The Growing Process

How do plants adapt to support the functions of a rain garden in order to reduce polluted runoff and improve water quality?

An exercise to study characteristic adaptations of plants:
• Deep root systems
• Variations in growing seasons
• Ability to withstand drought and wet conditions

Objective
To educate students on the growing process, including the following:

• Elements of a Rain Garden
  • Exploration of plant layout within a rain garden
  • Exploration of plants that make up a rain garden and their characteristics

• Root systems
  • The ability that native plants have to help break up the soil

• Identifying plant life
  • Identification of native vs. non-native plants
  • Identification of plant adaptations that help functionality

• Blooming times
  • How different blooming times allow plants to survive in their environment
  • Reasons to use perennials in a rain garden

Science State Standards

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Education Module #1
Activity Instructions:
This module is broken down into three separate grade-appropriate versions. Each version includes a basic introductory activity (“A” Page) for the lower grade levels associated with the version and a supplementary activity (“B” Page) for the higher grade levels. Questions should be appropriate for the entire grade range associated with the version, but the level of difficulty and thought required for the answers will vary. It is recommended that the teacher follow the chart below for applicable grade levels:

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Each step can be implemented with or without a physical rain garden. Where a rain garden is not accessible, images provided at the end of this module should be used for student observation purposes. “Out In the Field” and “Writing Topics” have been added throughout the module that may be used when resources are available or at the teacher’s discretion.

General Activity Tips:
Make sure that students have a basic understanding of a rain garden and its purpose. A discussion or illustration of how a rain garden works, its function, and basic plant life cycle should be presented to students prior to completing this module. This can be based on the “Background Information” page or may be drawn from other resources. Where possible, students should read the background information page.

Version 1 Tips:
- **Decide if this will be an indoor or outdoor activity, depending on amenities available.** If a rain garden is not available for viewing on your campus or nearby, use image “Module 1: Rain Garden” either in digital format or color prints for students to observe.
- Questions 1-4: Depending on learning levels of students within the class, questions within this version may be asked to the entire class, allowing volunteers to answer by raising their hands. Teachers may skip the recording of these answers or have students complete the worksheet as a class.
- Question 5: Have crayons, markers, or other appropriate drawing tools prepared for this exercise, where students are asked to draw plants they see.
- Out in the Field: This portion of the module is designed for schools where gardens are easily accessible to students. If your onsite garden is not suitable to visit, these activities may be performed in the classroom. Teachers may provide samples of soil in a rectangular box for students to pick up and feel in order to make their observations. Also, teachers should provide pre-gathered leaves for students to touch and observe.
Version 2 Tips:

- **Decide if this will be an indoor or outdoor activity, depending on amenities available.** If a rain garden is not available, use image “Module 1: Rain Garden” either in digital format or color prints for students to observe.

- **Question 4:** Have crayons, markers, or other appropriate drawing tools prepared for this exercise, where students are asked to draw plants they see.

- **Question 5:** Use image “Module 1: Native vs. Non-Native Plants” either in digital format or color prints for students to observe. Guide students to compare the two types of plants and write sentences that compare and contrast the plants’ characteristics.

- **Writing Topics:** Teachers should use their discretion in choosing the depth of the writing assignment. Students may be given the choice of topic; they may write on all three topics; or the teacher may choose one topic for the entire class. Additional details or grading criteria (i.e., penmanship, grammar, typing skills, essay format, etc.) may be used by the teacher to increase difficulty of the writing assignment based on learning levels of the students. This portion of the module is appropriate as an in-class or take-home assignment.

- **Out in the Field:** This portion of the module is designed for schools where gardens are easily accessible to students. If your onsite garden is not suitable to visit, these activities may be performed in the classroom.

- **Question 1:** Teachers may provide samples of soil in a rectangular box for students to pick up and feel, in order to make their observations.

- **Question 2:** Provide rulers with inches and centimeters or other measuring tools for student use. If a garden is not suitable or available for student interaction, use image “Module 1: Plants to Measure” as a black-and-white or color copy.
Version 3 Tips:

- Decide if this will be an indoor or outdoor activity, depending on amenities available. If a rain garden is not available, use image “Module 1: Rain Garden” either in digital format or color prints for students to observe.

