Research the plant in question to determine how it spreads and note any precautions to take before removing it.
        i. For example: Brazilian Pepper can cause rashes in some people and thus you should wear gloves and long sleeves when planning on removing this particular species.
    c. Propose how to remove the invasive plant from their site. This may include mechanical or chemical means. *NOTE: Use of an herbicide requires adult supervision and following all safety precautions.*
    d. If a student is surveying a nearby public area, they can report the invasive by calling 1-888-IVE-GOT1 or online using the IveGot1 app.
    e. If a student is surveying a private property that does not belong to them, such as an apartment complex, students can report their findings to the landlord or property management with the assistance of an adult.
8. **Project Presentations and Reflections:** Students will put together a short presentation based on their personal mini BioBlitz and biodiversity action plan and submit it for review.
    a. As a class, encourage students to share their results with their classmates and discuss the following based on the data or other information they have discovered:
        i. What similarities were there in the findings?
        ii. What differences were there in the findings?
        iii. Are there any patterns forming?
        iv. Does season or time of year matter?
        v. What are some of the different methods proposed for removal?
        vi. If you could do this again what would you change or do differently?
        vii. What are more ways you or a community as a whole can help increase biodiversity?

Optional Extension

As an optional extension activity, some students may be able to apply their biodiversity action plan in their local area. Please encourage them to follow these steps and all safety precautions if they choose to do so:

Identify the plants for removal and obtain permission to remove the plants. Once ready for removal:

1. Use a trowel to dig up smaller plants and a larger shovel to dig up larger plants.
2. Remove as much of the root system as possible to ensure that the plant doesn't grow back again afterwards.
3. Bag the invasive plant leaving no pieces left behind on the ground, and tie it shut, ensuring no parts of the plant poke through or out of the garbage bag before disposing of the bag.

If students are unable to remove the invasive plant due to its size or location, refer them to the resources section to find an agency that may visit their home and remove it for them.

If chemical methods are required for plant removal, students must ask an adult or expert to supervise and assist with the handling any of chemicals. Following all directions for use, any manufacturer recommended safety precautions, and proper PPE is highly recommended.

For the optional extension please note that invasive plant species may have means of protecting themselves such as thorns or even contain chemical irritants that causes rashes or itching. Gloves and long sleeves should always be worn when removing invasive species as a precaution.

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/

Additional Resources

- Florida Invasive Plant Species Mobile Field Guide - http://www.plantatlas.usf.edu/flip/
- Florida Native Plant Society Online Guide - https://www.fnps.org/plants
- FloridaInvasives.org - http://floridainvasives.org/index.cfm (has a list of resources for private landowners to remove invasives)
- Florida Wildflower Foundation - https://flawildflowers.org/invasive-alternatives/ (lists native alternatives to common invasive species)
- Florida Exotic Pest Control Council - https://www.fleppc.org/list/list.htm (lists invasive and non-native exotic plant species in FL as of 2019)
- Global Biodiversity Information Facility - www.gbif.org
- LeafSnap Application
  - Apple Application: https://apps.apple.com/us/app/LeafSnap-plant-identification/id1487972880
  - Google Application: https://play.google.com/store/apps/details?id=plant.identification.snap&hl=en_US&gl=US
- SEEK Application
  - Apple Application: https://apps.apple.com/us/app/seek-by-inaturalist/id1353224144
  - Google Application: https://play.google.com/store/apps/details?id=org.inaturalist.seek&hl=en_US&gl=US

