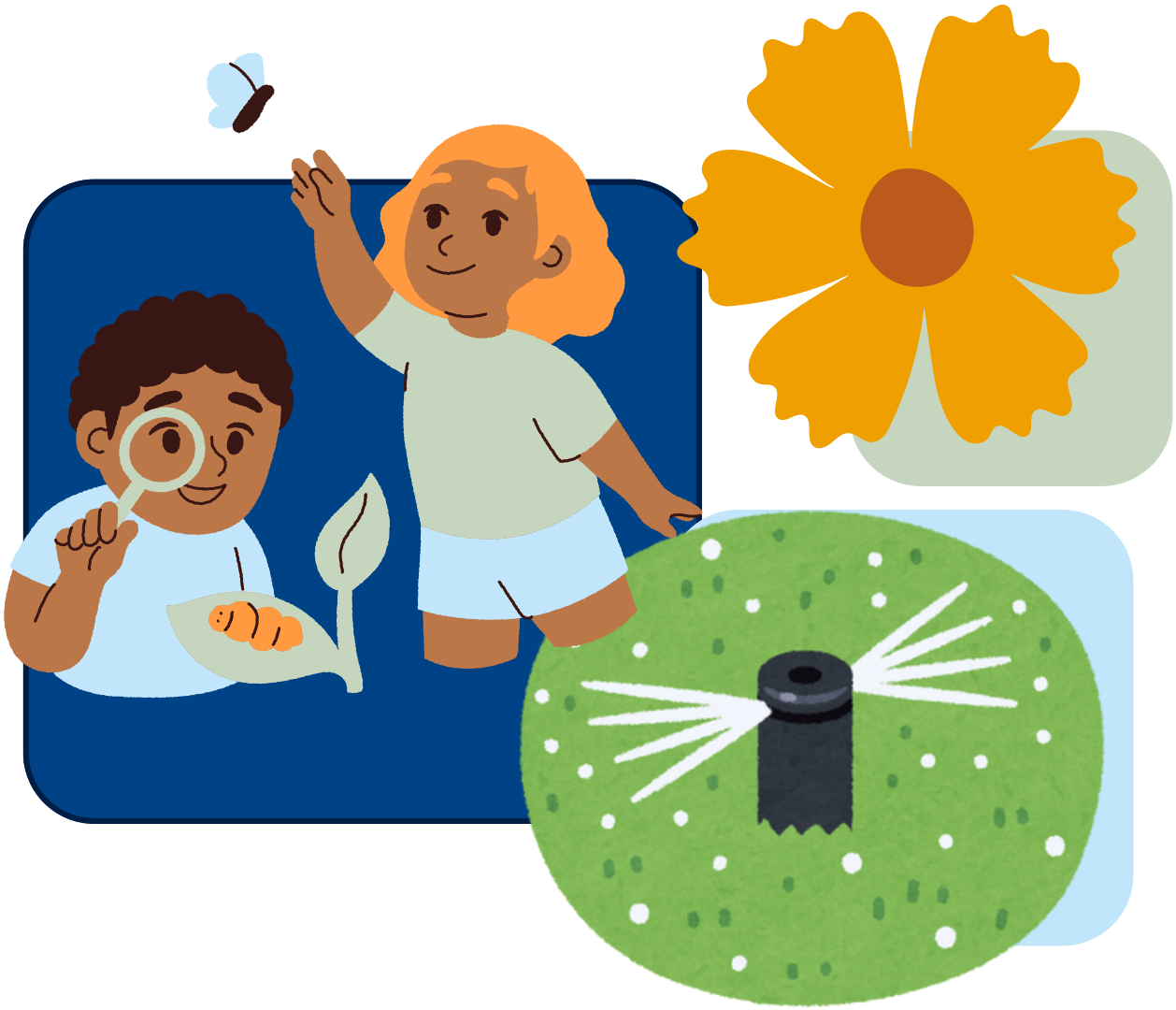
Florida-Friendly Landscaping™ Program

FFL Middle School Lesson Plans



Published on **September 9th, 2025**

Middle School FFL Overview

These lesson plans immerse middle school students in real-world environmental challenges, using the **9 Florida-Friendly Landscaping™ (FFL)** principles to explore sustainability, plant science, and ecosystem health while addressing issues in the ecosystems around them. In this curriculum, students participate in hands-on activities including designing habitat-specific plants, testing water quality, comparing mulched and non-mulched areas, and testing different fertilizer levels to discover how landscaping practices are impacting the wildlife and water quality around the state. Students will learn how human actions impact Florida's resources and develop solutions to protect these resources. Students will be able to implement these lessons to their lives as the lessons connect to real environmental issues.

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Middle School Curriculum Map

FFL Principle	Essential Questions	Florida Standards	Resources/ Materials	Assessments
1- Right Plant, Right Place	What are the basic parts of a plant? How do variations in those parts provide advantages to various environments? How can the structure or physiology of a plant inform where it should be planted?	SC.7.L.15	Instruction slides, worksheet, technology with designing applications or art supplies, site plans, access to online FFL plant guide, large post-it paper or tech for digital sharing	1. Students will design an imaginary plant to fit a particular environment. 2. Students will use plant and site information to match plants with their best fit locations for planting.
2- Water Efficiently	Where does our water come from in Florida? How do our choices affect the quality and availability of water? What can we do in our neighborhoods and schools to protect Florida's water?	SC.7.E.6.6 SC.7.L.17.3 SC.6.N.1.4	FFL principles summaries, worksheets or drawing paper, markers, colored pencils, or access to digital tools, printed article	1. Completed group project 2. Students have presented their project and demonstrated understanding 3. Completed student worksheet/ exit ticket
3- Fertilize Appropriately	How much fertilizer does a plant need?	SC.6.L.14.1 SC.7.L.17.3 SC.8.N.1.6	Images of nutrient deficient and nutrient toxic plants, FFL online plant guide, FFL handbook, fast growing seeds, planting pots and soil, water, different concentrations of fertilizer solutions, labels, markers, rulers, observation journal/worksheet, lab sheet, diagrams of runoff from a farm and before/after images of healthy vs. unhealthy lake	1. Lab Report 2. Journal Observations

4- Mulch	Why is it important to apply mulch?	SC.6.E.7.6 SC.7.L.17.3 SC.8.L.18.4	Time lapse video of mulched vs. non-mulched soil drying out, Worksheet, school map, moisture meter (optional), thermometer, clip board, Data Collection Worksheet, FFL Principle Handbook	Present their findings to the class
5- Attract Wildlife	What is necessary for plants to survive and thrive in a certain location? How do plants interact and impact each other, and how do the plants present impact the other organisms that may be found there? What other factors should be considered when designing a natural area such as a garden, yard or courtyard area to help attract wildlife?	SC.7.L.17.1 SC.7.L.17.2 SC.7.L.17.3 SC.6.N.1.1, SC.7.N.1.1, SC.8.N.1.1 SC.7.N.1.6	FFL Handbook, Florida Friendly and Non-Florida Friendly plants list, technology to use FFL Plants Mobile App, poster board with coloring and art supplies or technology with digital designing applications	Students will create a poster board/blueprint of their own thoughtfully researched and designed natural area from scratch and be able to justify their choices of plants and explain how they will impact the wildlife of the area.
6- Manage Yard Pests	What are the body segments of insects and arthropods? What is the difference between partial and complete metamorphosis? Why are some bugs considered pests?	SC.7.L.17.1 SC.912.L.15.6 SC.912.L.15.7	FFL Handbook, worksheet, markers/crayons, paper, laminated bug body segments, presentation	1. Students will design their bugs in class and present each bug's body segment and explain their bug's metamorphosis. 2. Worksheet contains questions asking students to explain the ecological role of each bug even pests “bad bugs”

7- Recycle Yard Waste	What materials are found in yard waste? What is the Law of Conservation of Mass? Energy? How do plants play a role in recycling carbon? Energy? How can the nutrients and energy in yard waste be conserved? (how recycling impacts ecological footprint?) What (if any) benefits does composting have for native gardens? What scientific evidence can be observed to support the claim?	SC.8.L.18.4 SC.8.N.1.1 SC.8.N.1.3	Presentation slides, composting materials, 2L bottle, worksheet	1. Formative discussions 2. Reflection exit tickets or lab report 3. Written description or model of compost system 4. CER based on data presented
8- Reduce Stormwater Runoff	How does stormwater pollution cause environmental changes?	SC.7.E.6.6 SC.7.L.17.1 SC.7.E.6.3 SC.7.N.1.5	Sample of Clean Water, Sample of Retention Pond Water, Sample of Mystery Water, Test kit from Carolina Biological or similar, stormwater runoff video/images, computers, projector	1. Develop an Environmental Impact (not as detailed) Report to present to peers and administration 2. Lab Sheet
9- Protect Waterfront	How can landscapes be developed to protect the environment? How does wind and water affect the landscape?	SC.7.L.17.1 SC.7.E.6.6 SC.7.E.6.3 SC.7.N.1.5	Presentation, Plastic Tubs, Clay, Newspaper, Rocks, Sand, Water, Fan and wavemaker, landscape template	1. Exit tickets 2. Lab Notebook with research 3. Physical model in a plastic tub of the landscape design

Florida-Friendly Landscaping™ Program

Principle 1:

Right Plant, Right Place

Middle School

Published on **August 7th, 2025**

About This Activity

Title: Right Plant, Right Place

Subject, Grade, Level:
7th Grade Science

Abstract:

This middle school lesson plan integrates Florida-Friendly Landscaping™ (FFL) Principle 1—Right Plant, Right Place—with key life science standards on plant structure, adaptation, and natural selection. Through a blend of direct instruction, creative design, and applied research, students explore how plant adaptations affect survival and reproduction in specific environments. Over two to three class periods, students first learn about plant structure and function, then apply this knowledge to design their own plants tailored to a selected environment. Building on these concepts, students analyze environmental variables in site plans and use the FFL plant guide to select appropriate plant species. Activities promote systems thinking, environmental awareness, and science literacy, culminating in group presentations and a gallery walk. Optional extensions include simulations of natural selection over generations and a discussion on native vs. invasive species, reinforcing the importance of biodiversity and sustainable landscaping practices.

Learning Objectives:

At the conclusion of this activity, participants will be able to:

1. Understand the connection between plant structure and function.
2. Understand that adaptations are variations that allow the organism to survive and reproduce successfully in the environment.
3. Apply this information to choosing the right plant for the right location.

Author: Lisa Fabulich
P.K. Younge Development Research School
Edited by Melody White, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.L.15.1	Recognize that fossil evidence is consistent with the scientific theory of evolution that living things evolved from earlier species.
SC.7.L.15.2	Explore the scientific theory of evolution by recognizing and explaining ways in which genetic variation and environmental factors contribute to evolution by natural selection and diversity of organisms
SC.7.L.15.3	Explore the scientific theory of evolution by relating how the inability of a species to adapt within a changing environment may contribute to the extinction of that species

Timeframe:

This activity is designed to take approximately 60-80 minutes of class time for each 2-3 class periods, plus an extra 10 min if you choose to use the FFL Plants App.

List of Materials

Day 1:

- direct instructions slides
- worksheet with questions
- technology for computer-based design or art supplies for handmade designs

Day 2:

- direct instructions slides
- site plans for each group with hardiness zone, soil drainage, pH, etc
- access to technology for FFL plant guide
- large post-it paper for gallery walk or technology for digital sharing

Procedure and General Instructions (for instructor)

Introduction

Day 1:

1. Introduction (30 min)
   - Introductory lesson on plant structure and function. Discuss variations in those structures that can provide advantages to various environments. Discuss the meaning of 'fitness' as the ability to not just survive, but also to reproduce successfully.

2. (30 min)
   - Students will choose an environment and design their own plant with various characteristics that help their plant to survive and reproduce. Students will complete the worksheet and include a drawing or computer-based design. Students may share their designs and justifications in small groups or in a whole group setting.

Day 2:

3. (25 min)
   - Begin with review of day 1 and discuss structure:function for fitness.
   - Introduce the FFL Principle 1 of "Right Plant, Right Place"
   - Brainstorm varying environmental factors within a yard that may affect species survival and fitness (shade, soil pH, water- low lying, on a slope, quick/slow draining, etc.)

4. (35 min)
   - Provide each group of students a site plan with criteria/constraints that include hardiness zone, soil drainage and pH, etc. Students should use the FFL plant guide to choose at least 6 appropriate plants for their site.

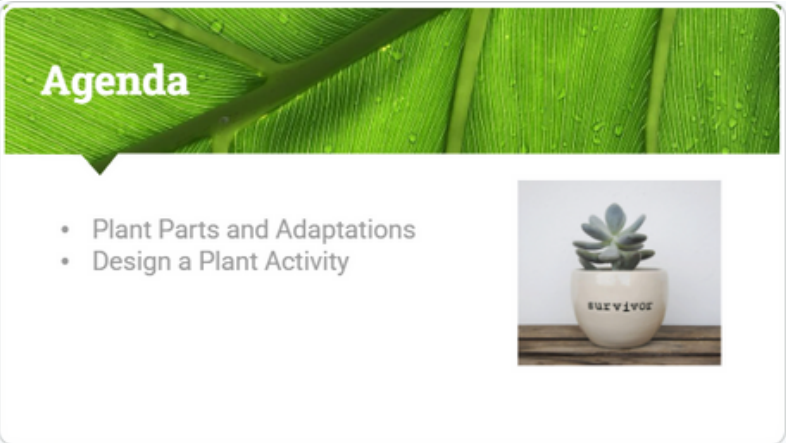
5.
   - Allow students to compare their site plans between groups- Could use a gallery walk style. Include justifications for why each plant was chosen.

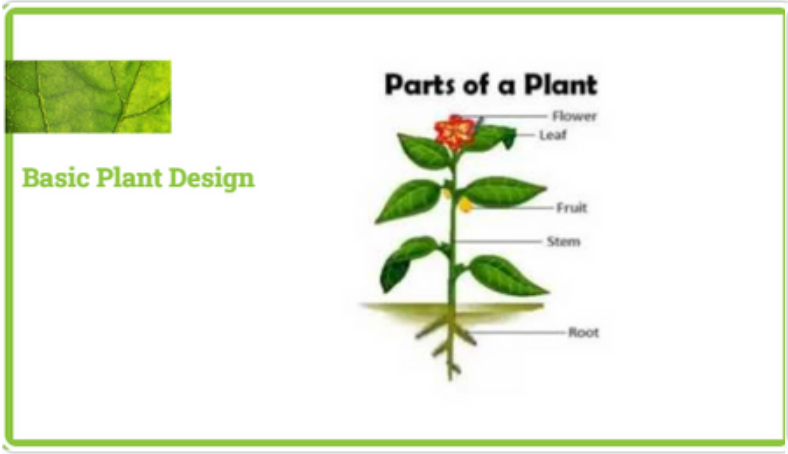
Student Activity Sheets and Assignments

Included with this Activity

1. "Design a Plant" PowerPoint
2. "Design a Plant" Worksheet
3. Landscaping Plants in Florida Plant Information Cards
4. Site Plan Worksheet

Included Slides:





Leaves

- Where photosynthesis takes place
- Captures sunlight and makes food (sugar)
- Exchanges carbon dioxide and oxygen; water may evaporate from leaves
- Dry environments- small to no leaves to avoid water loss; may have a thick cuticle around it to keep water in
- Wet environments- broad leaves

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Stem

- Transport water from the roots and food (sugars) from the leaves around the plant
- Store water and sugar
- Support the plant and prop the leaves out to get to the sun
- Dry environments- thick stem for storing water
- Wet environments- may be thinner
- Will grow in a direction to allow the plant to get more sun if its in a shady area

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Stem

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Flowers

- Brightly colored and sweet smelling to attract pollinators.
- Where reproduction occurs

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Plant Defenses

- Thorns or spikes
- Tough Bark
- Poison
- Movement!

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9

Carnivorous Plants

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Other cool plant adaptations...

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Survival of the FITTEST

Fitness is an organism's ability to survive AND reproduce, passing its genes to the next generation.

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Seed Adaptations

Travels by...	
Wind	 
Water	
Animal Carrier	 
Animal Digestion	 

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Your Challenge...


Use your knowledge of adaptations to design a plant that your client, Crazy Dave, can use in his plant army.

Crazy Dave's criteria is that he needs a plant that has the following requirements:

-well-adapted to its environment

-able to defend from predators (including invading zombies!)

-has seeds with adaptations that allow them to reproduce successfully, making it easier to grow his plant army population

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Your Challenge...

Your constraints (limitations): You get to be VERY creative in this activity, so there are very few limitations in your design this time! As long as the plant has adaptations that allow it to survive in the habitat you chose, you can be as creative as you want!

Your **deliverable** will be the **prototype** that you create.

You will need to include a written description and a drawing or 3D model in TinkerCAD.

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Choose Your Environment

Pick which environment your plant will live in. Keep in mind that your design will need to include **structural adaptations** that 'fit' this environment.

Choose ONE of the following environments:

-desert

-rain forest

-underwater

-tundra

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What adaptations will your plant have to survive in its environment?

Think back to your lesson (and look back at the slides if needed). What adaptations will your plant have to survive in those conditions. Describe at least 2 features of your plant and how that will help them to better survive.

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Defense from Predators

What defenses will your plant have? These could be defenses that hide or protect them, but you can also be creative with adaptations that allow them to go on the offense too!

You can use some of the real plant defenses we talked about in the lesson or design your own adaptations to help Crazy Dave's plant army!

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Plant Seed Adaptations

Crazy Dave needs a large army... that means that the plants need to spread their seeds successfully!

Using the seed adaptations we discussed in the lesson, tell me how your plant will successfully spread its seed to grow its army.

*Hint: Consider the environment where your plant lives... Would it make sense to use water, wind, or animals to help the seeds spread?

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Design a Plant Challenge

Adaptations for the Environment

1. What is the environment where your plant lives?
2. Describe at least 2 structural adaptations it has to better survive in the environment.

Defense from Predators

3. Describe at least 2 adaptations (structural or behavioral) that your plant has to protect itself from predators. Explain HOW each adaptation helps it to defend itself or allows it to better fight off enemies.

Seed Adaptations

4. What adaptations will the seeds of your plant have in order to better spread and therefore grow their plant army population? Be sure to describe HOW those adaptations are useful in the environment you chose.

Sketch or Model of your Plant- This can be a hand-drawn picture or model that is photographed and attached separately or a computer-drawn picture. But it must be YOUR own design. Please do not use something from google images :)

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What are some basic parts of a plant?

Design a Yard that can THRIVE!

Day 2

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Agenda

- Review plant adaptations
- Design a yard applying "Right Plant, Right Place"

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Basic Plant Design

Discuss:

Give examples of how variations in these parts can be a benefit to the plant in a particular environment.

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Florida-Friendly Landscaping™ Principle 1: Right Plant, Right Place

Achieving a healthy, low-maintenance home landscape starts with putting the right plant in the right place. Select plants that match a site's soil, light, water, and climatic conditions.

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Design a Yard!

Work with your team and the criteria and constraints of your site to identify at least 6 species that are well-suited to your yard.

- Choose plants recommended for your USDA Hardiness Zone.
- Choose plants appropriate to your sun/shade patterns (Full sun, partial shade, or shade).
- Choose plants that match your site's water availability (require wet/moist/dry).

https://ffl.ifas.ufl.edu/apps/plants

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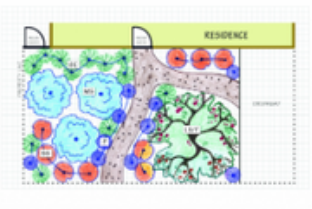
Share your design!



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Design a Plant Worksheet page 1

UF CPET

FFL Principle 1- Right Plant, Right Place
Design a Plant WorkSheet

Name: _____

Date: _____

Adaptations for the Environment

1. What is the environment where your plant lives?

2. Describe at least 2 structural adaptations it has to better survive in the environment.

Defense from Predators

3. Describe at least 2 adaptations (structural or behavioral) that your plant has to protect itself from predators. Explain HOW each adaptation helps it to defend itself or allows it to better fight off enemies.

Design a Plant Worksheet page 2

Seed Adaptations

4. What adaptations will the seeds of your plant have in order to better spread and therefore grow their plant army population? Be sure to describe HOW those adaptations are useful in the environment you chose.

Sketch or Model of your Plant- This can be a hand drawn picture on the back of this page, a 3D model that is photographed and attached separately, a 3D model in TinkerCAD, or a computer-drawn picture, but it must be YOUR own design. Please do not use something from google images ;)

Landscaping Plants in Florida Plant Information Cards

Landscaping Plants in Florida Plant Information Cards

All information and images derived from the Florida-Friendly Landscaping™ Plant Guide

Florida Arrowroot *Zamia integrifolia*

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Can tolerate full/partial shade or full sun

Drought Tolerance: High

Soil:
Any Texture
Well Drained
pH 4.5-8

Appearance: Groundcover

Fun Fact! This poisonous plant is the only larval food plant for the Atala butterfly

Information and images from Florida-Friendly Landscaping™ Plant Guide

Wild Banyan Tree *Ficus citrifolia*

Photos by Ryan Fessenden

Hardiness Zone: 10a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Any Texture
Medium Drainage
pH 4.5-8.0

Appearance: 25-50ft trees, edible fruit

Fun Fact! Shouldn't be planted near drain fields due to aggressive roots

Information and images from Florida-Friendly Landscaping™ Plant Guide

Podocarpus *Podocarpus macrophyllus*

Photos by Ryan Fessenden

Hardiness Zone: 7a to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Sandy
Well Drained
pH 4.5-7.2

Appearance: Large Shrub or Small Tree

Information and images from Florida-Friendly Landscaping™ Plant Guide

Chinese Hibiscus *Hibiscus rosa-sinensis*

Photos by Ryan Fessenden

Hardiness Zone: 5b to 9b

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Sandy Loam
Medium to Well Drained
pH 4.5-6.5

Appearance: Large spreading shrubs with large, colorful flowers

Information and images from Florida-Friendly Landscaping™ Plant Guide

Firebush *Hamelia patens*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any texture
Medium to well drained
pH 4.5-8.0

Appearance: Irregularly shaped spreading shrub with red and orange flowers

Fun Fact! Attracts butterflies, hummingbirds and other birds

Information and images from Florida-Friendly Landscaping™ Plant Guide

Croton *Codiaeum variegatum*

Photos by Ryan Fessenden

Hardiness Zone: 9b to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Low

Soil:
Any Texture
Well Drained
4.5-8.0

Appearance: Irregularly shaped large shrubs

Fun Fact! This species has over 100 variants in a range of colors and shapes.

Information and images from Florida-Friendly Landscaping™ Plant Guide

Ixora *Ixora coccinea*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Not Native

Light Requirements: Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium to Well Drained
pH 4.5-5.5

Appearance: Small, round shrubs with year-round flowers

Information and images from Florida-Friendly Landscaping™ Plant Guide

Scrub Palmetto *Sabal etonia*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Sandy Loam
Well Drained
pH 4.5-8.0

Appearance: Small, shrub palm

Information and images from Florida-Friendly Landscaping™ Plant Guide

Simpson's Stopper *Myrcianthes fragrans*

Photos by Ryan Fessenden

Hardiness Zone: 9b to 11

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: High

Soil:
Any Texture
Well Drained to Wet
pH 6.0-7.2

Appearance: Large Shrub to Small Tree with fine leaves and tiny white flowers that bloom year-round

Information and images from Florida-Friendly Landscaping™ Plant Guide

Powderpuff *Mimosa strigillosa*

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained
pH 4.5-7.2

Appearance: low-growing groundcover with striking pink flowers, tolerates foot traffic and mowing

Fun Fact! Also called the "sensitive plant", the leaves visibly retract when touched

Information and images from Florida-Friendly Landscaping™ Plant Guide

Wild Coffee *Psychotria nervosa*

Photos by Ryan Fessenden

Hardiness Zone: 8b to 11

Native/Non-Native Status: Native

Light Requirements: Full or Partial Shade

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained
pH 6.0-7.2

Appearance: Large, irregularly shaped shrub with tiny white flowers and small, red fruit that provides food for wildlife

Fun Fact! This is NOT the coffee that you drink, and the fruits contain no caffeine.

Information and images from Florida-Friendly Landscaping™ Plant Guide

Maidenhair Fern *Adiantum capillus-veneris*

Photos by Ryan Fessenden

Hardiness Zone: 7a to 11

Native/Non-Native Status: Native

Light Requirements: Partial to Full Shade

Drought Tolerance: Low

Soil:
Any Texture
Medium to Well Drained
pH 6.0-6.8

Appearance: Round spreading fern with fine-textured, delicate leaves

Information and images from Florida-Friendly Landscaping™ Plant Guide

Milkweed *Asclepias* spp.

Hardiness Zone: 8b to 10b

Native/Non-Native Status: Not Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained to Wet
pH 6.0-7.2

Appearance: Upright perennial with large flowers in a range of colors

Fun Fact! These plants are a big food source for caterpillars and butterflies, but all parts are poisonous to humans

Information and images from Florida-Friendly Landscaping™ Plant Guide

Bamboo *Bambusa* spp.

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium Drained
pH 6.0-7.2

Appearance: Large, fast-growing clumping trees

Fun Fact! Grows very aggressively, should not be planted near lakefronts or streams

Information and images from Florida-Friendly Landscaping™ Plant Guide

Trumpet Creeper *Campsis radicans*

Photos by Ryan Fessenden

Hardiness Zone: 4a to 10b

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium Drained
pH 4.5-8.0

Appearance: Spreading vines that can reach up to 40 feet long

Information and images from Florida-Friendly Landscaping™ Plant Guide

Fakahatchee Grass *Tripsacum dactyloides*

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium to Well Drained
pH 4.5-7.2

Appearance: Spreading ornamental grass

Fun Fact! Tolerates flooding and standing water

Information and images from Florida-Friendly Landscaping™ Plant Guide

Site Plan Worksheet
page 1

UF|CPET

FFL Principle 1- Right Plant, Right Place
Develop a Site Plan WorkSheet

Name: _____

Date: _____

Site #1: Gainesville (North-Central Florida)

USDA Hardiness: 9a
Soil: Sandy Loam
Drainage: Well Drained
Soil pH: 5.8-6.5
Notes: Slightly hilly with some areas of canopy from oaks and pines. Occasional frost in the winter and rolling topography creates variations in microclimates. Sloped areas may impact drainage or pooling of water during storms.

Selected Plants:

Common Name	*Scientific Name*	*Sketch*	*Justification- Why will this plant do well?*

Lesson developed by Lisa Fabulich, P.K. Yonge Developmental Research School
Worksheet by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Site Plan Worksheet
page 2

UF|CPET

FFL Principle 1- Right Plant, Right Place
Develop a Site Plan WorkSheet

Name: _____

Date: _____

Site #2: Fort Lauderdale (Coastal, Southeast Florida)

USDA Hardiness: 10b
Soil: Coastal sand and fill
Drainage: Rapid drainage
Soil pH: 7.5-8.0
Notes: Often subjected to full sun exposure and soil that loses moisture rapidly. Urban and suburban areas with the possibility of salt spray closer to the coast. Frequent tropical storms and poor stormwater infiltration can increase flooding risk.

Selected Plants:

Common Name	*Scientific Name*	*Sketch*	*Justification- Why will this plant do well?*

Site Plan Worksheet
page 3

UF|CPET

FFL Principle 1- Right Plant, Right Place
Develop a Site Plan WorkSheet

Name: _____

Date: _____

Site #3: Lakeland (Central Florida)

USDA Hardiness: 9b
Soil: Fine sand
Drainage: Moderate drainage
Soil pH: 6.2-6.8
Notes: This region contains extensive agriculture, especially citruses and livestock pastures. Flat terrain; residential neighborhoods usually include lawns and garden beds. Irrigation is often needed during dryer months, and stormwater runoff from development and agriculture can impact soil.

Selected Plants:

Common Name	*Scientific Name*	*Sketch*	*Justification- Why will this plant do well?*

Site Plan Worksheet
page 4

UF|CPET

FFL Principle 1- Right Plant, Right Place
Develop a Site Plan WorkSheet

Name: _____

Date: _____

Site #4: Key West (Southernmost Florida Keys)

USDA Hardiness: 11a
Soil: Shallow limestone with minimal soil
Drainage: Excessive Drainage
Soil pH: 7.8-8.2
Notes: Built on limestone bedrock with minimal natural soil, Key West is highly vulnerable to saltwater intrusion into the soil and storm surge flooding during tropical storms and hurricanes. Limited freshwater availability and high sun exposure in many areas.

Selected Plants:

Common Name	*Scientific Name*	*Sketch*	*Justification- Why will this plant do well?*

Lesson developed by Lisa Fabulich, P.K. Yonge Developmental Research School
Worksheet by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Site Plan Worksheet
page 5

UF|CPET

FFL Principle 1- Right Plant, Right Place
Develop a Site Plan WorkSheet

Name: _____

Date: _____

Site #5: Tallahassee (Florida Panhandle)

USDA Hardiness: 8b
Soil: Clay Loam
Drainage: Poor drainage with seasonal wetness
Soil pH: 5.5-6.0
Notes: Seasonal wet areas are prone to flooding or poor drainage. Shaded areas and woodland edges are common, and runoff can be significant near low-lying or suburban areas. Temperate climate means the occasional frost in the winter.

Selected Plants:

Common Name	*Scientific Name*	*Sketch*	*Justification- Why will this plant do well?*

Lesson developed by Lisa Fabulich, P.K. Yonge Developmental Research School
Worksheet by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Florida-Friendly Landscaping™ Program

Principle 2:

Water Efficiently

Middle School

Published on **August 11th, 2025**

About This Activity

Title: Water Efficiently

Subject, Grade, Level:
Middle School Science

Abstract:

In this 100-minute middle school classroom activity, “Water Efficiently: Protecting Florida’s Freshwater Through Smart Landscaping,” students explore how human actions affect water availability and quality, and how thoughtful landscape practices can contribute to water conservation. Designed by Jennifer Troy from Newberry High School, this two-day lesson integrates real-world environmental issues with Florida science standards (SC.7.E.6.6, SC.7.L.17.3, SC.6.N.1.4), guiding students through inquiry, discussion, and creative problem-solving. Students learn about Florida’s freshwater sources, common threats like pollution and overuse, and strategies such as using native plants and efficient irrigation. After analyzing a sustainability-focused article, students collaborate in groups to investigate Florida-Friendly Landscaping™ principles and apply their knowledge in a design challenge. By creating a water-efficient landscape plan for their school, students demonstrate their understanding of water-saving strategies and reflect on actionable ways to protect Florida’s environment. This lesson fosters environmental awareness, critical thinking, and civic responsibility in the next generation of stewards.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Recognize that human actions impact water availability and quality.
- Describe basic strategies to reduce water use in their community.
- Explore how landscape practices affect Florida’s freshwater systems.
- Propose ways to make landscapes more water-efficient using Florida-Friendly Landscaping™ principles.

Author: Jennifer Troy
Newberry High School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.E.6.6	Identify the impact that humans have had on Earth, such as deforestation, urbanization, and pollution.
SC.7.L.17.3	Describe and investigate various limiting factors in ecosystems and their impact on population size.
SC.6.N.1.4	Discuss how scientific knowledge changes as new information becomes available.

Timeframe:

This activity is designed to take approximately 100 minutes.

List of Materials

- Printed FFL principle summaries (simplified for middle school)
- Student worksheets or drawing paper
- Markers, colored pencils, or access to digital tools
- Printed article

Procedure and General Instructions (for instructor)

Introduction

DAY 1: (50 minutes)

5 min: Students complete bell work answering questions about where their water comes from.

20 min: Lecture on Florida's water

- Florida's freshwater sources: rivers, aquifers, lakes, springs
- Common uses: drinking, farming, lawns, tourism
- Threats: pollution, overuse, runoff, saltwater intrusion
- Solutions: saving water, using native/Florida-Friendly plants, smarter irrigation

20 min: Article Reading & Discussion

- "Improving Water Resilience Through Environmental Education"
  - Source: Journal of Sustainability Education (2020), a study of Project FLOW in Southwest Florida classrooms licensed under the Creative Commons Attribution License. https://www.susted.com/wordpress/content/improving-water-resilience-through-environmental-education_2020_03/
- Students read individually or in pairs, highlighting or annotating key points about water sources, problems, and solutions.
- Student Discussion/Reflection Questions
  - What is one problem Florida is facing with water?
  - Why does it matter how we water our yards?
  - What's one way to help save water at home or school?
  - What role do plants play in protecting our water?

