3rd Grade Unit "Pollution and Plant Growth"

SPLASH! Stormwater Pollution: Learn and Share

Objective: *This unit explains that pollution cannot always be seen and that polluted water can harm plants and affect plant growth. This unit was developed to be used as an extension of the Plant Growth Science Kit.*

Materials and supplies to support this lesson: *

- Tagboard, foil, sponge, clear plastic container, plastic cups, sugar, salt, lemon juice, cotton swabs, food coloring, peat cups and lima beans.
- "Natural Treatment Plants" pdf or handout

Lesson 1: What happens when precipitation hits the ground?

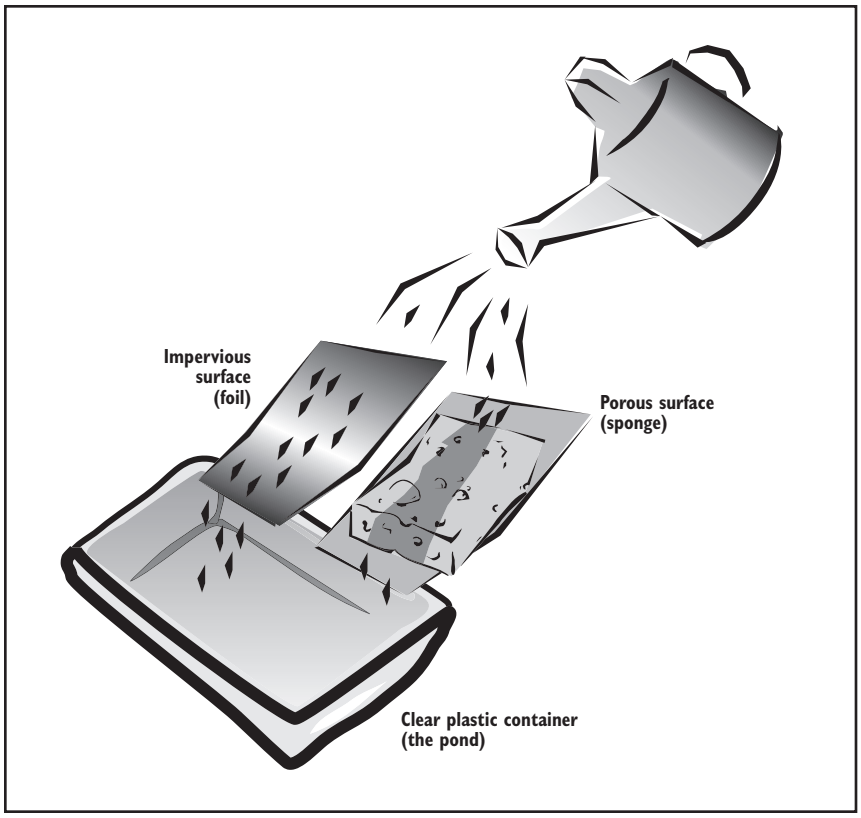
The earth is made up of land and water. When it rains or snows, precipitation can fall back into lakes, rivers, streams and the ocean. Precipitation also soaks into the ground, where it is used by plants for growth. Precipitation that soaks into the ground is referred to as groundwater. Some precipitation falls on impervious surfaces, such as roofs, paved roads, and parking lots. Water cannot soak into the ground through an impervious surface, so it often runs into local storm drains. When water runs off impervious surfaces into storm drains, it is called stormwater. Stormwater flows down a storm drain and into a network of pipes that eventually empty directly into a stream or river. Stormwater is not "cleaned" before it discharges into local waterways. Anything (oil, leaves, soap suds, dirt, garbage) that washes down the storm drain with stormwater goes directly into local wetlands, rivers, lakes, and streams.

Activity 1: *What is an Impervious Surface?* Demonstrate runoff. Using a simple model, illustrate and explain the difference between an impervious surface and a porous surface. Materials needed:

- two 4 x 6 pieces of tagboard
- 1 clear plastic square container
- 1 sponge
- watering can
- aluminum foil

Create an impervious surface by wrapping 1 piece of tagboard in aluminum foil. Attach the sponge to the other piece of board. Fill the plastic container (the pond) part way with clean tap water. Prop up the two boards so water can run off the boards into the plastic container. Sprinkle water over the foil-covered board and let it pour into the pond. Explain to students that water cannot soak into an impervious surface. Next, pour water onto the board with the sponge. Discuss what happens to the water. To demonstrate how stormwater runoff can carry pollutants into local waterways, sprinkle cocoa on the foil-covered board and pour water over the cocoa. As the water mixes with the cocoa, it will become murky and

* available for teachers from the City of Eugene. See end of unit to order.



