



Sum of the Parts (from GA Project WET)

For grades 2 - 8

Lesson plan adapted for the ACCGOV Stormwater Management Program

Lesson Summary

Students learn about ecosystems, watersheds, stormwater runoff, and the many different types of pollutants that can get into our water sources. Students demonstrate how everyone contributes to the pollution of a river as it flows through a watershed and recognize that everyone's "contribution" can be reduced.

Objectives

- Students will learn the basic components of a freshwater ecosystem.
- 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, excess fertilizers and pesticides, oil, and sediment.
- Students will learn several simple ways for humans to reduce their impact on water quality, i.e. pick up after pets and routinely check cars for oil leaks.
- Students will distinguish between point and non-point source pollution.
- Students will recognize that everyone contributes to and is responsible for a lake or river's water quality.

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

- property template with blank space and river, numbered at the top (template included on following page)
- crayons
- markers
- colored pencils
- pollutant stuffed animals (representing sediment, oil, and bacteria)
- several pieces of clean litter (plastic bags, empty cans, paper fast food bags, cups, water bottles)

Background Information

This activity focuses on ecosystems, stormwater runoff, and common household pollutants.

Ecosystems

According to Encyclopedia.com, an ecosystem is a “complete community of living organisms and the nonliving materials of their surroundings.” Ecosystems include everything from animals, plants, and bacteria, to rocks, soil, bodies of water, and even the atmosphere around them. The size and make-up of ecosystems vary tremendously.

A freshwater ecosystem, specifically, is a type of aquatic ecosystem. These include lakes, ponds, rivers, streams, and springs. Freshwater ecosystems, as opposed to marine or saltwater ecosystems, are often classified by temperature, light penetration, and vegetation, and they are home to many different insects, amphibians, fish, and birds.

Stormwater runoff and household pollutants

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 (freshwater ecosystems). Some common 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.

Water quality

Water quality is largely a reflection of land uses and natural factors found in the watershed or ecosystem. If soil near a river is naturally eroding, chances are the river has sediment and turbidity problems. If the land has stable vegetative cover, erosion is kept in check. When humans settle and develop land, water quality is affected. Breaking sod, cutting forests, building cities, mining, and other land uses make an impact on water quality.

Everyone bears responsibility for the health of a watershed and the water systems within a drainage basin. Individual actions, both negative and positive, add up. Understanding a river or lake's water quality and quantity involves investigating the condition of the contributing properties. If the watershed is polluted somewhere, the river will likely be polluted as well.

Procedure

Start by discussing watersheds. Determine student knowledge by asking them to name several major North American rivers. Where do these rivers originate and end? How many states does each cross or touch? See if they can name the local rivers as well. Next, start a discussion about stormwater. Ask the students what happens to rain when it hits the earth. 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 [picks up pollutants, can heat up, goes into a storm drain and enters the water quickly]. Ask students to compare/constrast stormwater in natural areas and urban ones.

Next, discuss some of the predominant types of land uses found along a river as it flows through a single city or state (i.e. farms, industrial factories, neighborhoods, conservation properties, large commercial buildings, etc.). Do students think these different practices could affect the river? Ask students if they can identify pollutants that may be generated from these different land uses.

Inform students that they have just inherited a piece of riverfront property and 1 million dollars. Have them brainstorm ways they could use the land and money. Pass out the property sheets with water drawn on the bottom. This sheet represents each student's property, and they can develop the property however they wish. They will use colored pencils, crayons, or markers to draw their development.

After most students are done with their drawings, ask them to look in the upper left corner for a number. Explain that each piece is actually part of a larger puzzle, and they will be assembling their properties in order. Starting with number 1, papers should be laid down on the ground followed by number 2 facing number 1, with the stream sides touching each other. Number 3 will be put next to number 1, and so forth.

One by one (if time is short, select five students to share), have students describe how they developed their land and how they used water. They should identify if any of their actions polluted or added material to the nearby river. Have students represent each of the contributions to the river with a stuffed animal (provided), piece of litter, or simply an item from their desk. As students share down the line, each pollutant must be passed from the first person to the next, until the last student is holding tons of items. This illustrates the movement of pollutants within a river and shows that properties upstream can greatly impact properties downstream.

Assessment

Ask students:

- How did those students toward the middle or at the end of the river feel?
- Could a student downstream be affected by the actions of a student upstream?
- Could upstream users alter the water quality of those downstream?
- How could you convince someone to stop polluting?
- Can you identify which pollutants were point or non-point sources?
- What can you do to help keep Athens-Clarke County streams clean?

As a follow-up, have students write a paragraph detailing ways to reduce the amount of pollution he or she contributed. Students can also research the regulations governing waterfront property in their communities.

Property Template