5 min: Exit Ticket- What is one thing YOU can do to help protect water in Florida?

Procedure and General Instructions (for instructor) cont.

Day 2: (60 Minutes)

5 min: Bell Work: Why is it important to save water in Florida?
30 min: Group Activity: Divide students into 9 groups, each assigned one of the FFL principles.

- Each group reads a short summary and answers the following questions (summary made from IFAS Website).
  a. What does this principle mean?
  b. How does it help save or protect our water?
  c. Can you give an example?

30 min: Water efficient design challenge

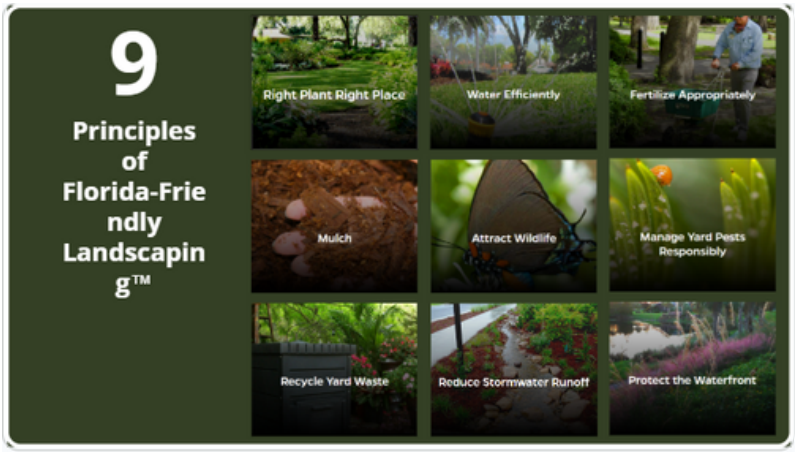
- Your school wants to redesign part of its lawn to save water and protect Florida's environment. Create a plan using 3–4 FFL principles.
- Plan must include:
  - At least 2 Florida-friendly plants
  - A way to reduce water use
  - A method to reduce runoff (mulch, rain garden, etc.)
  - Drawings or labels explaining each part
  - Students can draw their design on paper or use basic drawing tools on a computer.

5 min: Exit ticket- Describe one change that would help your school save water in the landscape

Teacher-Facing Materials

Included with this Lesson

- PowerPoint



1

2

3

4

5

6

Turn Off Automatic Irrigation

- Saves water
- Saves money
- Improves health of lawn

March '06	APR'06	MAY '06	JUNE '06	JULY '06	Aug '06	SEPT '06
33000	20000	14000	9000	12000	16000	33000
72000	85000	42000	32000	44000	26000	17000
29000	39000	45000	15000	26000	22000	17000
42000	40000	30000	5000	19000	21000	32000
0	57000	29000	18000	17000	23000	12000
0	38000	45000	41000	40000	33000	25000
21000	19000	4000	11000	5000	4000	3000
64000	20000	19000	6000	16000	6000	10000
0	0	96000	18000	22000	19000	15000

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

7

Watering to Establish

- "Established" means plant can survive primarily on rainfall
- Promote rapid root growth for establishment

8

Watering Best Practices

Right Plant, Right Place

The right plant in the right place won't need irrigation after it is established

PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

9

Watering Best Practices

Handwater when possible

- Use a can or hose with a nozzle
- Water pots, shrubs, trees, vegetables and beds

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

10

Watering Best Practices

Maintain your irrigation system

- Repair leaks and sprinkler heads
- Point heads at plants
- Prune interfering plants

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

11

Watering Best Practices

Maintain your irrigation system

- Inspect and clean filters and emitters
- Flush system quarterly
- Reset controller seasonally

12

13

14

15

16

17

18

Student Activity Sheets and Assignments

Included with this Activity

1. General design template
2. Guided reading worksheet

General Design Template:

Florida-Friendly Landscaping™ Design Template

Name: _____

Location: _____

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Guided Reading Worksheet

Guided Activities for Teaching and Outreach Resources

UF CPET **Article:** ***Improving Water Resilience Through Environmental Education***

Student Reading Worksheet

Name: _____

Date: _____

Instructions: As you read the article, highlight or annotate and answer the following questions.

Highlight/Annotate:

- ☐ Water Sources
- ☐ Water Challenges
- ☐ Solutions

Guided Reading Questions:

1. What is one major problem related to water that Florida (or other regions) is facing, and what causes it? *Use evidence from the article to support your answer!*

2. How can the way we water our lawns and care for our landscapes either help or harm our water resources? List one practice that can HELP water resources and one that can HARM.

3. What's one realistic action that students, families, or schools could take to use water more efficiently? How would it help?

4. According to the article, how do plants and green spaces help improve water resilience in communities?

5. Reflection: After reading the article, how has your thinking about water conservation or environmental education changed? What's one idea you'd want to share with others?

Activity developed by Jennifer Troy, Newberry High School
Worksheet developed by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Florida-Friendly Landscaping™ Program

Principle 3:
Fertilize Appropriately

Middle School

Published on **August 12th, 2025**

About This Activity

Title: Fertilize Appropriately-
The Goldilocks Principle: Nutrients and Plant Growth

Subject, Grade, Level:
6th- 8th Grade Life Science

Abstract:

This middle school lab-based lesson explores the importance of appropriate fertilization through a hands-on investigation aligned with Florida-Friendly Landscaping™ Principle #3. Students test how different concentrations of fertilizer affect plant growth, applying the "Goldilocks Principle" — not too much, not too little, but just right. Over multiple class periods, students plant seeds, apply varying levels of fertilizer, and observe outcomes such as plant height, leaf color, and overall health. They collect and analyze data to determine optimal nutrient levels while making connections to real-world environmental issues like fertilizer runoff and eutrophication. The activity supports scientific inquiry, reinforces plant biology concepts, and fosters environmental awareness.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Understand that plants need nutrients in specific concentrations.
- Investigate how different nutrient levels affect plant health.
- Analyze experimental results to determine optimal nutrient concentrations for plant growth.
- Understand the role excess nutrients play in affecting water quality.

Author: Christy Giuliano
Kanapaha Middle School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.6.L.14.1	Describe and identify the basic structures of a plant and explain their functions.
SC.7.L.17.3	Describe and investigate how organisms interact with biotic and abiotic components of an ecosystem.
SC.8.N.1.6	Understand that scientific investigations involve collecting evidence, identifying variables, and interpreting data.

Timeframe:

This activity is designed to take approximately 2-3 days of class, (with additional days 4-21 for observations of plants only) 45-60 minutes each day.

List of Materials

- Show images of plants with nutrient deficiencies and nutrient toxicities.
- Free FFL Handbook: https://ffl.ifas.ufl.edu/media/fflifasufledu/docs/FFL-Handbook_revisions03062024_web_new_zone_map.pdf
- Fast Growing Seeds (radish or bean)
- Planting Pots
- Potting soil
- Water
- Fertilizer solutions at different concentrations (none, low, optimal, high)
- Labels and markers
- Rulers
- Observation journal or worksheets
- Lab Sheet
- Notes table

Visuals:

- Diagram of a farm with rain causing fertilizer runoff into a water body.
- Before-and-after image of a healthy lake vs. a eutrophic lake (green with algae).
- FFL 3 Power Point

Important Note:

Differentiation Suggestion:
Basic learners: Fill-in observation journals
On-level learners: Write a full lab report
Advanced learners: Present findings or explain real-world applications (e.g., eutrophication in water systems)
Activity Set-Up:

1. Prepare slides with images of plants with nutrient deficiencies and nutrient toxicities.
2. Set up Lab
3. Observe plants
4. Wrap up/ Discussion

Teacher Notes (for setup)

- Fertilizer can be diluted in water to create the various concentrations.
  - 25%: Mix 1 part fertilizer with 3 parts water
  - 100%: Use the manufacturer's recommended amount
  - 200%: Double the recommended amount
- Keep lighting, pot size, and watering schedule consistent across all groups.

Extension (Optional): Students research how different nutrients (nitrogen, phosphorus, potassium) affect specific parts of plant growth and present them to class.
Real-world connection: Interview a gardener or agricultural expert

Procedure and General Instructions (for instructor)

Introduction

Introduction: (10 minutes)

- Pose the question: “Can plants have too much of a good thing?”
- Show images of plants with nutrient deficiencies and nutrient toxicities.
- Ask students to hypothesize what happened in each case.
- **Connect to FFL principle #3**

Lab Activity: Day 1 Set-up

- Students plant seeds in identical pots with the same soil and lighting conditions.
- Each group receives a different fertilizer concentration:
- **Group A:** No fertilizer (deficient)
- **Group B:** Low concentration
- **Group C:** Package concentration
- **Group D:** High concentration (over-fertilized)
- Students predict outcomes

(Day 2–21 Ongoing Observations)

- Allow seeds to germinate for 7-10 days
- After 5–7 days, have students:
- Measure plant height
- Observe leaf color and plant health
- Record data
- Compare growth rates and appearance among groups
- On day 8 -10 apply fertilizer
- On day 15-21, have students:
- Measure plant height
- Observe leaf color and plant health
- Record data

Wrap-Up & Discussion

- What concentration worked best?
- How does this relate to farming and ecosystems?
- Discuss overuse of fertilizer in agriculture and its impact on ecosystems (eutrophication)

Teacher-Facing Materials

Included with this Lesson

- PowerPoint

Christy Giuliano

Kanapaha Middle School

Principle #3 Fertilizer

Principle # Mulch

1

The Goldilocks Principle: Nutrients and Plant Growth

A hands-on investigation for 6th-8th grade students to discover how plants, like Goldilocks, need nutrient levels that are "just right" - neither too little nor too much.

2

Lesson Overview

Grade Level	Duration
6th-8th Grade Life Science	2-3 class periods (45-60 minutes each)

Objective

Students will investigate how different nutrient levels affect plant health and determine optimal concentrations for growth.

Standards:

SC.6.L.14.1 – Describe and identify the basic structures of a plant and explain their functions.

SC.7.L.17.3 – Describe and investigate how organisms interact with biotic and abiotic components of an ecosystem.

SC.8.N.1.6 – Understand that scientific investigations involve collecting evidence, identifying variables, and interpreting data..

3

Engage: The Central Question

"Can plants have too much of a good thing?"

Show students images of plants with:

- Nutrient deficiencies
- Optimal growth
- Nutrient toxicities

Have students hypothesize what happened in each case.

4

Explore: Controlled Investigation

1	**Group A** No fertilizer (deficient)
2	**Group B** Low concentration
3	**Group C** Optimal concentration (per package instructions)
4	**Group D** High concentration (over-fertilized)

Students plant seeds in identical conditions, varying only the fertilizer concentration. They predict outcomes and record initial observations.

5

Materials Needed

- Fast-growing seeds (radish or bean)
- Small planting pots or seed trays
- Potting soil
- Fertilizer solutions (none, low, optimal, high)
- Labels and markers
- Rulers
- Observation journals
- Digital camera/tablets (optional)

6

Explain: Data Collection

1 — **Days 1-4**
Initial germination and setup

2 — **Days 5-7**
Measure plant height, observe leaf color and health, record data

3 — **Days 8-10**
Compare growth rates and appearance among groups

4 — **Final Day**
Discuss why too little nutrients stunt growth and why too many can damage roots or cause toxicity

7

Classroom Connection:

- In class, we observed how **nutrient levels affect plant growth**.
- Similarly, excess nutrients in nature cause **imbalances**, not better growth.
- How does this relate to farming and ecosystems?

Visuals:

- Diagram of a farm with rain causing fertilizer runoff into a water body.
- Before-and-after image of a healthy lake vs. a eutrophic lake (green with algae).

8

Elaborate: Real-World Connections

Agricultural Impact

Discuss the overuse of fertilizer in agriculture and its impact on ecosystems, including eutrophication of water bodies.

Connect classroom findings to farming practices and environmental concerns.

9

Assessment & Extensions

Formative Assessment

- Observation journals
- Group discussions
- Hypothesis revisions

Summative Assessment

- Lab report with hypothesis, data, conclusion

Extensions

Research how different nutrients (N, P, K) affect specific aspects of plant growth and present findings to class.

10

Student Activity Sheets and Assignments

Included with this Activity

1. FFL 3 Power Point
2. Lab Worksheet
3. Notes Worksheet

Included Slides:

Can Plants Have Too Much of a Good Thing?

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

1

Important Soil Nutrients

Nitrogen

Role in Plants: Key component of chlorophyll, important for making proteins, enzymes and plant tissues. Supports growth and helps make sure plants can grow and photosynthesize.

In the Soil: Usually comes from soil microbes that convert it into usable forms. One common form, nitrate (NO_3^-) is very mobile and can easily leak out of sandy soils with heavy rainfall.

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

2

Nitrogen

What about too much nitrogen?

Can lead to weak overgrowth, weak stems and plant may prioritize stem growth over fruit/flowers

3

Why it Matters

Nitrogen

Too little → Plants grow slowly and turn pale green or yellow

Too much → Fast, weak growth

Environmental Impact: extra nitrogen can leach out of the soil and pollute waterways, leading to contamination and algae blooms

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

4

Important Soil Nutrients
Phosphorus

Role in Plants: Important for DNA, ATP (energy) and root and flower development. It helps promote strong growth and flowering and fruiting.

In the Soil: Binds tightly to many components in the soil and is fairly immobile- it can accumulate quickly and is does not leach out easily. Most of the phosphorus that is lost in soil is lost through erosion as the soil washes away.

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

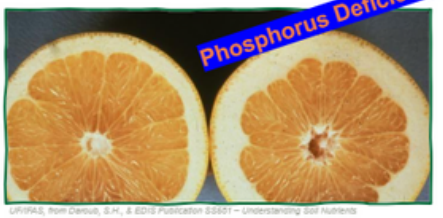
5

UF/IFAS, from Broschat, T.K. (2016). Nutrient Deficiencies in Landscape and Field Crops.

Phosphorus

What about too much phosphorus?

Can harm native plants and contribute to algae blooms



UF/IFAS, from Daroub, S.H., & EDIS Publication SS601 – Understanding Soil Nutrients

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

6

Important Soil Nutrients
Phosphorus

Too little → Slows growth, leaves may turn dark green, reduces flowering and production of fruit

Too much → Can block uptake of other nutrients, may harm native plants that prefer low-phosphorus soils

Environmental Impact: Many soils in Florida already have enough phosphorus- adding too much can harm native plants and contribute to pollution that can cause algae blooms.

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

7

Important Soil Nutrients
Potassium

Role in Plants: Helps regulate water movement in and out of leaves, photosynthesis and enzymes. It helps with resistant to drought and disease.

In the Soil: Exists in three forms, fixed in clay, exchangeable and soluble. Plants readily absorb the soluble form.

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

8

UF/IFAS, from Broschat, T.K. (2016). Nutrient Deficiencies in Landscape and Field Crops.

Potassium

What about too much potassium?

Interferes with the uptake of other essential nutrients like magnesium, calcium, and nitrogen.

UF/IFAS, from Broschat, T.K. (2016). Nutrient Deficiencies in Landscape and Field Crops.

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

9

Important Soil Nutrients
Potassium

Too little → Leaves develop yellowing or brown edges and become less resistant to drought, cold and disease

Too much → Can block uptake of other nutrients and can damage root development and lead to weak structure

Environmental Impact: Less mobile than nitrogen or phosphorus but can leach

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

10

Sources

- UF/IFAS Gardening Solutions https://gardeningsolutions.ifas.ufl.edu/care/fertilizer/fertilizer-basics.html
- UF/IFAS Soils and Nutrient Management https://soils.ifas.ufl.edu/nutrients/overview/
- UF/IFAS Gardening Solutions https://gardeningsolutions.ifas.ufl.edu/water/articles/how-do-my-yard-care-practices-affect-our-water.html

Prepared by Morgan Nielsen, Center for Precollegiate Education and Training, University of

11

Lab Worksheet page 1:

UF|CPET

FFL Principle 3- Fertilize Appropriately
The Goldilocks Principle: Nutrients and Plant Growth
Lab Worksheet

Name: _____ **Partner:**_____

Date: _____ **Partner:**_____

Class: _____ **Partner:**_____

Objective: To investigate how different concentrations of nutrients affect plant growth.