- Question 4: Have crayons, markers, colored pencils or other appropriate drawing tools prepared for this exercise, where students are asked to draw the shape of the garden and label various aspects.

- Question 6: Once students have completed their drawings and explanations independently, ask them to partner with another student. Allow students a specific amount of time to discuss with their partner why their drawings are different or why they reached the same conclusions.

- Use image “Module 1: Native vs. Non-Native Plants” either in digital format or color prints for students to observe. Guide students to compare the two types of plants and write sentences that talk about the plants’ characteristics and, based on their observations, how each has adapted to its environment.

- Writing Topics: Teachers should use their discretion in choosing the depth of the writing assignment. Students may be given the choice of topic; they may write on all three topics; or teachers may choose one topic for the entire class. Additional details or grading criteria (i.e., using research sources, grammar, typing skills, essay format, etc.) may be used by the teacher in order to increase the difficulty of the writing assignment based on learning levels of students. This portion of the module is appropriate as an in-class or take-home assignment. This exercise may also be expanded to become a group research project that would result in a presentation to the entire class.
### What's The Problem?

Stormwater runoff coming from developed areas can be a significant source of pollution. The rain water runoff, and even melting snow, can carry contaminants into streams, lakes and rivers. Water pollution can be traced to our own homes and yards. An average home may produce over 1,000 gallons of runoff from one inch of rainfall. As water runs off the roof, driveway, patio and lawn, it picks up contaminants such as fertilizer, pesticides, bacteria from pet waste, grass clippings and other yard debris. One of the ways you can help to keep some of these pollutants out of our rivers and streams is by planting a rain garden.

### A Great Solution

**Rain gardens** can be an important way to reduce the pollutants carried by stormwater runoff into our streams, lakes and rivers. They can also help stormwater soak into the ground so that less stormwater enters the sewer system.

A rain garden is a landscaped area that is designed to capture rain water runoff from hard surface areas such as rooftops, sidewalks, driveways and even lawns. Stormwater is directed to the rain garden, where it is allowed to collect and pond for a short period of time – usually 24 to 48 hours. They are planted with native perennial plants that can tolerate the cycles of rainfall and dry weather that occur in Northeastern Indiana. Native perennial plants are hardy and come back from year to year. They have extensive root systems that help stormwater soak into the ground rather than running off.

Some of the plants used in the rain garden can help to remove chemical pollutants such as nitrogen and phosphorus from stormwater before it flows into a water body. By slowing down runoff, a rain garden can help to remove sediment and debris from stormwater before it enters a waterway.

Rain gardens help to remove pollutants from stormwater in several ways. First, as stormwater runs off, rain garden plants in the path of the water cause dirt and pollutants to settle around, keeping them from flowing any further. Next, the mulch layer of the garden removes heavy metals that the water may have picked up along the way. Finally, plant roots remove nutrients such as nitrogen and phosphorus that can be harmful to the environment in excessive amounts.

The design of the rain garden also helps it work. A rain garden is designed so that rain water flows to the center, or deepest, part of the garden. Plants that prefer wet conditions are placed closer to the middle, while plants that prefer dryer conditions are planted closer to the edge. Regardless of the location, it is necessary for plants with deep root systems to be in a rain garden in order to break up the soil, allowing for the maximum amount of water to be absorbed into the ground. Native plant species help to improve the rate at which water soaks into the soil due to their dense and deep-growing roots. The plants in a rain garden must be able to withstand dry and wet conditions in order to thrive through the seasons, making perennials the ideal choice.

A rain garden can also serve other purposes. Rain gardens provide habitat and food for birds and butterflies. Plants may be selected for a rain garden so that the rain garden has a variety of colors, textures and heights, which adds a beautiful feature to any location. Plants can be chosen to bloom throughout the spring, summer and into the fall, for an attractive yet functional solution to help the environment.
Examine the pictures of the rain garden or visit your school’s rain garden.

