

WATER TREATMENT PLANTS

6-8

OBJECTIVES

The student will do the following:

1. Describe how plants remove pollutants from water.
2. Discuss the limitation of plants' ability to remove pollutants from water when overburdened with pollutants from the land.

BACKGROUND INFORMATION

Many people fail to realize that plants are essential to the health of our water supply. Wetlands and their plants are an increasingly popular alternative for filtering wastewater from homes, factories, schools, and businesses. Plants growing in a wetland filter pollutants out of runoff, rainwater, and wastewater before it enters bodies of water.

The tangle of leaves, stems, and roots in a densely vegetated wetland trap trash and particles of sediment. These remain in the wetland, while the cleaner water moves away. As water moves through a wetland, plants also take up toxic pollutants and nutrients. Nutrients are used by the plant for metabolism and growth while other substances are stored in the tissues of the plant.

In a natural system, plants are fairly efficient at keeping the system in balance even when there is a naturally occurring flow from upstream. However, when human activities in the water and on land add nutrients, sediment, and toxic pollutants, plants cannot clean everything. We must be careful that our activities will not send pollutants into the water. We also must maintain and even add to the wetlands that help keep out those pollutants that we miss or cannot control.

Many pollutants run off of the land from construction sites, highways, streets, and the communities in which we live. Sometimes ponds or ditches are built to filter runoff from these sites. These ponds are ditches, which are often planted with wetland plants to aid in the filtering. Rain and runoff also rest a bit here before moving on. This means that many of the pollutants, especially soil particles, settle to the bottom while the cleaner water drains off from the top. These ponds or ditches are called storm water management ponds.

Natural and constructed wetlands are now being used for sewage treatment in some areas. One city in California transformed a 160 acre garbage dump into a series of ponds and marshes. The sewage is first pumped into the holding ponds where it undergoes the settling process. Bacteria and fungi digest the organic solids that have settled out. Effluent from the holding ponds then passes through the marshes where water is filtered and cleansed by aquatic plants.

Terms

nutrient: an element (or compound thereof), such as nitrogen, phosphorus, and potassium, that is necessary for plant growth.

pollutant: an impurity (contaminant) that causes an undesirable change in the physical, chemical, or biological characteristics of the air, water, or land that may be harmful to or affect the health, survival, or activities of humans or other living organisms.

storm water runoff: surface water runoff that flows into storm sewers.

SUBJECTS:

Biology, Botany, Health

TIME:

Teacher set-up one day ahead, then 30 minutes for demonstration and discussion.

MATERIALS:

celery stalks
2 beakers (jars may be used)
food coloring
water
knife
teacher sheet
student sheet

ADVANCE PREPARATION

- A. The activity may be done in groups or as a demonstration. Prepare the demonstration one day before the lesson. Repeat these steps in front of the class to show how the demonstration was prepared.
- B. Place one set up of celery in the refrigerator to note whether any differences are noted in the chilled plant.

PROCEDURE

I. Setting the stage

- A. Prepare a solution in a beaker by adding several drops of food coloring to water. Explain that the food coloring represents pollution by a toxic substance (a pesticide, for example). Students may come up with other examples.
- B. Ask students to imagine water flowing through a wetland that has many plants. Tell students that the stalks of celery are similar to plants growing in a wetland, such as sedges, cattails, and grasses.

II. Activity

- A. Cut off the bottom half inch of the celery stalks and place them in the water overnight. Over time the colored water will travel by capillary action up the stalk. This will be a visible demonstration of how plants can absorb pollutants with the water they "drink."
- B. The colored water may or may not be visible on the outside of the stalk. Cut off one-inch pieces of the celery and hand them to the students to study closely. They will see colored dots on the cross section, which are water-filled channels in the celery.

III. Follow-Up

- A. Ask the following questions or have students answer them in groups:
 - 1. How do wetland plants help to purify water? (They purify water by taking up pollutants from it.)
 - 2. Why is the water remaining in the beaker still polluted? (Plants can only do so much. As new, hopefully clean, water flows into the system, the pollutants will be somewhat diluted and the water a bit less polluted. If the water continues to flow on to other parts of the wetland, other plants will continue to remove pollutants. Wetland soil also helps to filter out some pollutants.)
 - 3. Where does the water go after uptake into the plant? (It is transpired out through the stomata in the plants' leaves and usually evaporates.)
 - 4. What happens to the pollutants? (Some are used in the plants' metabolic processes, some are transformed into less harmful substances, while others are stored in the plants' tissues and could be re-released into the environment if the plants die.)
 - 5. Why can't we simply dump all of our waste into wetlands? (Wetlands can only do so much, so many pollutants still end up in the water. Too many pollutants will harm or destroy a wetland. The best solution is to reduce the pollution.)

IV. Extensions

- A. Have the students check their neighborhoods and other places undergoing construction to observe the areas after a rainstorm.
- B. Have the students write a plan for how they would control pollutants if they owned a large plant nursery.

- C. If the neighborhood has a storm water management pond, ask the students to observe it. Many are located near large shopping centers and parking lots. Ask the students to observe the pond on a dry day and on a day after a heavy rain.

RESOURCES

"Treatment Plants," Discover Wetlands.

WOW!: The Wonder of Wetlands.

Cunningham, William P. and Barbara Woodsworth Saigo, Environmental Science: A Global Concern, Wm. C. Brown Publishers, Dubuque, Iowa, 1995.

Dennison, Mark S. and James F. Berry, Wetlands: Guide to Science, Law, and Technology, Noyes Publications, Park Ridge, New Jersey, 1993.