Background

Plants need the right amount of nutrients to grow properly. Too few nutrients can lead to poor growth, while too many nutrients can harm or even kill the plant. In this lab, you will observe how varying amounts of fertilizer affect plant development over time.

Materials (Per Group)

- 4 small pots or cups with drainage
- Potting soil
- Radish or bean seeds (4 per pot)
- Water
- Measuring cups or droppers
- Labels or tape
- Ruler (cm)
- Observation Journal or worksheet
- Fertilizer solutions
    - **Group A:** No fertilizer (0%)
    - **Group B:** Low concentration (25%)
    - **Group C:** Optimal concentration (100%)
    - **Group D:** High concentration (200%)

Directions

Day 1: Setup

1. **Label** each pot with the treatment group (A, B, C, D).
2. **Fill** each pot with the same amount of soil.
3. **Plant** 2–3 seeds in each pot (same depth).
4. **Water** each pot with its assigned fertilizer concentration (use the same amount of liquid).
5. **Place** all pots in the same environment (sunlight or grow light).
6. **Record** your hypothesis in the table on the next page.

Christy Giuliano, Kanapaha Middle School
Edited by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Lab Worksheet page 2:

Hypothesis: Predict what will happen to the plants in each group

Group	Prediction
A (0% fertilizer)	
B (25% fertilizer)	
C (100% fertilizer)	
D (200% fertilizer)	

Daily Observations (Suggested: 7 days)

Record height, color, leaf health, and any other noticeable features.

Day	Group A Height (cm)	Group B Height (cm)	Group C Height (cm)	Group D Height (cm)	Notes (color, leaves, etc.)
1					
2					
3					
4					
5					
6					
7					

Data Analysis

1. Which group grew the tallest on average?

2. Which group(s) showed signs of nutrient deficiency? (yellow leaves, stunted growth)

3. Which group(s) showed signs of nutrient toxicity? (brown edges, wilting)

4. What concentration appeared to be best for plant health?

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Edited by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Lab Worksheet page 3:

Conclusion

Write a short paragraph explaining what you learned about how nutrient concentrations affect plant growth. Use evidence from your data.

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Notes Worksheet:

UF CPET

FFL Principle 3- Fertilize Appropriately
Too Much of a Good Thing? Student Notes Sheet

Nutrient	*Role in Plants*	*Effects of Too Much*	*Effects of Too Little*	*Environmental Impacts*
Nitrogen				
Phosphorus				
Potassium				

Lesson Plan by Christy Giuliano, Kanapaha Middle School
Resources Developed by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Florida-Friendly Landscaping™ Program

Principle 4:

Mulch

Middle School

Published on **August 13th, 2025**

About This Activity

Title: Mulch Matters

Subject, Grade, Level:
Middle School Science

Abstract:

This middle school lesson introduces students to the ecological and functional benefits of mulch as outlined in Florida-Friendly Landscaping™ Principle #4. Through classroom discussion, visual demonstrations, and a schoolyard observation activity, students explore how mulch conserves soil moisture, regulates temperature, reduces erosion and weeds, and contributes to nutrient cycling. Aligned with key science standards, the lesson includes hands-on data collection and collaborative group roles to encourage engagement and critical thinking. Students assess mulched areas around campus and present their findings, building awareness of sustainable landscaping practices and their impact on local ecosystems.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Understand the ecological and practical importance of mulching by examining how mulch
  - Conserves soil moisture
  - Regulates soil temperature
  - Reduces weed growth
  - Adds organic matter
  - Prevents erosion

Author: Christy Giuliano
Kanapaha Middle School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.6.E.7.6	Differentiate among radiation, conduction, and convection, the three mechanisms by which heat is transferred through Earth's system. (linked when discussing how mulch affects soil temperature)
SC.7.L.17.3	Describe and investigate various limiting factors in ecosystems and their impact on native populations. (linked to mulch as it relates to water retention and plant health)
SC.8.L.18.4	Cite evidence that living systems follow the Laws of Conservation of Mass and Energy. (linked when discussing nutrient cycling in mulched vs. bare soil systems)

Timeframe:

This activity is designed to take approximately 75 minutes of class time, 1-2 classes.

List of Materials

- Time lapse video of mulched vs. non-mulched soil drying out
- Free FFL Principle #4 Mulch:
- ffl.ifas.ufl.edu/media/fflifasufledu/docs/FFL-Handbook_revisions03062024_web_new_zone_map.pdf
- Worksheet
- School map
- Moisture meter (optional)
- Thermometer for measuring soil temperature
- Clip board
- Data Collection Worksheet

Important Note:

Scaffolding and Support
For Struggling Learners or ELLs:

- Provide **sentence starters** and **word banks** (e.g., "Mulch helps plants by…" or "I observed that…").
- Offer **visual vocabulary cards** (e.g., erosion, mulch, temperature).
- Allow oral instead of written reflection if needed.
- Use **peer support or buddy system**.

Extension for Advanced Learners

- Have students research different types of mulch (pine bark, straw, compost) and their pros/cons.
- Ask them to **design an experiment** to test mulch types or long-term effects on plant growth
- Integrate **data graphing** and analysis (e.g., line graphs of soil temperature or moisture).
- Connect with SC.8.L.18.4 by mapping nutrient cycles with and without mulch.

Assessment Suggestions:
Formative:

- Observe group work, participation in discussion.
- Use student worksheet as informal check for understanding.

Summative:

- Student **presentations** (can be visual, oral, or written).
- Optional **exit slip**: "One way mulch helps the environment is…"

Procedure and General Instructions (for instructor)

Introduction

1. **Introduction (5-7 min)**
   - Ask: “Have you ever seen wood chips or straw around trees and plants? Why do you think they’re there?”
   - Show a quick time-lapse video of mulched vs. non-mulched soil.
   - https://youtu.be/uYdxlBhj254?si=Fe3MsHaOjoFODMfZ

2. **Student Handout:** What Is Mulch and Why Is It Important?
   - Principle #4 Mulch Florida Friendly Landscaping Program

3. Look at school map and assign students different areas to observe **(5-10 minutes)**

4. **Complete data collection (25 minutes)**
   - Place students into groups with pre-assigned tasks (scribe, data collector, artist, etc) and location determined before activity begins- set a time limit and monitor students.

Student Activity Sheets and Assignments

Included with this Activity

1. What is Mulch Handout
2. Student Worksheet: Observation and Reflection Log

What is Mulch Handout:

UF CPET

FFL Principle 4- Mulch Matters

Student Handout: What is Mulch and Why Is It Important?

What is Mulch?

Mulch is a protective layer of material placed on top of the soil. It can be made of organic materials like wood chips, leaves, straw, or grass clippings, or inorganic materials like rocks or plastic sheeting.

Why Do We Use Mulch?

Mulching helps improve the health of plants and the environment. Here's how:

1. **Retains Moisture**
   Mulch covers the soil and reduces water evaporation, helping plants stay hydrated longer.

2. **Regulates Soil Temperature**
   It keeps the soil cooler in the summer and warmer in the winter.

3. **Prevents Weed Growth**
   Mulch blocks sunlight from reaching weed seeds, stopping them from growing.

4. **Reduces Erosion**
   It protects soil from being washed away by rain or blown by wind.

5. **Adds Nutrients**
   Organic mulch breaks down over time and returns nutrients to the soil.

Student Worksheet: Observation and Reflection Log page 1:

UF CPET

FFL Principle 4- Mulch Matters
Student Worksheet: Observation and Reflection Log

Name: _____ Date: _____ Class: _____

Part 1: Experiment Observation AREA:_____
Directions: Fill out the table below while observing on school grounds

Observation Date:	Areas with Mulch	Areas without Mulch
Weed Growth		
Soil Temperature		
Water/Moisture Content		
Notes (smell, texture, appearance)		
Sketch of area and location		

Christy Giuliano, Kanapaha Middle School
Edited by Morgan Nielsen, Center for Precollegiate Education and Training, University of Florida

Student Worksheet: Observation and Reflection Log page 2:

Part 2: Reflection Questions

1. What differences did you notice between the areas of mulched and unmulched soil?

2. How do you think the mulch will affect water retention?
   ☐ It will hold more water ☐ It will hold less water ☐ No change

   Why?

3. Do you think mulch is helpful for plant health? Why or why not?

4. What would you say to someone who says mulch is just for decoration?

Christy Giuliano, Kanapaha Middle School
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Florida-Friendly Landscaping™ Program

Principle 5: Attract Wildlife

Middle School

Published on **August 13th, 2025**

About This Activity

Title: Attracting Wildlife: Landscape Architects

Subject, Grade, Level:
Middle School Science

Abstract:

This middle school lesson immerses students in the principles of Florida-Friendly Landscaping™ through the lens of wildlife habitat design. Aligned with FFL Principle 5 – Attract Wildlife – the lesson empowers students to explore the ecological relationships between Florida-Friendly plants and animals, trophic levels, and the importance of designing sustainable natural spaces. Over the course of approximately two hours, students engage in hands-on classification of Florida Friendly and Non-Florida Friendly plants, explore plant-animal interactions, and use scientific inquiry skills to design a landscape blueprint that supports biodiversity. By creating and presenting their own habitat plans, students demonstrate an understanding of ecological balance, responsible landscaping, and environmental stewardship, while reinforcing core life science and scientific thinking standards.

Learning objectives:

At the conclusion of this activity, participants will have:

- Learned how to design a landscaped area in a way that attracts and provides a habitat for Florida fauna and why it is important to mindfully design landscaping to support a wide range of species.

Author: Alex Horvath and Morgan Nielsen
UF Center for Precollegiate Education and Training

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.L.17.1	Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.
SC.7.L.17.2	Compare and contrast relationships among organisms, including mutualism, predation, parasitism, competition, and commensalism.
SC.7.L.17.3	Describe and investigate limiting factors in local ecosystems (e.g. food, water, light, space, nesting sites, disease, parasitism, predation) and their impact on Florida wildlife populations.
SC.6.N.1.1, SC.7.N.1.1, SC.8.N.1.1	Plan and carry out investigations, use scientific reference materials, define problems, identify variables, collect and interpret data, analyze results, make predictions, and defend conclusions. These scientific inquiry benchmarks support how students evaluate habitat design.
SC.7.N.1.6	Explain that empirical evidence is the cumulative body of observations of natural phenomena on which scientific explanations are based—this underpins claim-making in habitat design projects.

Timeframe:

This activity is designed to take approximately 2 hours of class time.

List of Materials

- FFL Handbook - Available for free online through UF IFAS
- List of Florida-Friendly and Invasive plants- specific to the certain area and in any of the listed formats depending on classroom needs
- FFL Plants Mobile App (if technology is available)
- Poster board with coloring and art supplies OR laptops/iPads capable of preparing digital images

Activity Set-Up:

- Prepare grade-appropriate lecture materials focused on local FFL “Attracting Wildlife” content.
- Create plant and wildlife ID cards or slideshows featuring both Florida-Friendly and Invasive species.
- Ensure the FFL Plant Guide app is available on devices (if needed), and gather all supplies for posters or presentations.

Procedure and General Instructions (for instructor)

Introduction

1. **Introductory Lesson based on FFL Principle 5** (20min)
   - Talk about the importance of plants as a habitat and how the distribution of plants can impact what animals will be found in that habitat.
   - Can also begin to discuss topics such as trophic levels and introduce the idea of biotic and abiotic factors.

2. **Students identify common landscaping plants** (20min)
   - Have students work together to identify (from a series of pictures) which common landscaping plants are Florida-Friendly vs Invasive. This could be done as either a "card game" type activity where each group receives a deck of cards with each of the plants or as a gamified PowerPoint or online quiz game where teams can earn points or a prize for correct answers.

3. **Matching Plants to Animals** (20min)
   - Have students consider what types of plants that may attract local species. Depending on grade level, can also provide a list of Florida-Friendly animal species that may rely on local plant growth. Remind students of "right plant right place" as it relates to their community. Depending on technology availability for the class, introduce the FFL plants mobile app and show students some of the Florida-Friendly plants they could use.

4. **Design Your Own Landscape** (1 hour)
   - Show students some examples of a gardening/landscaping plan and challenge them to design a landscaping area of their own from scratch. Students will need to prepare full renderings of their plan (either sketched and colored with markers/colored pencils/crayons or a digital mock-up with images depending on technology options) and include at least four specific, Florida-Friendly species with descriptions of the wildlife that they attract and what makes those species an appropriate choice for that location.

5. **Presentations** (20min)
   - Have students present and display their plans, offering feedback to one another

Student Activity Sheets and Assignments

Included with this Activity

- Landscaping Plants in Florida Plant Information Cards

Included Plant Cards:

Landscaping Plants in Florida Plant Information Cards

All information and images derived from the Florida-Friendly Landscaping™ Plant Guide

Florida Arrowroot *Zamia integrifolia*

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Can tolerate full/partial shade or full sun

Drought Tolerance: High

Soil:
Any Texture
Well Drained
pH 4.5-8

Appearance: Groundcover

Fun Fact! This poisonous plant is the only larval food plant for the Atala butterfly

Information and images from Florida-Friendly Landscaping™ Plant Guide

Podocarpus *Podocarpus macrophyllus*

Photos by Ryan Fessenden

Hardiness Zone: 7a to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Sandy
Well Drained
pH 4.5-7.2

Appearance: Large Shrub or Small Tree

Information and images from Florida-Friendly Landscaping™ Plant Guide

Wild Banyan Tree *Ficus citrifolia*

Photos by Ryan Fessenden

Hardiness Zone: 10a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Any Texture
Medium Drainage
pH 4.5-8.0

Appearance: 25-50ft trees, edible fruit

Fun Fact! Shouldn't be planted near drain fields due to aggressive roots

Information and images from Florida-Friendly Landscaping™ Plant Guide

Chinese Hibiscus *Hibiscus rosa-sinensis*

Photos by Ryan Fessenden

Hardiness Zone: 5b to 9b

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Sandy Loam
Medium to Well Drained
pH 4.5-6.5

Appearance: Large spreading shrubs with large, colorful flowers

Information and images from Florida-Friendly Landscaping™ Plant Guide

Firebush *Hamelia patens*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any texture
Medium to well drained
pH 4.5-8.0

Appearance: Irregularly shaped spreading shrub with red and orange flowers

Fun Fact! Attracts butterflies, hummingbirds and other birds

Information and images from Florida-Friendly Landscaping™ Plant Guide

Ixora *Ixora coccinea*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Not Native

Light Requirements: Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium to Well Drained
pH 4.5-5.5

Appearance: Small, round shrubs with year-round flowers

Information and images from Florida-Friendly Landscaping™ Plant Guide

Croton *Codiaeum variegatum*

Photos by Ryan Fessenden

Hardiness Zone: 9b to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Low

Soil:
Any Texture
Well Drained
4.5-8.0

Appearance: Irregularly shaped large shrubs

Fun Fact! This species has over 100 variants in a range of colors and shapes.

Information and images from Florida-Friendly Landscaping™ Plant Guide

Scrub Palmetto *Sabal etonia*

Photos by Ryan Fessenden

Hardiness Zone: 9a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: High

Soil:
Sandy Loam
Well Drained
pH 4.5-8.0

Appearance: Small, shrub palm

Information and images from Florida-Friendly Landscaping™ Plant Guide

Simpson's Stopper *Myrcianthes fragrans*

Photos by Ryan Fessenden

Hardiness Zone: 9b to 11

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: High

Soil:
Any Texture
Well Drained to Wet
pH 6.0-7.2

Appearance: Large Shrub to Small Tree with fine leaves and tiny white flowers that bloom year-round

Information and images from Florida-Friendly Landscaping™ Plant Guide

Powderpuff *Mimosa strigillosa*

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained
pH 4.5-7.2

Appearance: low-growing groundcover with striking pink flowers, tolerates foot traffic and mowing

Fun Fact! Also called the "sensitive plant", the leaves visibly retract when touched

Information and images from Florida-Friendly Landscaping™ Plant Guide

Wild Coffee *Psychotria nervosa*

Photos by Ryan Fessenden

Hardiness Zone: 8b to 11

Native/Non-Native Status: Native

Light Requirements: Full or Partial Shade

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained
pH 6.0-7.2

Appearance: Large, irregularly shaped shrub with tiny white flowers and small, red fruit that provides food for wildlife

Fun Fact! This is NOT the coffee that you drink, and the fruits contain no caffeine.

