

## **NATURE LAB SUMMER CAMP:** *Build Healthy Cities*

### **Experiential Project Concept:**

Natural areas filter water.

**Grade Levels:** 3-8

### **Essential Question:**

- How do paved areas impact the filtration of rainwater?



### **Introduction:**

Nature works to filter and release water over time – for free! In this way, nature reduces the amount of artificial treatment needed to filter water and also contributes to prevention of flooding. In nature, water is filtered through layers of soil, sand, rock, and other natural materials like leaves. Surfaces where water can penetrate are called permeable surfaces. Impervious surfaces, like rooftops and paved roadways, are surfaces where water cannot penetrate. As impervious (or impenetrable) surfaces increase in urban areas, this leads to less natural water filtration. Impervious surfaces can contribute to pollution in urban watersheds because rainwater accumulates pollutants like car oil, fertilizers, detergents, and pesticides as it moves across them. These pollutants eventually end up contaminating the watershed.

Students will conduct a hands-on project that focuses on the role of natural areas as filters that produce clean water. Such natural filters are contrasted with impervious (paved) areas to compare the impact of development on the ability of nature to provide clean freshwater. Students will learn that impervious areas increase pollution because runoff does not pass through nature's filtering systems.

# Compare Natural Materials and Impervious Surfaces

## In preparation to lead this activity with a child, you may watch the following:

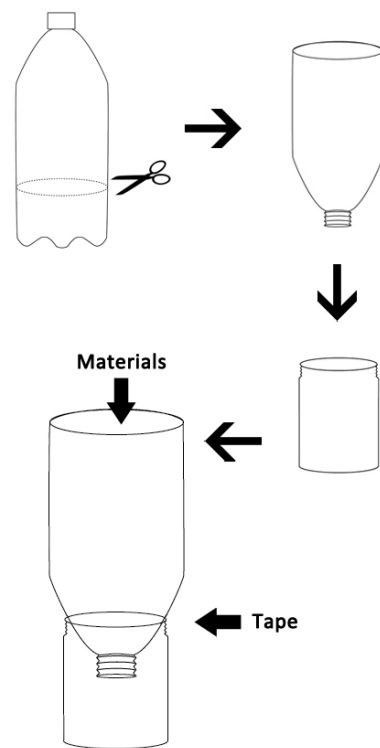
- YouTube video where a 3<sup>rd</sup> grader shows a simple experiment of impervious versus natural surfaces (Activity 2) <http://www.youtube.com/watch?v=Dw9p8jEB7m0>
- Video of Conservancy scientist conducting Activity 2 – Water Filtration Experiment <https://vimeo.com/137868819>

## Materials:

- 2 soda bottles with bottom removed
- 2 large jars about the same diameter as the soda bottles
- duct tape
- handful of horticultural moss (available from gardening stores)
- handful of dried leaves
- bag of river sand
- bag of gravel
- several pieces of concrete
- old newspaper
- old plastic cups
- garden soil
- bucket
- tap water
- vegetable oil
- 1 liter pouring jug
- timer with seconds
- ruler

## Procedure:

1. Construct two funnels with the soda bottles as shown in the diagram to the right. Invert one of the soda bottles to make a funnel and use the duct tape to secure the soda bottles to the large jars.
2. Mix together a handful or so each of the garden soil, sand, gravel, leaves and moss. The quantities are not important, but try to keep the amounts of each material about equal. Keep aside a small handful of moss.
3. Place the small handful of moss in the neck of the funnel. Add the mixture to the funnel. