How to build a rain barrel

A hands-on rain barrel lesson using the visual arts.

For grades K - 8

Created by the Athens-Clarke County Stormwater Management Program

Lesson Summary

Students learn about the water cycle, stormwater runoff and the role rain barrels play in reducing runoff and water pollution. After the lesson, students assemble a rain barrel and create a plan for decorating it. This lesson encourages scientific exploration and incorporates art into the scientific process.

Objectives

- Students will learn the parts of the water cycle.
- Students will learn that stormwater runoff is the number one source of water pollution.
- Students will learn about common water pollutants, including animal waste, litter and sediment.
- Students will learn what a rain barrel is, how it functions, and its role in reducing runoff.
- Students will be able to create a barrel design that reflects their new knowledge.

GSE Science Major Concepts

3rd Grade:

S3L2. Obtain, evaluate, and communicate information about the effects of pollution (air, land, and water) and humans on the environment.

4th Grade:

S4E3. Obtain, evaluate, and communicate information to demonstrate the water cycle.

S4L1. Obtain, evaluate, and communicate information about the roles of organisms and the flow of energy within an ecosystem.

5th Grade:

S5P1. Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.

6th Grade:

S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.

S6E6. Obtain, evaluate, and communicate information about the uses and conservation of various natural resources and how they impact the Earth.

7th Grade:

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

Materials

- rain barrel and rain barrel kit
- how to build and how to paint guides
- paints, brushes, and sponges
- paper
- crayons/markers/colored pencils

Background Information

This activity focuses on the water cycle, stormwater runoff and building a rain barrel.

Water cycle

The water cycle consists of evaporation, evapotranspiration, condensation and precipitation. Water continuously moves through this cycle.

- **Evaporation:** As liquid water in streams, rivers and oceans is heated by the sun, it turns into water vapor.
- **Condensation:** As water vapor rises, it begins to cool, causing the water vapor to condense into clouds.
- **Precipitation:** As clouds move across the sky, water particles can drop out of the sky as rain, snow or sleet.
- **Evapotranspiration:** The process by which water evaporates from soil and plants.

For K-3 classes, evapotranspiration can be excluded.

Stormwater runoff

Stormwater runoff is rainwater or snowmelt that flows over the ground. In natural areas, most rainwater soaks into the ground, because the ground there is pervious, allowing water to pass through it. In developed areas, the ground is hard and impervious, which prevents stormwater from infiltrating, resulting in runoff.

As runoff moves across the landscape, it can pick up many different pollutants. In Athens-Clarke County, when runoff enters a storm drain, it carries those pollutants directly from the streets and sidewalks to the streams and rivers. Some of those pollutants include:

- **Sediment.** Sediment can cloud the water and harm aquatic plant and animal life. Sediment also presents points of nucleation for bacteria, promoting the growth of harmful bacteria.
- **Bacteria and pathogens.** Present in animal waste, bacteria and pathogens can enter the stream through septic tank leaks, pet waste and wild animal waste. Once there, the bacteria can make the water unsafe for recreation and drinking.
- **Nutrients.** Found in fertilizers and animal waste, plant nutrients such as nitrogen and phosphorous can cause problems. Once in the stream, nutrients promote algae growth, resulting in algal blooms and the disruption of aquatic ecosystems.
- **Litter.** Trash and dumped items can suffocate, choke or otherwise harm aquatic animal life.
- **Household chemicals.** Soaps, pesticides, paints and other commonly used household chemicals can enter streams and rivers and poison aquatic life.

For grade 6, focus on the impact of water on topography. Consider how water can be stored as groundwater or surface water, and discuss how water can erode soil and rock to change the landscape.

For grade 7, discuss how the different pollutants can disrupt ecosystems by affecting different parts of the aquatic food web, such as the plants, macroinvertebrates, and fish.

Building a rain barrel

Rain barrels can reduce stormwater runoff by catching the rainwater before it can become runoff. Rain barrels are often connected to gutters through downspouts or rain chains, but some rain chains can be used without gutters, too. Water collected in rain barrels can be used for watering the lawn or washing the car. The water can also be used for watering gardens, provided the water is applied close to the soil's surface. Since approximately 40% of household water is used for outdoor purposes, rain barrels can make a big dent in reducing the need for city water.

Please reference the step-by-step rain barrel build guide (separate document) for the rain barrel building procedure.

Rain barrel created by Dan Smith, 2015.

Procedure

Discuss the stages of the water cycle and the way water transforms between two, sometimes three, states (liquid, gas and solid). Three main steps make up the water cycle. Ask if anyone can name them.

For K-3 students, this is a good time to ask the students to stand up, stretch and do the water cycle dance. First tell the students to imagine they are water droplets on the ground. The water cycle dance involves 1) evaporation (students crouch down and stand up slowly while wiggling as the dance leader tells them the sun's rays are warming them up), 2) condensation (students clap their hands as the dance leader tells them that the air is cool so far from earth, forming clouds), and 3) precipitation (the students move toward one another to form a clump and once the clump is formed, the students quickly crouch down or fall other to represent rain falling).

Ask the students what happens to rain when it hits the earth, and if possible, write their answers on the board. The students should generate a list that includes soaking into the ground, going into a river or hitting infrastructure or homes. Discuss what happens to the water when it soaks in [becomes groundwater, gets used by plants, can evaporate in evapotranspiration]. Then ask what happens to the water when it runs off the ground into our streams and rivers [picks up pollutants, can heat up, enters the water quickly]. As students to compare/constrast stormwater in natural areas and urban ones.

Ask students to name pollutants that runoff can pick up and explain how those pollutants harm the ecosystem and affect humans. Fill in the gaps of their list with pollutants from the background information. For older grades, ask students to explain what can happen when multiple pollutants enter our waters [algal blooms and warm water can both lower dissolved oxygen, harming fish, for example].

Pass out paper and crayons to all students. Tell them that they are drawing a pollution postcard. On the front of the postcard, they draw a picture of one of the types of pollution discussed earlier. Older students should draw an infographic. On the back, they write a message to a friend explaining what happens when people pollute. Remind them to consider their audience when crafting the message.

Ask the students to share a few of their postcards and pollution messages.

Next, ask students what we can do to reduce water pollution. Introduce the concept of reducing runoff if the concept is not student generated. Talk to them about how rain barrels can reduce pollution and save water, and tell them that they are making one for their school.

Follow the rain barrel how-to guide for the proper rain barrel making procedure.

If time permits, have students decorate the barrel or work together to create an idea for the barrel.

Assessment

Students will create pollution postcards, which will show their understanding of one type of common pollutant. Students will also be answering questions throughout and at the end of the activity.

Sample questions include:

- How does sediment in water affect how you can use the water?
- Which two pollutants increase when animal waste enters the water?
- How would you convince someone to stop polluting?
- What can you do to help keep Athens-Clarke County streams clean?

From STEM to STEAM: Connecting to art

Learning about water pollution is not enough: that message needs to be shared and put into action. One great way to practice sharing scientific and technical information is through art.

The pollution postcards allow students to practice their communication skills, preparing them for future work with graphs, infographics and flowcharts. If participants seem stuck, talk them through the various pollutants discussed in class.

Decorating the barrel with relevant scenes can also help kids connect science and art. The rain barrel, beyond being functional, can also tell a story and add beauty to the school's campus. Work with the class to create and implement a strategy for decorating the rain barrel. Provide paint, brushes and

Rain barrel created by Lily Swindle, 2015.