Information and images from Florida-Friendly Landscaping™ Plant Guide

Maidenhair Fern *Adiantum capillus-veneris*

Photos by Ryan Fessenden

Hardiness Zone: 7a to 11

Native/Non-Native Status: Native

Light Requirements: Partial to Full Shade

Drought Tolerance: Low

Soil:
Any Texture
Medium to Well Drained
pH 6.0-6.8

Appearance: Round spreading fern with fine-textured, delicate leaves

Information and images from Florida-Friendly Landscaping™ Plant Guide

Milkweed *Asclepias* spp.

Hardiness Zone: 8b to 10b

Native/Non-Native Status: Not Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Well Drained to Wet
pH 6.0-7.2

Appearance: Upright perennial with large flowers in a range of colors

Fun Fact! These plants are a big food source for caterpillars and butterflies, but all parts are poisonous to humans

Information and images from Florida-Friendly Landscaping™ Plant Guide

Bamboo *Bambusa* spp.

Photos by Ryan Fessenden

Hardiness Zone: 8a to 11

Native/Non-Native Status: Not Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium Drained
pH 6.0-7.2

Appearance: Large, fast-growing clumping trees

Fun Fact! Grows very aggressively, should not be planted near lakefronts or streams

Information and images from Florida-Friendly Landscaping™ Plant Guide

Trumpet Creeper *Campsis radicans*

Photos by Ryan Fessenden

Hardiness Zone: 4a to 10b

Native/Non-Native Status: Native

Light Requirements: Full Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium Drained
pH 4.5-8.0

Appearance: Spreading vines that can reach up to 40 feet long

Information and images from Florida-Friendly Landscaping™ Plant Guide

Fakahatchee Grass *Tripsacum dactyloides*

Hardiness Zone: 8a to 11

Native/Non-Native Status: Native

Light Requirements: Partial Shade to Full Sun

Drought Tolerance: Medium

Soil:
Any Texture
Medium to Well Drained
pH 4.5-7.2

Appearance: Spreading ornamental grass

Fun Fact! Tolerates flooding and standing water

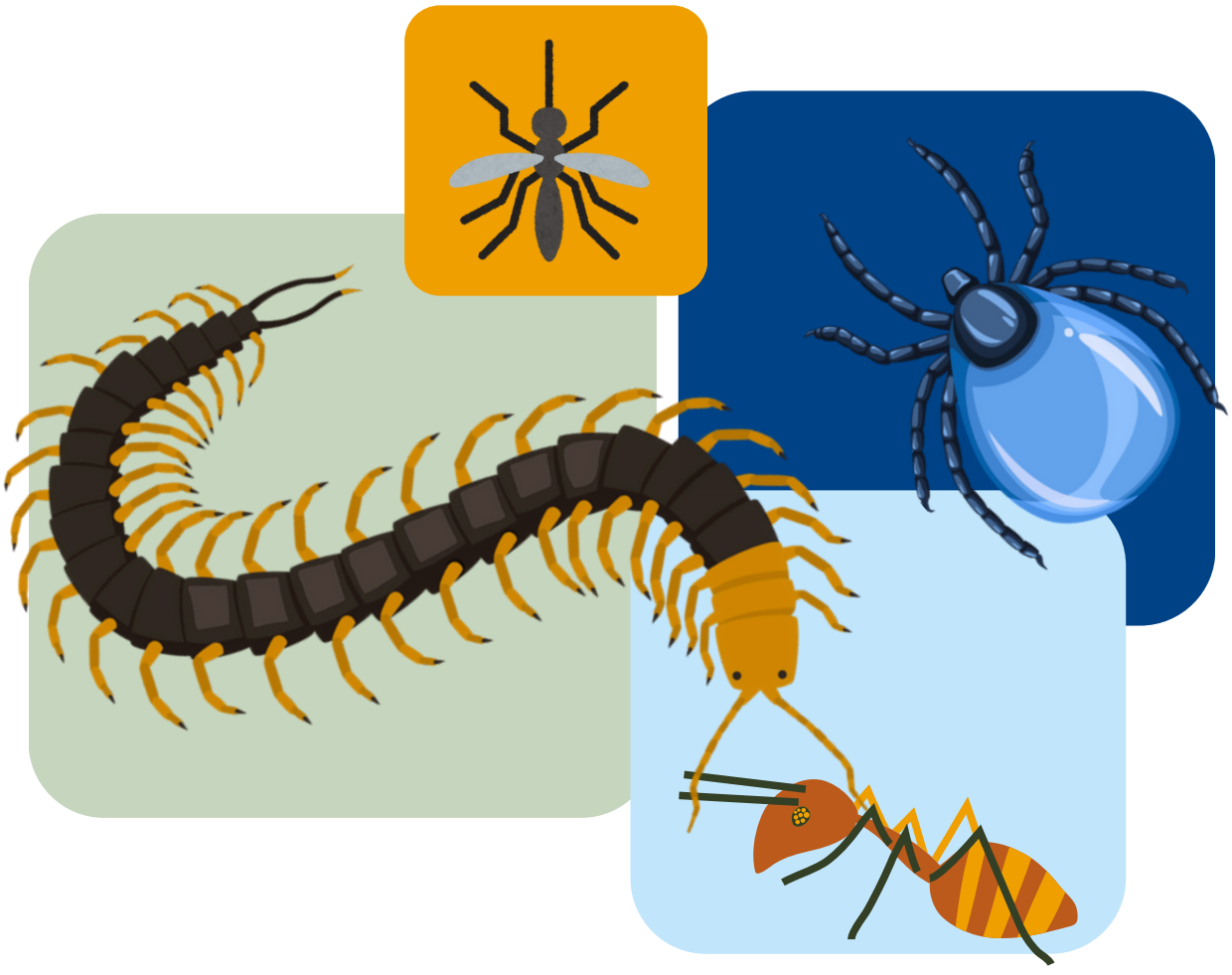
Information and images from Florida-Friendly Landscaping™ Plant Guide

Florida-Friendly Landscaping™ Program

Principle 6:

Manage Yard Pests Responsibly

Middle School



Published on **July 30th, 2025**

About This Activity

Title: Build A Bug

Subject, Grade, Level:
Middle School Science, On-Level

Abstract:

In this activity, students investigate insect and arthropod anatomy by assembling bug parts and classifying them as helpful or harmful. They design and present their own bugs to demonstrate understanding of key features and functions.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Understand insect and arthropod body segments
- Understand complete and partial metamorphosis
- Understand that all bugs have an important ecological role.
- Understand that no bug is “bad”

Authors: Alex Horvath and Morgan Nielsen
CPET, University of Florida

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.L.17.1	Explain and illustrate the roles of producers, consumers, and decomposers and describe how energy is transferred through a food web.
SC.912.L.15.6	Discuss distinguishing characteristics of the domains (Archaea, Bacteria, Eukarya) and describe characteristics of kingdoms within each domain.
SC.912.L.15.7	Identify distinguishing characteristics of major vertebrate and invertebrate phyla and describe representative examples of each chordate class.

Timeframe:

This activity is designed to take about one hour of class time.

List of Materials

- "Bug Bag" for each group of 4 students- each bag should contain each of the five sample insects, cut into pieces
- Build-A-Bug Worksheet (1 per student)
- Markers/Crayons/Art Supplies for coloring bugs
- Extra pens/pencils for writing on the activity sheet
- Extra sheets of paper in case students need more pages to explain their bug's life cycle, or extra drawings.

Important Note:

Bugs are a vital part of the food web and should not be indiscriminately targeted by insecticides or other chemicals. We need all Florida Friendly species to maintain healthy Florida ecosystems. (Make sure students understand that we may want to manage pests for an economic purpose, health reason, or to deter Non-Florida Friendly pests, but we want our bugs!)

Need to print before activity:

- Groups will be split into 3-4 students. Each group will need one set of bugs from the print-a-bug sheet.
- These need to be cut into pieces based on body segments so that the students can put them back together.
- The print-a-bug sheets will also need to be cut and if possible laminated ahead of the activity and separated into separate bags for ease of use.

Procedure and General Instructions (for instructor)

Introduction

1. **Introductory lesson based on the FFL "Pest Management" principle.** ~15min
    - Focus on explaining the difference between insects and other arthropods. Show a few common "good bugs" (non pests) and a few common "bad bugs" (pests) in Florida and the local community.
    - Show examples of partial and complete metamorphosis. Teach them that **bugs are not actually "bad bugs"**

2. **Build-A-Bug Activity** ~15min
    - Students will get in small groups where they will be given body segments of 5 arthropods, at least 2 insects, and 2 arthropods in each bag. These groups will then put them together and identify the following:
        - Is it an insect or other arthropod? Is it a "good bug" or "bad bug"?
        - What species is this bug?
        - Identify each body segment of the bug.
    - They will also be filling out a worksheet that asks them to consider what ecosystem these bugs may live in.

3. **Design A Bug & Presentations** ~20min to build, 1-3min per presentation
    - Each student will design their own bug by drawing a bug and labeling each body segment.
    - They will also design their own partial or complete metamorphosis for the bug and draw the morphology of those life stages and consider what ecological role they fill in their environments.
    - Each student will quickly explain their bug's body segments, their metamorphosis process, and one fun fact about their bug.

Student Activity Sheets and Assignments

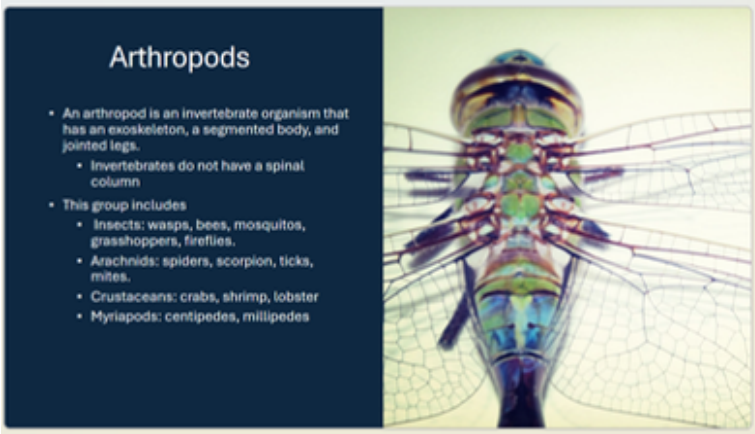
Included with this Activity

1. Lecture PowerPoint
2. Student Worksheet
3. Printable Bug Pictures (print, cut and laminate for bug bags)

Included Slides:

1

2



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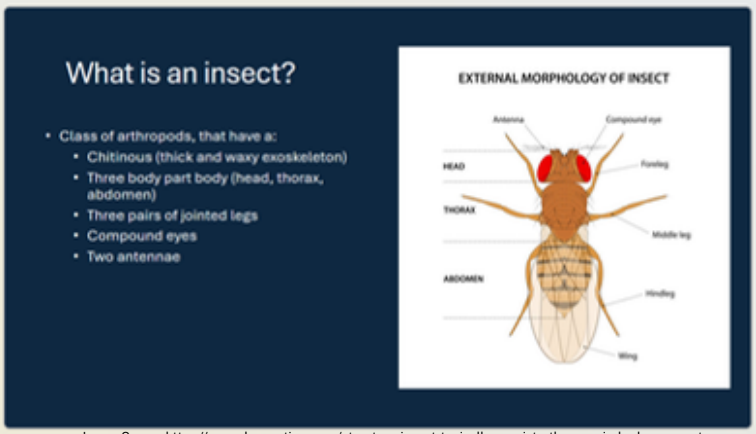

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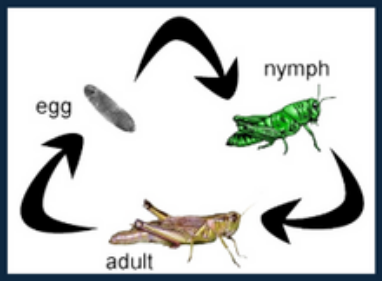
Image Source https://www.dreamstime.com/structure-insect-typically-consists-three-main-body-segments-head-thorax-abdomen-head-contains-image281233011

Incomplete Metamorphosis

- Insects have two different kinds of life cycles. Some undergo **incomplete metamorphosis**, in which the **egg** Hatches, and the insect gradually develops from a **nymph** to and **Adult** without stark changes



5

Image source: https://metamorphosis4kids.weebly.com/incomplete-metamorphosis.html

Complete metamorphosis

- Some species of insects go through more distinct changes in their life cycle through the process of **complete metamorphosis.**

6

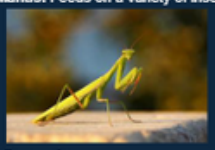
Photo: https://pixels.com/featured/complete-metamorphosis-mikkel-juul-jensen.html

7

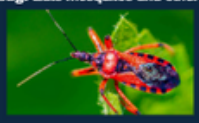
Not all arthropods are bad some beneficial "Good Bugs"

Honeybee: Vital plant pollinator

Praying Mantis: Feeds on a variety of insects



Assassin Bug: Eats mosquitos and other pests



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Honeybee: https://pixabay.com/photos/honey-bee-bee-insect-8545104/

Assassin Bug: https://www.planetnatural.com/assassin-bug/

Praying Mantis: https://www.istockphoto.com/photos/praying-mantises-pic

Some arthropods are "Bad Bugs"

- **Aphids:** Suck sap from plant; can defoliate or kill them

- **Hornworms:** Eat leaves, flowers, and buds

Ticks: Transmit diseases such as Lyme disease and rocky mountain spotted fever.

9

Hornworm: https://www.aces.edu/blog/topics/lawn-garden/interesting-hornworms-beautiful-caterpillars-a-pest-and-a-parasitoid-reservoir/

Aphids: https://www.lawnbuddies.com/blog/identify-get-rid-aphids-trees-shrubs

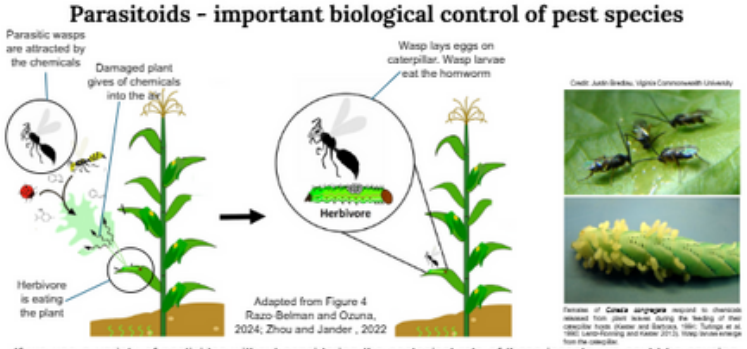
Ticks: https://www.si.edu/stories/how-do-tickstick

Remember!

- **All** bugs are a vital part of the food web and should not be indiscriminately targeted by insecticides or other chemicals. We need all Florida Friendly species to maintain healthy Florida ecosystems.

10

Parasitoids - important biological control of pest species



If we use a variety of pesticides without considering the ecological role of those insects, we could be causing more harm than we are trying to prevent. An insecticide you spray around your yard to deter wasps could provide opportunities for hornworms! Using pesticides responsibly and localized areas help protect you and Florida ecosystems!

