

## Role of Plants in Water Filtration

**Subject Area:** Science

**Unit Title:** Source Water Protection

**Grade Level:** 4th & 5th grade

**Objectives:** To understand the role of plants in filtering the water moving through a watershed.

**Colorado Content Standards to be covered:**

### ECONOMICS

**Standard II** - Students understand how different economic systems impact decisions about the use of resources and the production and distribution of goods and services.

### GEOGRAPHY

**Standard V**- Students understand the effects of interactions between human and physical systems and changes in meaning, use, distribution, and importance of resources.

### SCIENCE

**Standard I** - Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

**Standard III** - Life Science: Students know and understand the characteristics and structure of living things, the processes of life and how living things interact with each other and their environment.

**Standard V**- Students know and understand interrelationships among science, technology and human activity, and how they can affect the world.

### Materials:

- sticky notes
- 6 potted plants: pots should be roughly six to eight inches in diameter with holes in the bottom. These plants need to be moderately dry, as if they had not been watered for a couple days. Plants with saturated soil will not absorb water, and very dry plants will absorb it all.
- Six clear containers, such as cups, which will support the plants and allow drainage to be viewed. You will need separate plants and cups for each of the materials in the water.
- Soil from outside (anywhere). The best soil is loamy, with particles smaller than sand.
- Unsweetened powdered drink mix, preferably grape or cherry for color.
- Vegetable oil.
- One or two different household cleaners (such as Comet/Ajax and Dish or Laundry soap). One should be liquid and the other powder.

**Anticipatory Set:** Ask the students whether they believe plants can or cannot filter out some pollutants from water. Have them write their answer “yes” or “no” on a sticky note.

### Input:

Experiments can be done to show how a plume of dissolved materials can move through soil and enter a ground-water aquifer; but soil and plants have something of a dual role in this process. Depending on whether materials are dissolved or suspended in the water, soils and plant roots can remove some or all of this material as the water moves down through soil. Most suspended materials will adhere to the soil. These may then be broken down and used as food by the plants. Dissolved nutrients, such as nitrogen or phosphorus, chemically bond with some types

of soil particles. They are then taken up by plants, thus removing them from the soil before they can enter an aquifer. For the plants, these elements are food; for an aquifer, they are pollution. Not all materials are absorbed by plants, and not all water pollutants are food for plants. However, sediments from eroding soil, nutrients in human and animal wastes, and some components of household wastewater (“graywater”) are excellent plant nutrients. Plants also use different nutrients at different rates, so that the amount of material they take up will depend on how much is dissolved in the water and how fast the water moves through. This experiment is a very simplified way to show whether plants will take up certain kinds of materials from water moving relatively quickly through their root systems.

**Checking for Understanding:** At the end of this section, choose one of the following for a quick check: ask the students to partner share and think, pair and share, do a quick 3 word write up as an exit slip, do a quick sketch or give each other a quick thumbs up or down to check for understanding. Determine the level of mastery for each student and provide individual remediation as needed.

**Procedures/Activities:**

**Role of Plants in Water Filtration**

**Prep:**

Set up the potted plants, each in its own cup. Slowly pour six to eight ounces of clean water through the pot, and check the **percolation rate** (the rate the water passes through the soil and plants) through the pot. Loosen or tighten the soil so that water percolates at about one ounce per minute. The rate should be fast enough to prevent long waiting periods, but slow enough not to carry very much soil through the pot.

**Directions:**

1. Place the potted plants into the top of their cups. Pour clean water slowly through one of the pots and watch it percolate through the bottom of the pot. The water should look as clean as what was poured.
2. Add a gram or so of soil to 6-8 ounces of water and stir so that the soil is well suspended and distributed in the water. Pour slowly into another flower pot. The water percolating through should look much cleaner than the dirty water poured.
3. Add about one ounce of vegetable oil to 6-8 ounces of water, stir (they won't mix completely) and pour into a third pot. See if the vegetable oil percolates through or is caught up by the plant roots.
4. Add some powdered drink mix to 6-8 oz. of water and pour through a fourth pot. See if the water percolating through retains its color.
5. Add some powdered cleanser to 6-8 oz. of water and pour through a fifth pot. Is the cleanser retained in the soil?
6. Add some liquid soap to the water (an ounce or so in 6-8 oz. water). Does the soap percolate through the soil?
7. Using the “contaminated” plants, pour some clean water at the same rate through each one (simulating a rain shower). Is more of the “pollutant” rinsed away from the soil by the clean water?

**Closure:**

Ask the following questions of your students:

1. In what ways can plants and soil benefit drinking water quality?
2. We saw plants and soil remove some types of impurities from water. How might the plants remove larger quantities?
3. Can plants and soil remove any type of impurity from water?
4. What other organisms in the soil-plant system might aid the uptake of water pollutants?
5. What is the role of rainwater moving through contaminated soil?

Ask the students the anticipatory question again: “Whether they believe plants can or cannot filter out some pollutants from water.” Compare their answer with their original answer and discuss.

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