This simple experiment demonstrates the difference between porous and non-porous (impervious) surfaces.

pollute the pond. Next, put some cocoa on the sponge and sprinkle the sponge with water. The sponge absorbs the water and cocoa mixture. Explain to students that the ground is like a sponge and can absorb water and pollutants.

Brainstorm: Have students list examples of impervious surfaces. Remember, an impervious surface is any surface that cannot absorb water. Have students list pollutants that can be carried with storm-water down a storm drain. (Examples include fertilizers and pesticides from our yards, oil from our cars, litter thrown in the street, and animal waste).

Lesson 2: What's in the water?

We use water every day for drinking, cooking, bathing and recreation. What happens when water becomes polluted? How does pollution harm people? How does pollution harm plants?

Many pollutants are obvious to the naked eye. It is easy to see garbage or debris floating in the water, water with soap suds, or the sheen of oil on the water's surface. However, what happens when pollutants mix with water? Are they still in the water? Explain to students that pollution cannot always be seen and that invisible pollutants can still be harmful.

Safety Alert! Teachers, please remind students to never taste anything in a science class unless it is a controlled experiment supervised by an adult!

Activity 1: *What's in the water?* To demonstrate that clear water is not always free of pollutants, this experiment lets students "taste" pollutants that have been dissolved in tap water.

Materials:

- Clear plastic cups
- Sugar
- Salt
- White Vinegar
- Lemon Juice
- Cotton swabs
- Water

Place tap water in 5 plastic cups. Stir 2 Tbs. sugar into cup #1, 2 Tbs. white vinegar into cup #2, 2 Tbs.salt into cup #3, and 2 Tbs.lemon juice in cup #4. Do not add anything to cup #5. Using cotton swabs, let each student taste the water from each cup. Can the students identify "the pollutants" dissolved in each cup? Why couldn't they see the pollutants?

Brainstorm: List common water pollutants on the chalkboard and discuss where they come from. Have students copy the words from the board. Identify pollutants that can be seen and discuss that some pollutants cannot be seen, but are still harmful. Can students think of any pollutants that may mix with water and not been seen? (Examples may be pesticides, fertilizers, paint thinner).

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Lesson 3: Can plants clean pollutants from water?

All plants, even plants that live in the desert, need water to survive. Most plants obtain water by using their roots to absorb water and nutrients for growth from the ground. Plant roots act like "straws" to draw water up into their stem and leaves.

Plants that live in wetland areas have an important role in helping to clean water that has been polluted by stormwater runoff. Water usually flows through wetland areas before being released into local creeks and rivers. Wetland plants (like cattails and grasses) soak up water with their roots, along with any dissolved pollutants. The pollutants are stored in the stems and leaves of the plants. As a result, the water that flows through wetlands is filtered and less pollution makes its way into creeks and rivers.

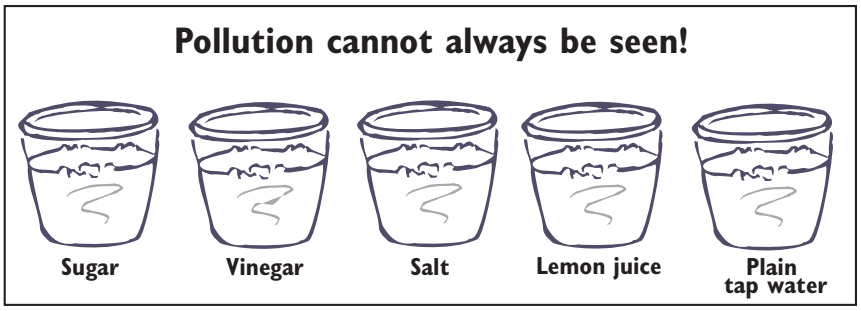
Handout: Hand out a picture page showing different types of wetland plants. Point out to students that some plants grow with their roots in the water.