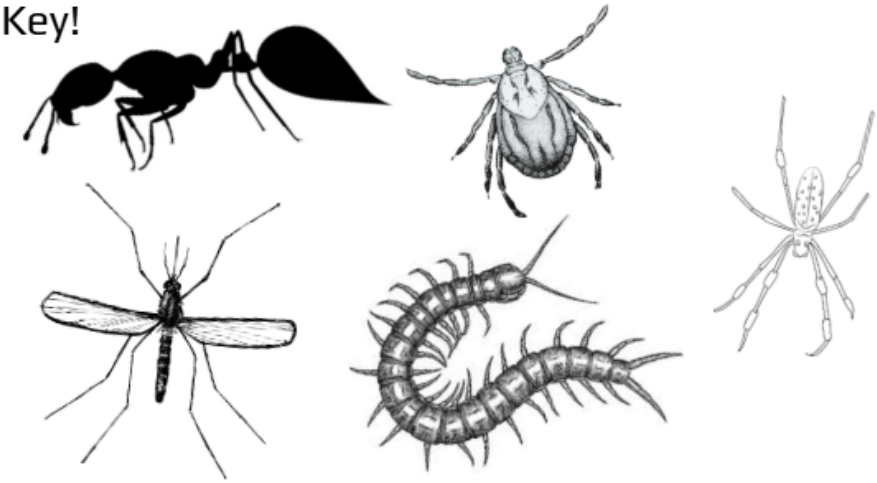
11

Activity

- Each group will receive one bag, and everyone will receive a worksheet. Once you have finished reconstructing the bugs in the bags, go ahead and start building your bug! Once most of you are done, we will present your bugs!

12

Key!



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Student Worksheet (Page 1)

UF CPET **FFL Principle 6- Manage Yard Pests: Build-A-Bug Worksheet**

Name(s): _____

Bug Reconstruction

Question	*Bug #1*	*Bug #2*	*Bug #3*	*Bug #4*	*Bug #5*
What kind of arthropod? What body parts do they have?					
Species (look up one)					
"Good bug" or "bad bug" for your landscape? Why?					
What ecosystem benefits could this bug provide?					

Student Worksheet (Page 2)

Now it's your turn to build a bug!

Draw your Insect and label the body segments.

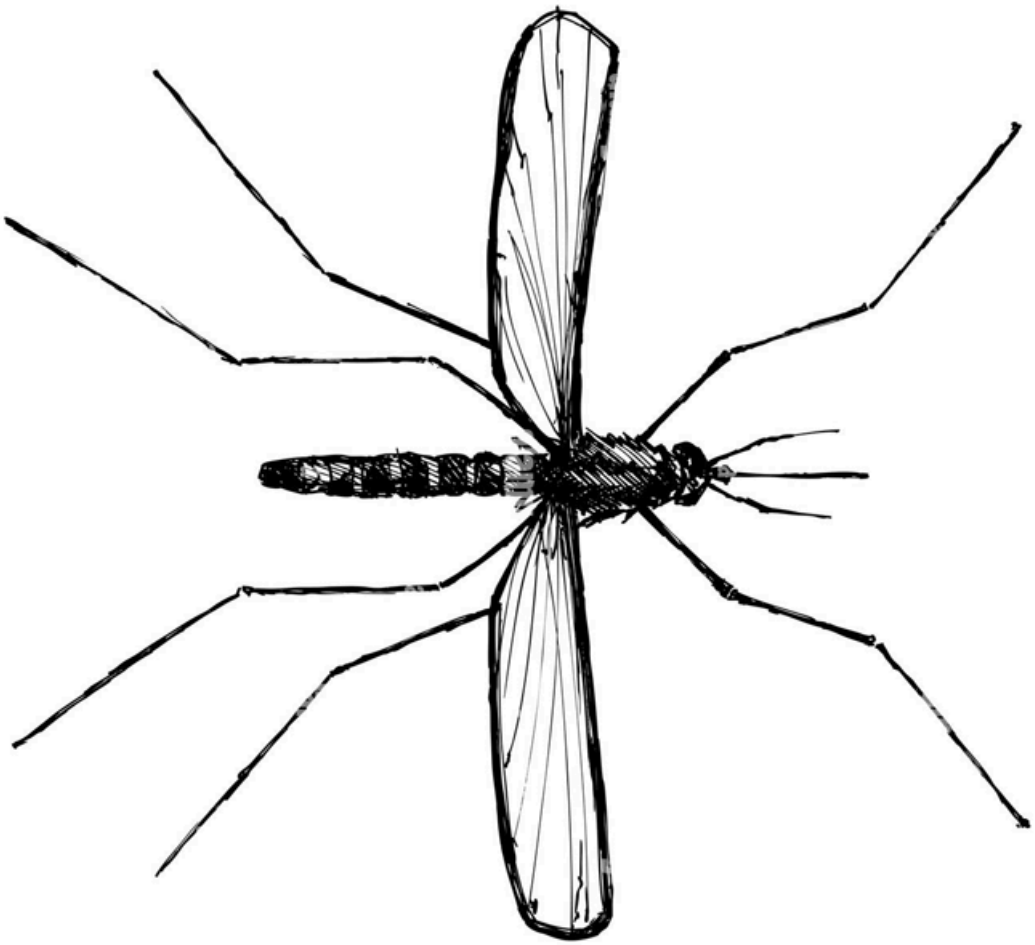
Insect Name: _____

What does your bug eat? Does it have any predators?

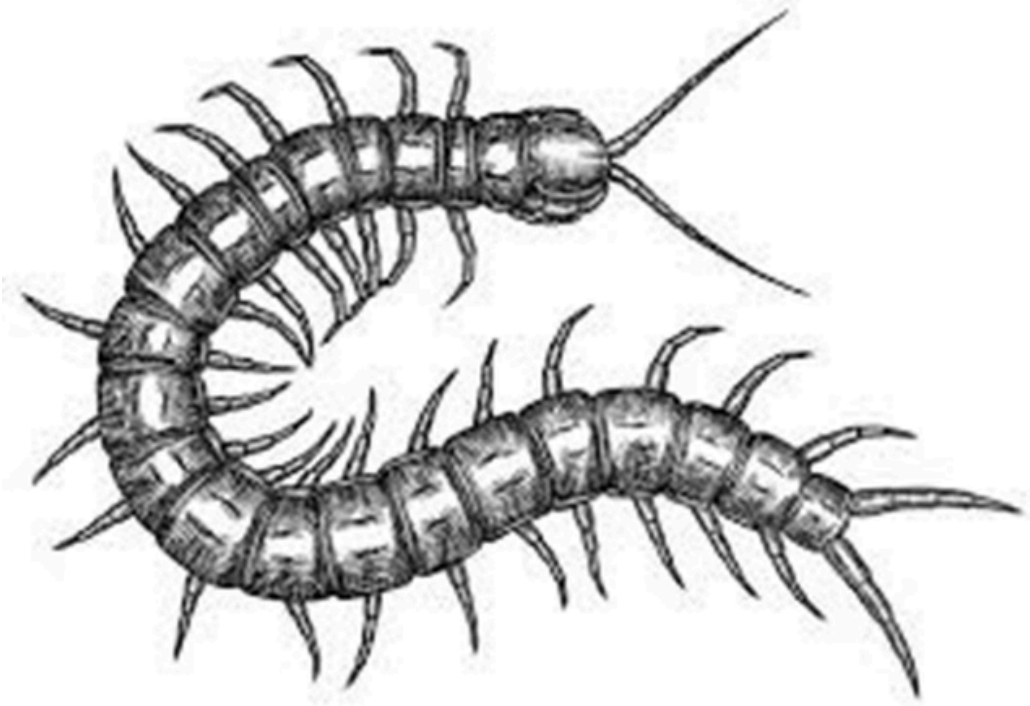
Does your insect go through a partial or complete metamorphosis?

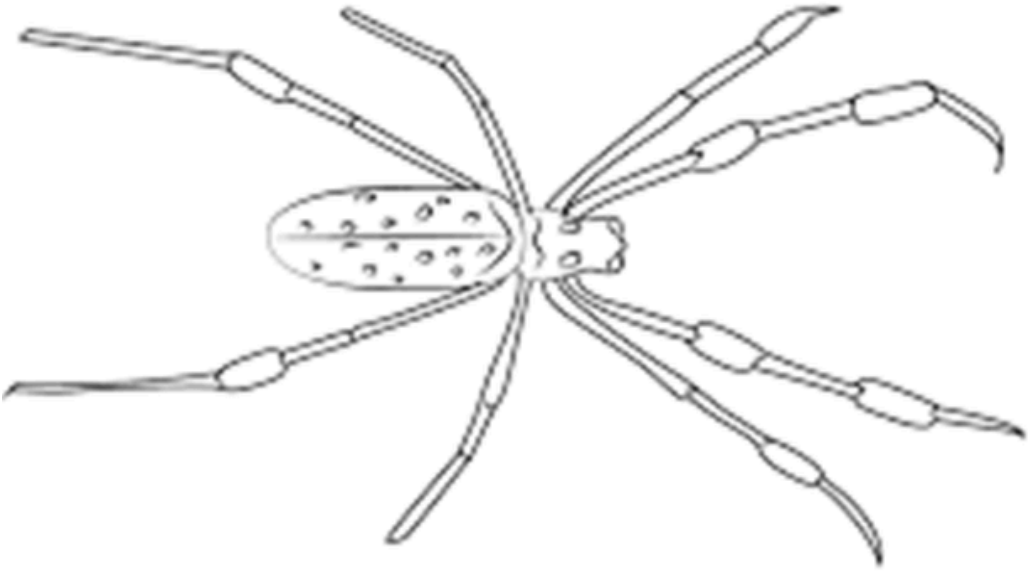
What is one fun fact about your bug?

Bug Printables

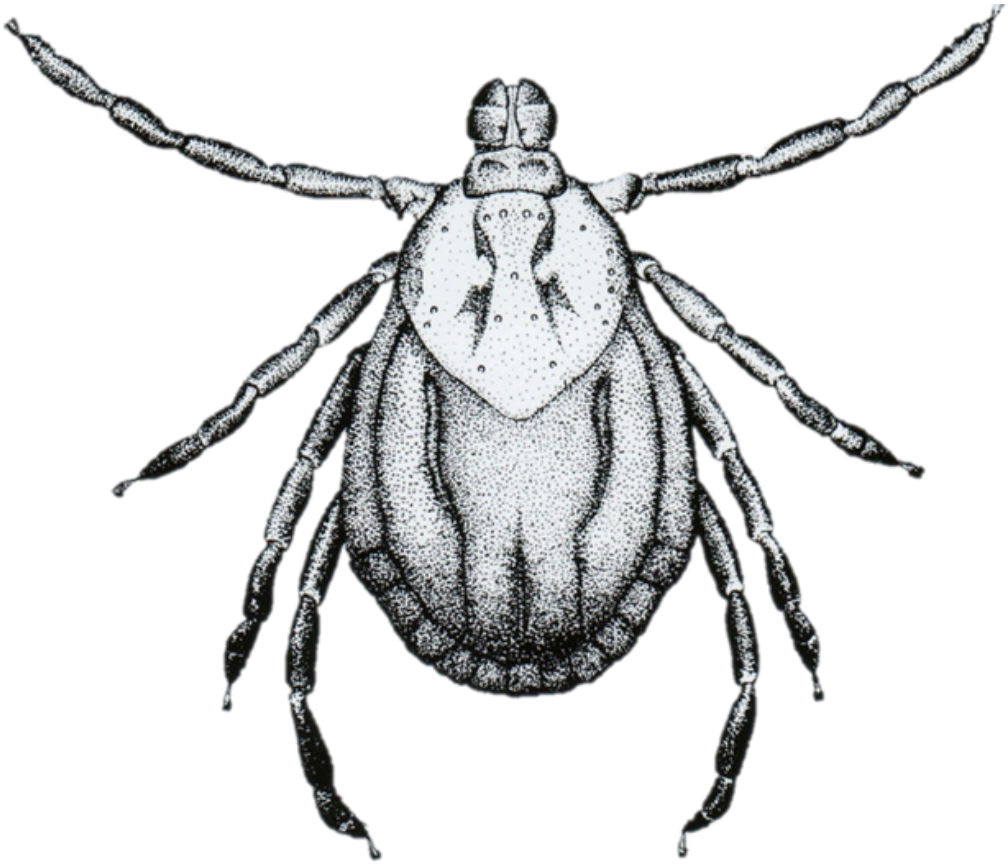


Bug Printables (Continued)





Bug Printables (Continued)



Florida-Friendly Landscaping™ Program

Principle 7:

Recycle Yard Waste

Middle School

Published on **August 14th, 2025**

About This Activity

Title: Recycle Yard Waste

Subject, Grade, Level:
Middle School Science

Abstract:

This lesson engages middle school students in exploring Florida-Friendly Landscaping™ Principle #7: Recycle Yard Waste through hands-on sorting, data analysis, and environmental science concepts. Students apply knowledge of the carbon cycle and the Law of Conservation of Mass and Energy to understand how composting conserves resources and reduces ecological impact. Aligned with science standards (SC.8.N.1.1, SC.8.N.1.3, SC.8.L.18.4), the lesson includes classifying yard waste, analyzing compost data, and creating a Claim-Evidence-Reasoning (CER) on composting's benefits. Assessment includes models, reflections, and CER responses. The activity promotes sustainability, scientific thinking, and practical application of waste reduction strategies.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Understand that recycling yard waste material in gardening is a way to conserve nutrients and reduce the amount of energy required to move it from place to place. Decomposing organic matter releases nutrients back to the soil in a form that plants can easily use. Using yard waste for composting is a sustainable way of creating organic fertilizer.
- Apply their knowledge of the carbon cycle to this practice. (Florida Friendly Landscaping Principle #7).

Author: Lisa Fabulich
P.K. Yonge Developmental Research School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.8.N.1.1	Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.8.N.1.3	Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.
SC.8.L.18.4	Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.

Timeframe:

This activity is designed to take approximately 1 class period or more with demo/lab.

List of Materials

- Bucket of material and bins
- Presentation slides
- 2L bottle and materials for composting (# will depend on if demo or if running as a lab)
- Slides
- Student worksheet with prompting questions

Procedure and General Instructions (for instructor)

Introduction

ENGAGE

- **Activity**: Bring a bucket of common yard waste material (or have students collect from a school garden). Students classify the material as trash, recycle bin, or compost.

DAY 1: Direct Instruction

- **Florida Friendly Landscaping Principle #7**
- Students should already be familiar with the Law of Conservation of Mass and Energy and the Carbon cycle although brief review can be included. We are applying these principles to compost as practice/applications of these ideas.
- Define composting and the compost process. (May elaborate by making a compost sample in a 2L bottle over time, or may have a before/after bottles already prepared)
- **Assessment-** Students may produce written explanations or create drawn models giving examples of a carbon transfer and an energy transfer.

DAY 2:

- Students should already have practice in the scientific method. Review the steps quickly, including identifying IV/DV, controls, etc.
- Provide context for Basil Iannone's work in urban landscape ecology and share the work on establishing native plants in degraded development soils. Point out that multiple stakeholders were involved (scientific consensus, importance of various perspectives, science in the field, science is collaborative, etc.) Do not show the conclusion slides until after student work is submitted and students have a chance to share their conclusions.

Students will:

- Work independently and then in partners or small groups (think-pair-share-style) to describe the experimental design used in the investigation and answer guided questions to practice scientific literacy in reading graphs (what type of graph, what information is on each axis, scale of the axis, etc.)
- After students think-pair-share, they will write their own individual Claim-Evidence-Reasoning on the value of composting

Student Activity Sheets and Assignments

Included with this Activity

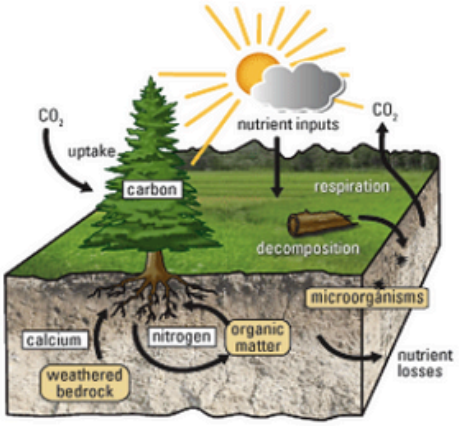
- Trash to Treasure PowerPoint
- Basil Iannone lecture slides

Included Trash to Treasure Slides:

1

2

Nutrient Cycling Review



3

Observing Composting in Action

Setup	Observe	Analyze
Students construct mini composters using 2L plastic bottles with layers of yard waste, food scraps, and soil.	Record temperature, volume, and visual changes in the composting materials over 1-2 weeks.	Graph temperature and volume data and document the breakdown of organic matter through written observations and photos.

