

Stormwater Management

Rain Gardens

Overview

Students will gain an understanding of rain garden function and benefits

Grade Level

3 - 5

Science Standards

MD 1.A.1, MD 5.A.2, MD 7.F.1, 5-ESS3-1, HS-ESS3-4

Time

60 mins

Teacher Difficulty



Group Size

3 - 4 Students

Materials

- Handouts (one per student): KWL chart, Vocabulary and Questions
- Journal or paper for recording observations
- Strips of white paper and colored construction paper
- Sticky notes

Objectives

- Learn what a rain garden is and why it's important
- Understand the benefits of a rain garden
- Understand the effects of pollution

Warm Up Activity (5 mins)

Evaluate prior knowledge of rain gardens by completing a KWL Chart

Hand out the KWL Chart and allow table groups (3-4 students) about two minutes to come up with as many things they know or wonder about rain gardens. Each table group will share with the class at least two things they discussed.

Suggested questions to ignite brainstorm activity:

1. What is a rain garden?
2. Compare and contrast the differences between a rain garden and a regular garden?
3. Are there different kinds of rain gardens?
4. What is the purpose of a rain garden?

Introductory Activity (5 mins)

Introduce Vocabulary and discuss rain garden elements

Hand out the Rain Garden Vocabulary Sheet and review it with the students. Use diagrams and drawings to aid understanding.

PROCEDURE CONTINUED

Developmental Activity (15 mins)

Take the students on a field trip to observe a local rain garden or show examples of rain gardens virtually

Have students draw what they observe, and record their observations in journals or on paper

Guided Practice Activity (10 mins)

As a group, have students answer the following questions:

1. *What are the benefits of a rain garden?*
 - a. Filter runoff pollution
 - b. Conserve water
 - c. Improve water quality
 - d. Protect rivers and streams
 - e. Create habitat for birds and butterflies

2. *What are pollutants and the dangers they create?*
 - a. Oil and grease from parking lots sediment
 - b. Fertilizers and herbicides from roads, parking lots, and yards
 - c. Can harm or kill fish and other wildlife

3. *Where can a rain garden be built?*
 - a. Residential neighborhoods
 - b. Public gardens and parks
 - c. Street scapes
 - d. Parking lots

Independent Task Activity (15 mins)

Have students complete “Agree or Disagree” activity

Provide each small group with a sentence strip. For about 5 minutes, have the groups discuss and record one benefit they learned about rain gardens on the strip. Pin up the sentence strips around the room.

Provide each group with enough pieces of colored construction paper to leave one response to all the other group’s sentence strips. For 5 minutes, have all students take a gallery walk around the room to read the sentence strips and discuss whether they agree or disagree with the sentences on the strips. Students must give and record reasons why they agree or disagree with the other group’s sentences on the construction paper.

Provide each individual student with a sticky note. For approximately 5 minutes have students take one last gallery walk around the room to read the reasoning statements and write a positive comment on a sticky note and stick it on the construction paper.

PROCEDURE CONTINUED

Assessment Activity (5 mins)

Have students reflect on what they have learned about rain gardens

Have students complete the Rain Gardens Questions Sheet then glue or tape the paper into their interactive science journals.

Closing (5 mins)

Summarize the lesson and reiterate the benefits of rain gardens.

Connect discussion back to stormwater and the different types of stormwater BMPs

Extension Activity

Expand knowledge of rain gardens with activities out of the classroom

- Students can research rain garden plants and materials
- Students can take a field trip to visit local rain gardens
- Students can research how to build and maintain a rain garden
- Students can create an inventory of rain gardens in their neighborhood

HELPFUL HINTS

If class size is too large or resources limited, the independent activity can be completed in small groups

The entire lesson plan can be completed at the rain garden location



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**Stormwater
Management**

Rain Gardens KWL Sheet

What I Know

What I Want to Know

What I Learned

Rain Gardens Vocabulary

Rain garden

A man-made depression that is planted with deep-rooted native plants and grasses that infiltrates and cleans storm-water runoff.

Infiltration

The process by which water on the ground surface enters the soil.

Stormwater runoff

Water that originates during precipitation events and flows over the land. It can pick up sediment, pollutants, and debris as it moves.

Pollution

Substances that make land, water, and air dirty and unsafe or suitable to use.

Rain Gardens Questions

Fill out answers in the space below the questions

Question 1

What is the purpose of a rain garden?

Question 2

What is one benefit of a rain garden that you learned about today?

Question 3

Where could a rain garden be built?

Stormwater Management

Rain Garden Plants

Overview

Students will gain an understanding of rain garden plants and benefits

Grade Level

9 - 12

Science Standards

MD 1.A.1, MD 5.A.2, MD 7.A.1, 5-ESS3-1, MS-ETS1-3, HS-ESS3-4,

Time

90 mins

Teacher Difficulty



Group Size

2 - 3 Students

Materials

- Handouts (one per student): **Vocabulary**, **Questions**, and **Plant chart**
- Access to a rain garden that can be revisited every year
- List of plants originally planted in the rain garden
- Original planting map for the rain garden
- Blank rain garden map for students

Objectives

- Observe and record different plant and animal species in a rain garden
- Compare observations with those from previous years
- Learn about native and invasive species

Warm Up Activity

Evaluate prior knowledge through class discussion

Ask students: What are some plants typically found in your area?

Answers will vary. The purpose is to get a conversation going about common plants found in your area and plant diversity in the landscape. Discuss plants they see in their yards, on the school grounds, etc.

Introductory Activity

Talk about endemic plants, invasive plants, and well-adapted plants and how they affect our ecosystems

Hand out and review rain garden plant vocabulary terms.