Data Collection Worksheet

Student Name: _____

1. Site Name: _____
2. Date: _____
3. Habitat Type: _____
4. Descriptive Information on Habitat: _____

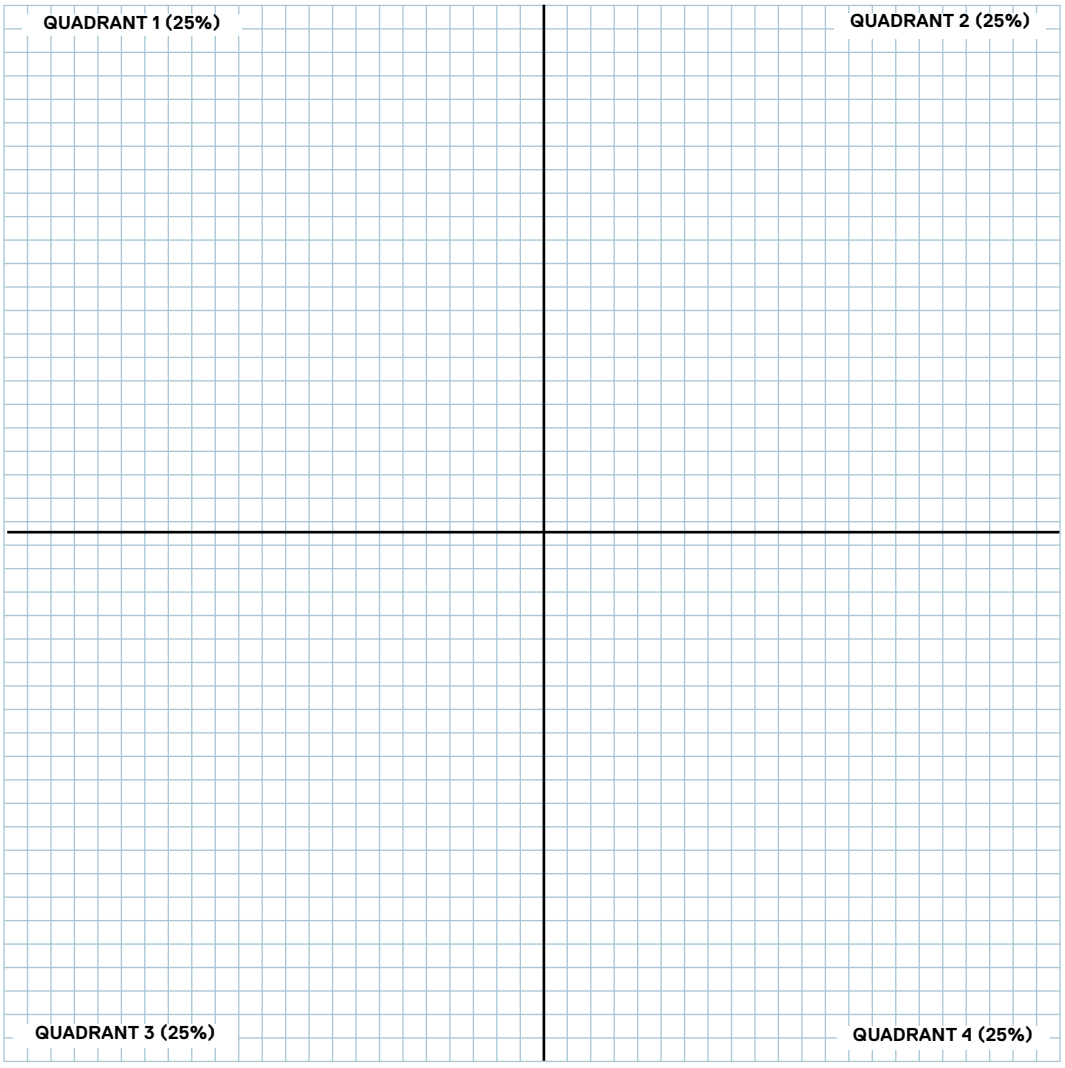
_____

Sampling Site Information

Establish a set perimeter for the surveying area. Divide the area into four equal quadrants and draw what you see as a map with a key or a diagram/sketch.

Site Width: _____

Site Length: _____



Key

Total Area of Site: _____

Data Collection Log

Plant Number	Location(s)	Notes and Possible Identification	Frequency	Plant Area (length x wide)	Plant Abundance (frequency x area)/ total area) x 100%

Biodiversity Action Plan

Use additional paper as needed.