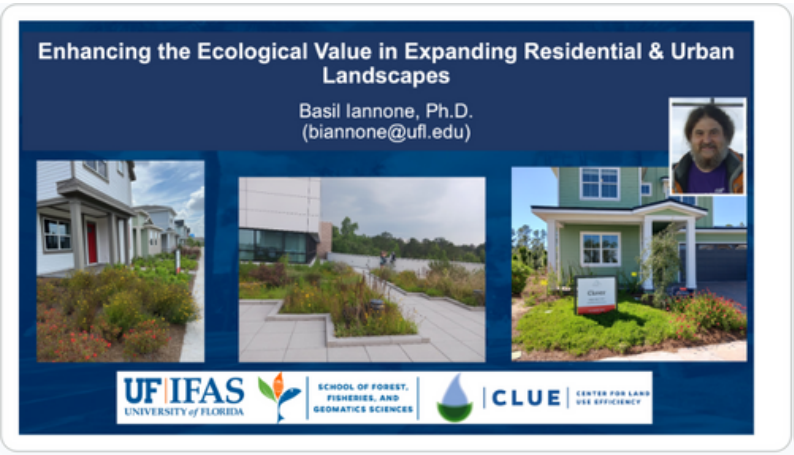
4

Let's compost as a school

- 1) We will go outside to observe yard waste around the school.
  - We will then go to the cafeteria and ask how many bags of food scrapes they produce a day. (This will give us an estimated volume of preventable waste our school produces)
- 2) We will analyze estimated volume of waste and estimate how that will accumulate annually
- 3) You will work In small groups to create a presentation (video, infographic, formal presentation…) (more details will be provided in rubric)
- 4) We will present to each other and come up with a plan as a class on how to implement composting into our school! Best presentation will present in front of school faculty.

5

Included Basil Iannone lecture slides:



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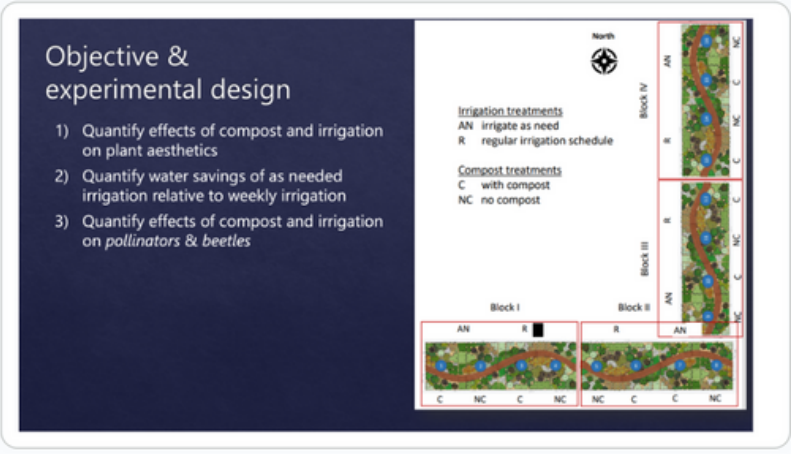

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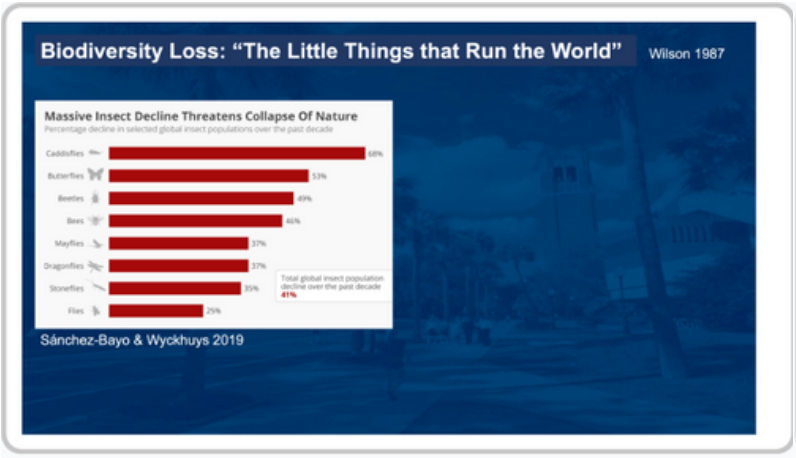

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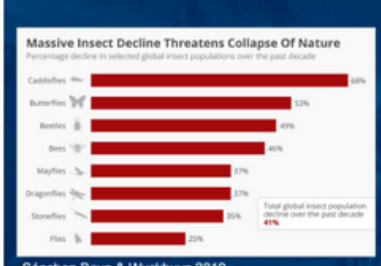
6

Biodiversity Loss: "The Little Things that Run the World"

Wilson 1987



Sánchez-Bayo & Wyckhuys 2019

Wagner et al. 2021

7

Plot set up

- Compost & irrigation installed Dec. 2021
- Plants installed Jan. 2022

8

Project plant list

Trees

Symbol	Plan Qty	Botanical Name	Common Name	Size
IV	8	Ilex vomitoria	Yaupon Holly	15 gallon
IVP	8	Ilex vomitoria pendula	Weeping Yaupon Holly	15 gallon
MF	16	Manicanthes fragrans	Simpson's Stopper	15 gallon

Shrubs & Groundcover

Symbol	Plan Qty	Botanical Name	Common Name	Size
HPC	48	Hamelia patens 'Calosa'	Firebush 'Calosa'	1 gallon
HR	48	Hypericum fasciculatum	St. Johns Wort	1 gallon
IG	16	Ilex glabra 'Gellberry'	Gellberry	3 gallon
LF	16	Lycania formaginea 'Rusty Staggerbush'	Rusty Staggerbush	3 gallon
SRC	16	Serenoa repens 'Cinerea'	Silver Saw Palmetto	3 gallon
VDA	48	Vaccinium darrowii 'Darrow's Blueberry'	Darrow's Blueberry	3 gallon
VOM	48	Viburnum obovatum 'Mrs. Schiller's Delight'	Mrs. Schiller's Delight Viburnum	3 gallon
ATR	48	Andropogon terrarius 'Spiliheard Bluestem'	Spiliheard Bluestem	1 gallon
#MS	48	Eragrostis spectabilis 'Purple Lovegrass'	Purple Lovegrass	1 gallon
MC	32	Muhlenbergia capillaris	Muhly Grass	3 gallon
SSB	48	Schizachyrium scoparium 'Little Bluestem'	Little Bluestem	1 gallon
CCO	48	Conoclinium coelestinum 'Mistflower'	Mistflower	1 gallon
CL	80	Coreopsis lanceolata 'Lanceleaf Tickseed'	Lanceleaf Tickseed	1 gallon
DH	48	Dychoriste humistrata 'Swamp Twinflower'	Swamp Twinflower	1 gallon
EY	80	Eryngium yuccifolium	Button Rattlesnake Master	1 gallon
AP	48	Asclepias 'Milkweed'	Perennial Milkweed	1 gallon
LC	80	Lobelia cardinalis	Cardinal Flower	1 gallon
MS	48	Mimosa strigillosa	Sunshine Mimosa	1 gallon
MP	192	Monarda punctata	Spotted Bee Balm	1 gallon
PN	48	Phyla nodiflora 'Turkey Tangle Frogfruit'	Frogfruit	1 gallon
SC	144	Salvia coccinea 'Sage'	Scarlet Sage	1 gallon
SA	192	Silphium asteriscus 'Starry Rosinweed'	Starry Rosinweed	1 gallon
TJ	96	Trachycarpheta jamaicensis	Blue Porterweed	1 gallon
VG	80	Vernonia gigantea	Giant Ironweed	1 gallon

9

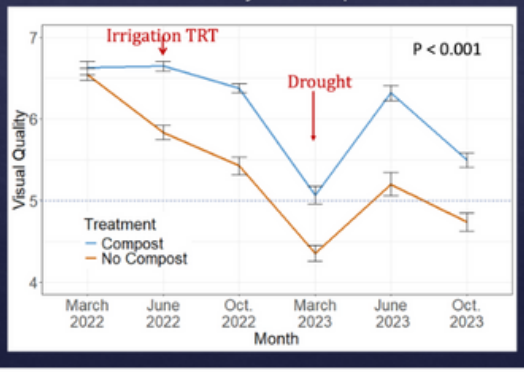
Visual quality rating 1 - 10

Adapted from UF/IFAS Gary Knox and Sandra Wilson

- 1 = dead, still intact
- 5 = fair quality, marketable
- 10 = excellent quality

10

Plot Level Visual Quality - Compost



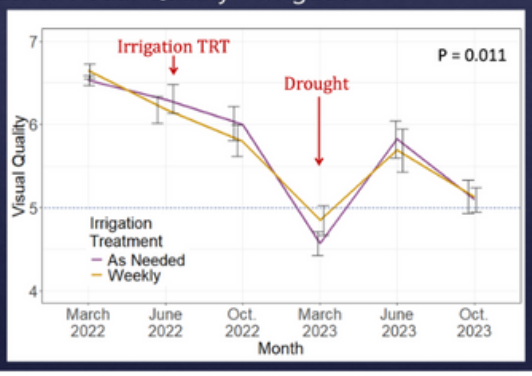
11

Water Use 6/24/22 – 10/05/23 (16 Months)

- **As-needed irrigation – 15,480 gal**
  108 gal x 8 plots X 18 applications
- **Once-a-week irrigation – 73,96 gal**
  108 gal x 8 plots x 86 applications
- **As needed = 79% water savings**

12

Plot Level Visual Quality - Irrigation



13

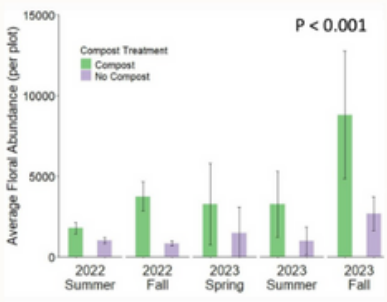
Treatment comparisons

Weekly Irrigation without Compost July 2023

As Needed Irrigation with Compost July 2023

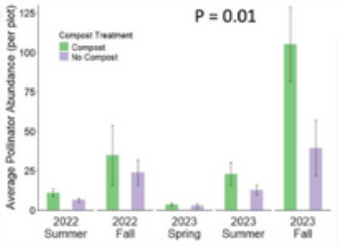
14

Compost Affects *Floral Resources*



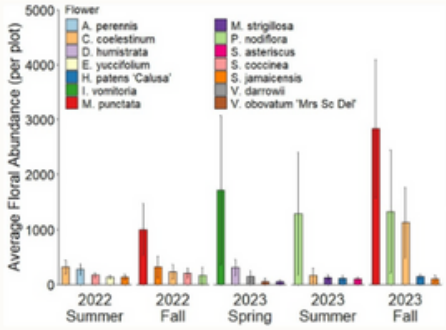
15

Soil Health → Increased *Pollinators*



16

Temporal Variation in Floral Resources



17

Conclusions

- Compost improved visual quality of plant materials at plot level
- Similar plant visual quality with 80% reduction of water use
- Soil quality is more of a barrier to establishing native plants than irrigation
- Compost benefits floral resources & pollinators
- Plant diversity contributes to sustained pollinator benefits

Next steps

- Species specific analyses (plants)
- Characteristics of the soil that drove results
- Effects on beetle communities

18

Florida-Friendly Landscaping™ Program

Principle 8:

Reduce Stormwater Runoff

Middle School

Published on **August 8th, 2025**

About This Activity

Title: Reduce Stormwater Runoff
Stormwater Effects on Water Quality

Subject, Grade, Level:
Middle School Science

Abstract:

This three-day middle school lesson plan introduces students to Florida-Friendly Landscaping™ (FFL) Principle 8: Reduce Stormwater Runoff, emphasizing the connection between human activity, stormwater pollution, and water quality. Through engaging discussions, hands-on water testing, and data analysis, students explore how pollutants travel through stormwater and impact aquatic ecosystems. Using local water samples, students test for pH, turbidity, temperature, dissolved oxygen, and nutrient levels, applying real-world scientific methods to assess environmental health. The lesson culminates in the development of a mock environmental impact report, where students communicate their findings and propose actionable solutions to reduce runoff-related pollution in their communities. Aligned with state science standards, this lesson fosters environmental awareness, data literacy, and civic responsibility — empowering students to think critically and act locally to protect Florida's water resources.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Identify key principles of Florida-Friendly Landscaping that help protect water quality.

Author: Maureen Shankman
Santa Fe High School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.E.6.6	Describe the effects of pollution (point and nonpoint sources) on water quality and aquatic ecosystems.
SC.7.L.17.1	Investigate and describe how environmental changes (such as pollution, natural disasters, or human activity) affect ecosystems.
SC.7.E.6.3	Explain the water cycle and how human activities, including stormwater runoff, affect water quality.
SC.7.N.1.5	Describe the importance of accurate and precise data collection and analysis in scientific investigations.

Timeframe:

This activity is designed to take approximately 3 days of class time.

List of Materials

- Sample of Clean water
- Sample of Retention Pond Water
- Sample of Mystery Water
- Test kit from Carolina Biological or similar
- Computers
- Projector

Procedure and General Instructions (for instructor)

Introduction

1. **Day 1- Explore:** Spark curiosity about stormwater and its impact on the environment.
    - Show a short video or images of stormwater runoff during a rainstorm in urban areas.
    - Ask students:
        - What happens to rainwater when it falls on streets, parking lots, or rooftops?
        - Where does this water go?
        - How might this water affect rivers, lakes, or oceans?
    - Introduce the idea that stormwater can carry pollutants and affect water quality.
    - **Homework:** Have students collect samples from the water fountain, the retention pond and a local pond close to their home

2. **Day 2- Explain:** Investigate local stormwater by testing water samples.
    - Provide students with water samples collected from different sources (e.g., tap water, pond, storm drain, rainwater).
    - Have students work in small groups to test key water quality indicators using simple kits or probes:
        - pH level
        - Turbidity (cloudiness)
        - Temperature
        - Dissolved Oxygen
        - Presence of nitrates or phosphates (if available)
    - Students record their observations and measurements.

Procedure and General Instructions (for instructor) cont.

3. **Day 2 or 3: Elaborate**- Understand how stormwater affects water quality and ecosystems
    - Discuss what each water quality indicator means and why it matters:
        - pH affects aquatic life health
        - Turbidity indicates sediment or pollution levels
        - Temperature impacts oxygen levels in water
        - Nitrates/phosphates can cause algae blooms
    - Relate findings from their water tests to potential stormwater pollution sources (e.g., fertilizers, oil, trash).
    - Compare results to Florida Department of Environmental Protection Acceptable Limits
    - Introduce the concept of nonpoint source pollution carried by stormwater runoff.
    - **Optional:** Invite Guest Lecturer from IFAS Mark Clark or AJ Reisinger

4. **Day 3/ Homework: Evaluate-** Assess Student Understanding and Application of Concepts
    - Have students create a mock environmental impact report
    - Reflection Questions:
        - What did you learn about stormwater and its effects on water quality?
        - How can water testing help us understand pollution?
        - What are some ways to reduce stormwater pollution?
    - Present report to class and class visitors

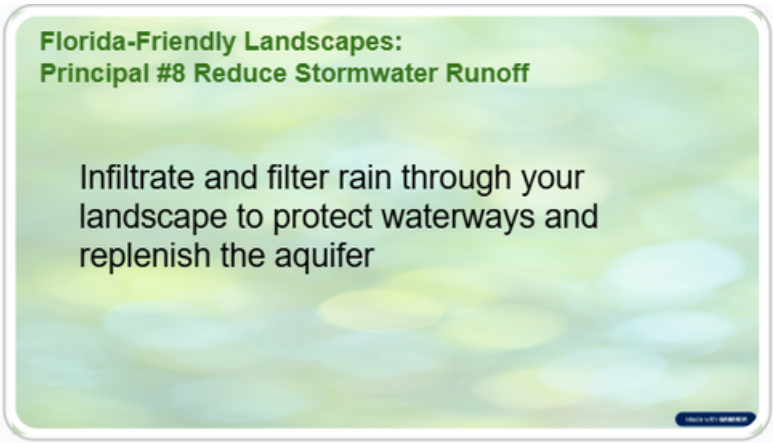
Student Activity Sheets and Assignments

Included with this Activity

- Power Point

Included Slides:

1



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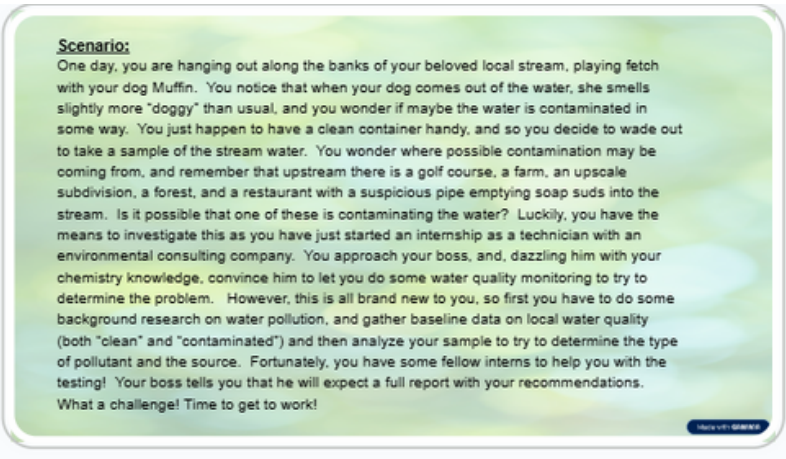


4

What Happens When It Rains?