Endemic or native plants are beneficial to the environment because they already have their own purpose and niche that works with the other native species to keep a productive, working ecosystem with diversity and growth.

PROCEDURE CONTINUED

Introductory Activity (continued)

Well-adapted plants that are not native are not as beneficial, but they are not harmful to the ecosystem and can have some benefits like aesthetics or helping other species. Invasive species take space and resources from other species, harm or overwhelm other species, and promote monocultures, or lack of diversity in the landscape.



Non-native, invasive kudzu vine covering other species



Native rain garden species

Developmental Activity

Introduce the plants that were originally planted in the rain garden as well as any new species that can be found.

Split students into groups. Review plant characteristics with students. Make sure to note that each plant has aesthetic features (flowers, fall color, fruits, or wildlife attraction) as well as preferences on the light it gets, soil it grows in, and water it needs. Note the fact that some of these plant characteristics may not be visible depending on the time of year.

Make sure to emphasize the characteristics that make these plants ideal for a rain garden. They are drought and flood tolerant, so whether the rain garden is overflowing or parched, the plant will survive. They also have deep, established roots which are ideal for absorbing as much water as possible from the soil.

Guided Practice Activity

Walk around the rain garden and have students observe the different plant and animal species they see.

Hand out a blank map of your rain garden and ask students to use different colors or symbols to draw each plant species they find on the map. Have students record species information on the **plants chart**. They should work in groups to try to find and identify as many plants on the list as possible and record any additional plants they come across. Students may draw or take pictures of what they observe.

*With teacher permission, students can remove invasive species in the rain garden. Students should try to identify the plant before removing.

PROCEDURE CONTINUED

Independent Task Activity

Have students work together to compare the observations from the past years with their own.

Back in the classroom, pass out observations from previous years. This can include maps, notes, photos, etc. Students should work in groups to compare their findings with past results and answer the Rain Garden Plants Questions Sheet

Assessment Activity

Have students discuss their analyses with the class and share examples of observations they made that differ from those from previous years.

Answers will vary. Students should share an observational difference, then explain why the change occurred. New species could be present because of lack of maintenance, invasive plant characteristics, wind or animal seed dispersal etc. If older plants aren't doing well, it could be related to light, water, soil conditions, pests or disease. Make sure to collect all observation notes and maps for future students to make comparisons.

Have students form a hypothesis as to how the plants will do in the future, or what the garden will look like in a few years. Answers will vary, but the purpose is to get the students familiar with plant characteristics and habits.

Closing

Summarize the lesson and reiterate the impact of endemic species vs. invasive species. Discuss how plants are a vital part of a rain garden and stormwater management.

Discuss which plants (if any) the students think might be invasive. Plants are an important part of a rain garden because they aid in filtering the stormwater that moves through the site. They also use that water to grow and then cause evapotranspiration, sending that water back into the water cycle.

Extension Activity

Expand knowledge of plants with activities out of the classroom.

- Students can identify and research the invasive species found in the rain garden, then write a short report on the plant's nativity, habit and other characteristics. They can research endemic plants that are similar and could replace the invasive species.
- Students can research the concept of plant diversity including Shannon's Diversity Index and write a small report on how it works (number of species and evenness of abundance) and why diversity is important. They should include their own thoughts about the diversity of plants found in the rain garden.

PROCEDURE CONTINUED

HELPFUL HINTS

This lesson can be done twice during the academic year: once in the fall and once in the spring. That way students can observe the changes in the plants at different points during the year. Make sure to teach the lesson around the same time(s) each year for accurate data.

Before removing a plant, make sure it is invasive and also not poison ivy.

Identifying plants will get easier every year that you teach the lesson. Students will also get the hang of identifying plants by their different characteristics.



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Berm

A raised bank, typically used to control where water is contained or flowing.

Bioretention

The process in which contaminants and sedimentation are removed from stormwater runoff by holding and infiltrating water into the ground.

Endemic

Native plants that have developed, occur naturally, or existed for many years in an area

Invasive

Non-native plants that have the ability to thrive and spread aggressively outside their natural range. They threaten to overtake other plant species.

**Low Impact Development
(LID)**

Design that works to treat stormwater as close to the source as possible to prevent erosion and polluted water sources.

Habit

Refers to the form or shape the plant is growing in. It can also be as simple as identifying if it is a tree, shrub, vine, groundcover, perennial, etc.

Infiltration

The process by which water on the ground surface enters the soil.

Non-native plants

Plants that have been introduced to a new area different from their native range, either purposefully or accidentally. They are not necessarily harmful to other plants in their native habitats, and can sometimes fill a certain need better than native plants.

Organic soil mixture

Soil consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms among other types of soil.

Rain Garden

A planted depression that infiltrates and cleans stormwater runoff.

Transpiration

The process in which water is carried through plants and is released through the leaves into the atmosphere as vapor. It is essentially the evaporation of water from a plant.

Stormwater Runoff

Water that originates during precipitation events and flows over the land. It can pick up sediment, pollutants, and debris as it moves.

Swale

A graded landscape feature appearing as a linear, shallow channel. Usually vegetated to help move and filter stormwater at a controlled rate.

Wetland

A land area that is saturated with water, either permanently or temporarily.

**Stormwater
Management**

Rain Garden Plants Chart

Species	Location	Tally	Notes

Rain Garden Plants Questions

Fill out answers in the space below the questions

Question 1

How many plants from the list did you identify? Which plants were missing or unidentifiable?

Question 2

Did you find any exotic species? Draw or describe these plants.

Question 3

Compare your map with one from another year. What year is it from? What are the similarities and differences between the two maps?

Question 4

What do you think are the differences between the maps/why do you think the changes occurred?