Activity 1: *Can plants suck it up?* To show how pollutants are absorbed and stored in plant stems and leave, do an experiment with a celery stalk.

Materials:

- fresh celery stalks with leaves
- water
- 1 clear glass
- knife
- red or blue food coloring

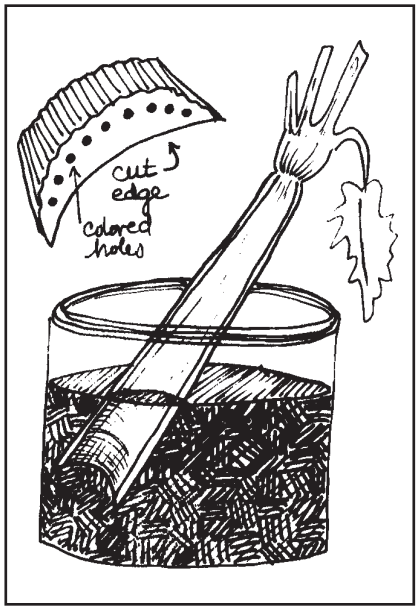
Add several drops of food coloring to water in a clear glass. Explain to the class that the food coloring represents a pollutant, such as a pesticide, that has mixed with stormwater. Ask students to name any other pollutants that the food coloring could represent.



By tasting "invisible" substances dissolved in tap water, students learn that all pollutants cannot be seen.

Cut off the bottom half-inch of the celery stalks and place them in the colored water. Explain to students that the celery stalks represent wetland plants and that the colored water is the polluted stormwater that flows through wetlands. Let the celery stalks remain in the water overnight. Overnight, the colored water will travel up the the celery stalks, showing how plants can absorb pollutants with the water they "drink." The colored water may not or not be visible on the outside of the stalk.

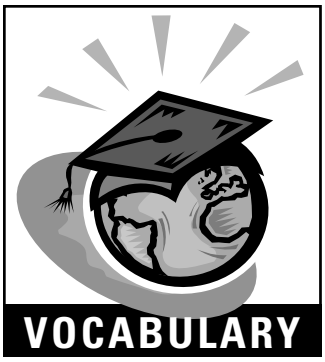
The next day, remove the celery stalks from the water and cut off one-inch pieces. Hand out the pieces to students and have them examine the pieces closely. On the cut surface, they will see colored dots. Explain that the dots are a cross-section of water-filled channels (like straws) that run up the celery stalk. These straws, inside the stem, soaked up the pollutants along with the water they drank. Explain that although the wetland plants can soak up pollutants too, many pollutants in the water will eventually kill the plants.



Using celery stalks and colored water, students can see how plants "drink" water and pollutants in the water.

Follow-up questions:

1. How do wetland plants help clean water?
2. Why is the water left in the jar still polluted?



precipitation
impervious surface
storm drain
stormwater
pollution
wetland
runoff
absorb
nutrient

Lesson 4: Can too many pollutants harm plants?

In Lesson 3, students saw how plants can absorb pollutants into their roots and stems. What happens when too many pollutants are absorbed into plants? Can the pollutants affect plant growth? Will certain pollutants hurt plants more than others?

Activity 1: *Do pollutants affect plant growth?* The purpose of this experiment is to see how different pollutants can affect plant growth. As students have learned, many pollutants, seen and unseen, enter the stormwater system with rainwater and are carried to local waterways. Three substances, dishwasher soap (phosphorous), bleach (chlorine), and ammonia will be used to represent "pollutants" and will be mixed with the water used on the plants. To compare the affect of watering plants with polluted water, clean tap water will be used on one plant in each group.