Rainfall
Rain falls on impervious surfaces like streets, parking lots, and rooftops

Runoff
Water flows across surfaces, collecting pollutants along the way

Waterways
Contaminated stormwater enters local streams, rivers, lakes and oceans

5

Common Stormwater Pollutants

Oil & Grease
From vehicles and machinery

Fertilizers
Containing nitrogen and phosphorus

Litter
Plastic, paper and other debris

Sediment
Soil from construction and erosion

These pollutants are examples of nonpoint source pollution - contamination that comes from many diffuse sources rather than a single point.

6

Water Quality Testing

In our investigation, we'll test water samples from different sources:

- Tap water (control)
- Pond water
- Storm drain runoff
- Retention Pond water

7

Schedule Layout:	Items Needed:
Have students take samples from the water fountain, the retention pond and a local pond close to their home	Sample of Clean Water Sample of Retention Pond Water Sample of Mystery Water
Run the following tests: pH, DO, turbidity, nitrates, and phosphates	Test kit from Carolina Biological
Compare results to Fl Dept of Environmental Protection acceptable limits	Image from Fl Dept of Env. Protection
Invite Guest Lecturer from IFAS Mike Clark or Reisinger	Contact CPET to set this up
Create report on Canvas with partners	Computers
Present report to class and class visitors	Computer/Projector

Standards	Appearance	Turbidity	pH	DO2 (ppm)	NO3 (ppm)
Taken from FL, EPA	Clear, colorless, odorless	< 40 JTU (unsafe)	8.0-8.2	>6 ppm	<44 ppm (safe) >44 ppm (unsafe)

8

Water Quality Data

Interpreting Our Results

1. **Collect Data** — Record all measurements from water quality tests
2. **Compare Samples** — How do different water sources compare to each other?
3. **Identify Patterns** — Look for relationships between location and water quality
4. **Draw Conclusions** — What do your results tell you about stormwater health?

9

Environmental Impacts: What Students Will Address

When Stormwater Pollution Enters Waterways:

- Reduced oxygen levels harm fish and aquatic life
- Excess nutrients cause harmful algae blooms
- Sediment blocks sunlight needed by underwater plants
- Toxic chemicals harm wildlife and contaminate drinking water

10

What students will possibly propose: Solutions to Stormwater Pollution

Rain Gardens
Planted depressions that collect and filter runoff

Permeable Pavement
Allows water to soak through rather than run off

Proper Disposal
Never dump chemicals, oil or trash into storm drains

Rain Barrels
Collect roof runoff for later use in gardens

11

Your Turn: Protect Our Waters: The Report and Presentation

1. **Reflect on Learning**
   What did you learn about stormwater and its effects on water quality?
2. **Take Action**
   Choose one way you can help reduce stormwater pollution at home or school
3. **Share Knowledge**
   Develop an Environmental Impact Statement and present your findings as a lab group to the class

12

Florida-Friendly Landscaping™ Program

Principle 9:

Protect the Waterfront

Middle School

Published on **August 8th, 2025**

About This Activity

Title: Protect the Waterfront

Subject, Grade, Level:
Middle School Science

Abstract:

This interactive middle school lab explores Florida-Friendly Landscaping™ Principle 9: Protect the Waterfront by engaging students through a modeling project. Where students will take what they learn from the Florida Friendly curriculum and CPALM standards to model a healthy coastline. Students will test these models under varying relevant conditions and see how well their models prevent coastline erosion.

Learning objectives:

At the conclusion of this activity, participants will be able to:

- Explain how waterfront areas are affected by stormwater runoff and pollution.
- Identify key principles of Florida-Friendly Landscaping that help protect water quality.
- Describe specific landscaping practices that reduce pollution entering waterways.
- Propose landscaping solutions to protect local waterfront environments.

Author: Maureen Shankman
Santa Fe High School
Edited by Morgan Nielsen, UF CPET

This curriculum was created during the 2025 University of Florida Center for Precollegiate Education and Training (CPET) Environmental Science Summer Program, funded in part by the U.S. Environmental Protection Agency and the Bingham Environmental Education Foundation and developed in collaboration with the UF/IFAS Florida-Friendly Landscaping™ Program.

Learning standards:

SC.7.L.17.1	Investigate and describe how environmental changes affect ecosystems.
SC.7.E.6.6	Describe effects of pollution on water quality and aquatic ecosystems.
SC.7.E.6.3	Explain how human activities affect water quality.
SC.7.N.1.5	Describe importance of accurate data collection and analysis.

Timeframe:

End of quarter project

List of Materials

- Plastic Tubs (bins)
- Clay
- Newspaper
- Rocks
- Sand
- Water
- Sticks
- Fan
- Plastic bottle to make waves or some other item
- Prepared presentation before activity

Important Note:

Before class begins, students will be given a list of necessary materials to make their shorelines at home, or instructor will hand out same materials to everyone to make the coastlines.

Procedure and General Instructions (for instructor)

Introduction

1. **Engage (10 min):**
   - Introduce the topic of water pollution protection with images of FFL presentation
   - Ask: "What happens to rainwater when it falls near homes or waterfronts?" Discuss stormwater runoff and its potential to carry pollutants to water bodies.
   - Show pictures comparing waterfront areas with traditional landscaping vs. Florida-Friendly Landscaping™
2. **Explore (15 minutes):**
   - Introduce Florida-Friendly Landscaping™ principles:
     - Use of native plants
     - Minimizing fertilizer and pesticide use
     - Creating buffer zones near waterways
     - Managing irrigation efficiently
   - Discuss how these practices reduce pollution and protect aquatic habitats.
3. **Elaborate:**
   - Students will create a model landscape using a river, lake, pond or coastal shoreline. In small groups, students design a simple landscaping plan for a waterfront property using Florida-Friendly principles by drawing the outline of the waterway and surrounding land here (use graph paper or draw to scale), including: Waterway (river, lake, pond), Shoreline or bank, Existing trees and plants, Pathways or walkways, Structures (docks, benches, fences). Indicate where you will place: Native plants (list specific species if known), Buffer zones (areas to filter runoff near water), Rain gardens or bioswales (areas to collect stormwater), Mulch or ground cover areas, Irrigation points (if any).
4. **Test:**
   - Use simulated waves, water in the tub and draw the profile of the coastline against the clear plastic tub. See how coastline shifts under waves (make waves in the water in the tub) and wind (fan blowing).
   - Students will create a lab report to discuss the results
   - Students will develop a landscaping plan to determine how to make a FFL area
5. **Evaluate (5 minutes):**
   - Exit ticket: Students write one way Florida-Friendly Landscaping™ protects water quality and one practice they would recommend for their community

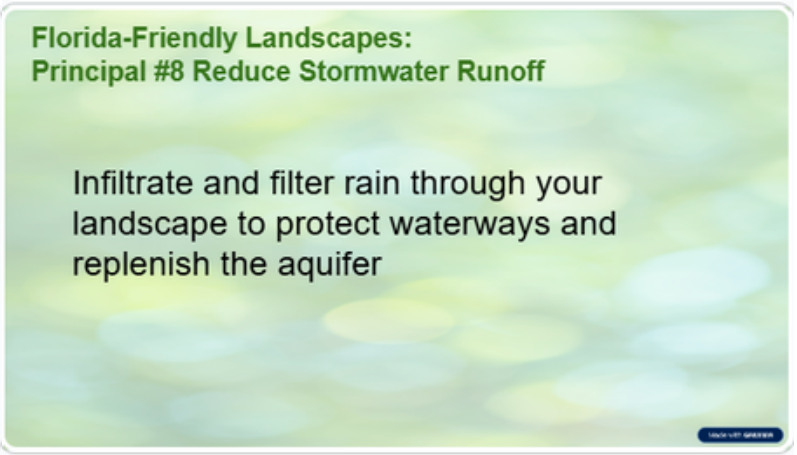
Student Activity Sheets and Assignments

Included with this Activity

- Power Point
- FFL Power Point

Included Slides:

1



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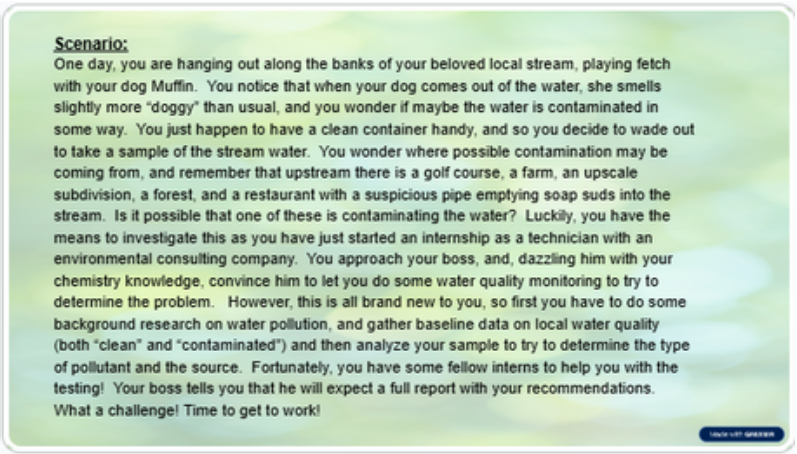

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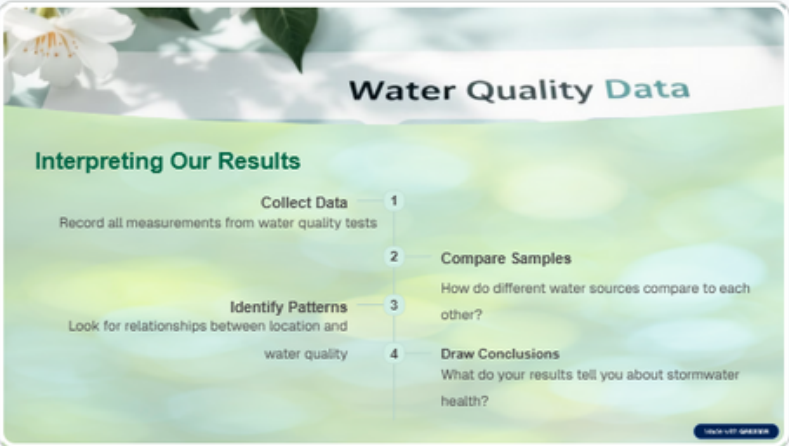

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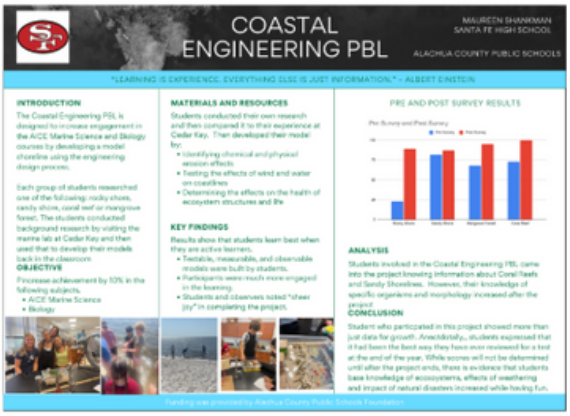
12

2nd Lesson Plan: Protect the Waterfront

Florida Friendly Landscape
Principle #9

13



14

FFL Principle 9 Power Point

1

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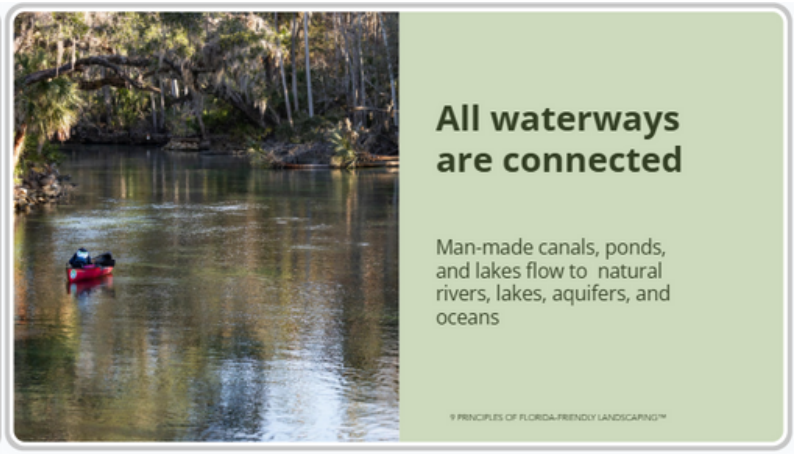

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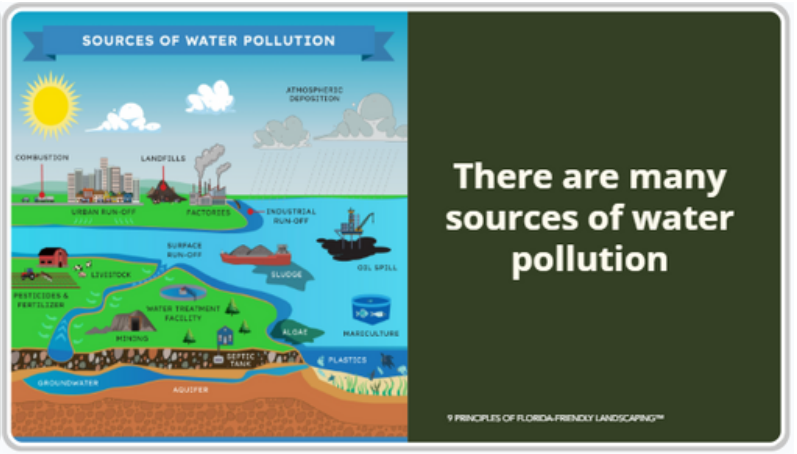

6

Low-Maintenance Zone

- Designate a 10-25 ft low-maintenance zone around water bodies
- No mowing, fertilizer or pesticides

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

7

Plant Shoreline Vegetation

- Plant in the riparian zone
- Choose Florida-friendly plants

8

Living Shorelines

- Vegetation planted in coastal areas
- Controls erosion
- Protect shoreline habitat

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

9

Seawalls and Rip Rap

- Seawalls
- Rip rap
- Gabions

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

10

Erosion Control

Soil erosion affects water quality

Vegetation prevents erosion

Also prevents thermal pollution

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

11

No Invasives Near the Water

- Remove invasive exotics
- Protect and plant native shoreline plants

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

12

Other Maintenance Considerations

- Pick up after pets
- Prevent plant debris from entering the water

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

13

Enhance Stormwater Ponds and Canals

Create wildlife habitat
Transform into neighborhood amenity

9 PRINCIPLES OF FLORIDA-FRIENDLY LANDSCAPING™

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Water at the Neighborhood Level

How can FFL practices protect the waterfront in your community?

15

Your yard can make a difference!

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