1. Do the plants in the garden appear to be growing better in one special area than in another area? ____________________________________________________________

2. How many different types of plants do you see? __________________________

3. Are plants growing in bunches or by themselves all over the garden? ____________________________________________________________

4. List the colors you see in the garden. ________________________________

5. Pick 2 different plants you see in the garden. Draw a picture of each of

Plant 1

Plant 2
6. Are there more plants in the center of the garden or at the sides? __________
___________________________________________________________________________

7. Name 3 things you think the plants in the garden need in order to grow.
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

8. Write a sentence describing the plants in the garden. __________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

9. Write a sentence about your favorite thing in the garden. __________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Out In the Field

___________________________________________________________________________

2. How do you think the soil in the garden helps the plants grow?
___________________________________________________________________________

3. What does a leaf from a plant in the garden feel like? Is it rough or smooth?
___________________________________________________________________________
Examine the pictures of the rain garden or visit your school’s rain garden.

1. Do the plants in the garden appear to be growing better in one special area than in another area? __________________________________________________________

2. Are plants growing together by type? Or are different types present in many areas? __________________________________________________________

3. How many different types of plants do you see? ______________________

4. Draw three types of plants found in your garden, in the boxes below.

5. Examine the pictures provided in the handout of the native vs. non-native plants usually found in a rain garden.

**Consider the following:**
Are the shapes of the blooming flowers different? How does each typically grow (stalks, bunches, singles)? Does the flower tend to be more opened or closed? Anything unique about their leaves?

List 2 ways that each plant seems to have adapted to its environment:

Plant 1:
________________________________________________________
________________________________________________________
________________________________________________________

Plant 2:
________________________________________________________
Writing Topics:

- Describe how rain gardens reduce pollutants going to the City of Fort Wayne’s waterways. Include a description of how the plants, soil, and location factor into the effectiveness of the rain garden.

- Research a native plant that could be in a Fort Wayne rain garden. Describe its characteristics, seasonal adaptations, and its life history. Include a schedule of its dormant, blooming, and pollinating times.

- Write a short story describing how you think the garden you looked at will change as the seasons change.

Out In the Field:

   __________________________________________________________

2. Using a ruler, measure the 3 types of plants you just drew.

   How tall is plant 1 in inches? _______________ in centimeters? ________________

   How tall is plant 2 in inches? _______________ in centimeters? ________________

   How tall is plant 3 in inches? _______________ in centimeters? ________________
Examine the pictures of the rain garden or visit your school's rain garden.

1. Do the plants in the garden appear to be growing better in one special area than in another area? What factors do you think affect what you observe? ______________________________________________________________

__________________________________________________________________________________

2. Are plants growing together by type? Or are different types present in many areas? ____________________________________________________________

__________________________________________________________________________________

3. How many different types of plants do you see? ____________________

4. Draw the basic shape of the garden. Based on the shape, where plants are located, and the growth and size of the plants observed, identify on your drawing the areas that you think would collect the most water and the areas that would tend to have less amounts of water. Circle and label the areas appropriately. Based on your observations, indicate with arrows which direction you think the water flows to the garden.
5. Look at your drawing. Give a short explanation on how you formed your conclusions for the areas you identified. ________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

6. Exchange papers with your partner. Look at their drawing and compare it with your drawing. Did your picture have the areas identified differently? Describe how your pictures are alike and how they are different. _______________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

7. There are many different type of plants in a rain garden. Why do you think it is important to select a variety of plants with different growing and pollination cycles? How could this help or hurt the function of the garden? __________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
8. Examine the pictures provided in the handout of the native and non-native plants usually found in a rain garden. Consider the following:

Are the shapes of the blooming flowers different? How does each typically grow (stalks, bunches, singles)? Does the flower tend to be more opened or closed? Is there anything unique about their leaves? Does one look like it could catch more water than the other?

Considering their native environments, describe two ways that each plant seems to have adapted to its environment:
Plant 1:
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
Plant 2:
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

Writing Topics:

- Describe how rain gardens reduce pollutants going to the City of Fort Wayne's waterways. Include how the plants, soil, and location factor into the effectiveness of the rain garden.
- Research a native plant that could be found in a Fort Wayne rain garden. Describe its characteristics, seasonal adaptations, and its life history. Include a schedule of its dormant, blooming, and pollinating times. Include the plant’s classification and technical name.
- Research two native perennials that can be found in a rain garden and have alternating or different seasonal growing cycles. Explain how these plants could be used in a rain garden to maintain the function of the garden year round. Discuss three characteristics of each.
- Write a short story describing how you think the garden you looked at will change as the seasons change throughout the year.