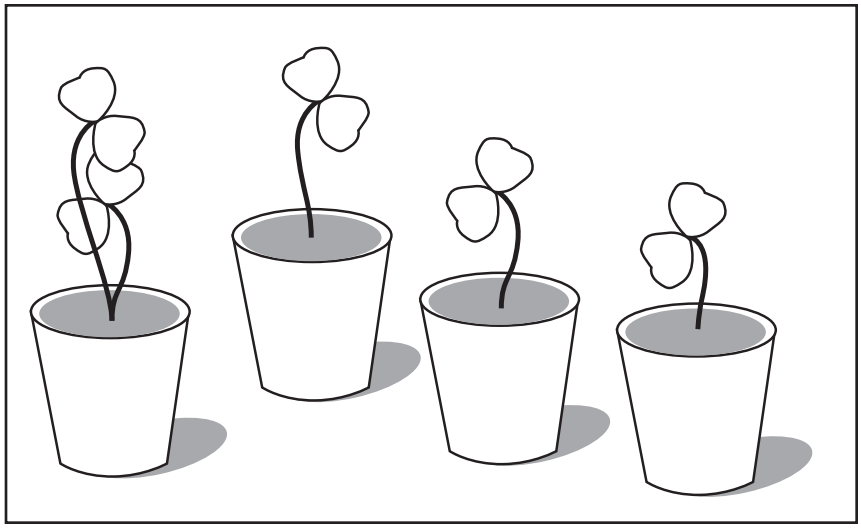
Safety Alert! It would probably be best if the teacher, rather than the students, watered the plants with the "pollutants."

Materials:

- small pulp pots
- lima beans
- potting soil
- bleach (chlorine) 2 tbs. mixed with one cup tap water
- dishwashing soap (phosphorous) 2 tbs. mixed with one cup tap water
- ammonia (ammonia) 2 tbs. mixed with one cup tap water
- water

Divide students into groups of four or less. Before starting the experiment, demonstrate how to plant the lima beans in the cups. Give each group eight cups and have them plant one lima bean in each cup. (Planting eight lima beans will give students a "back-up" plant if one of the lima beans fails to germinate.) Mark the cups according to which water solution will be used to water the plants. There should be two plants that will be watered with plain tap water and two plants that receive water mixed with each of the "pollutants." Mix two tablespoons of each "pollutant" with one cup of plain tap water.

After mixing the pollutants with the water, ask the students if they can see the pollutants in the water.



Demonstrating the affect polluted water has on lima beans will increase students' awareness of pollution in local waterways.

After planting the lima beans, ask the students what they think will happen to the beans watered with "polluted" water. Write down their hypotheses and use them later to compare with the final results of the experiment.

Place the cups on a windowsill or brightly lit shelf. Water the plants twice a week (for example, Tuesday and Friday) and measure their growth. At the end of three weeks, create a simple graph comparing the growth of each plant watered with the different pollutants. Make a separate graph of the plants watered with plain tap water. Have students compare the graphs and then ask the following questions:

1. Did any of the pollutants make the plants grow better?
2. Did any of the pollutants kill the plants?
3. What was the result of using plain tap water?
4. How do people use these substances in their everyday life and how can they get into the storm drain (e.g. soap and ammonia from washing cars)?
5. How did the students' hypotheses match the results?
6. Were there any results of the experiment the students did not expect?

Also available for your classroom:*

SPLASH! Songs CD with songs for children written and performed by Rich Glauber. Lyric sheet is online.

Schedule a visit from Lily the Frog, our stormwater mascot. Lily can visit your classroom to meet your students and help them learn about the wetlands where she lives.

Call or e-mail for details. *

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Stormwater Pollution: Learn and Share

SPLASH! classroom materials are online at happyrivers.org

SPLASH! was developed by the City of Eugene Stormwater Management program to support education about water quality in our community. This program is funded by City of Eugene stormwater user fees.

* For more information, supplies for use with these lessons, the SPLASH! Songs CD, or a visit from Lily, contact jeffrey.j.flowers@ci.eugene.or.us or call 541-682-8482 (Eugene schools only)

Natural Treatment Plants!

Wetland plants have adapted to life in areas where water is present all or part of the year and play an important role in keeping water clean.

Camassia quamash (Camas lily)

Wetland plants have adapted to life in areas where water is present all or part of the year. Represented by trees as mighty as the oak and flowers as tiny as the rein-orchid, there are hundreds of plant species found in wetlands. Specialized roots, stems and leaves help the plants obtain nutrients from the water and soil.

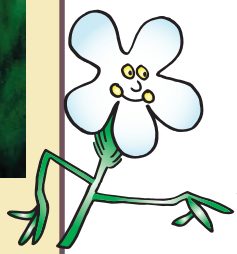
Wetland plants play an important role in keeping water clean by filtering out pollutants that are carried with the water that flows through wetlands. The pollutants are absorbed by the plant roots and stored in the stems and leaves.

Tufted hairgrass

Popcorn flower

Sedge

Juncus



Look for these plants when you visit the wetlands!

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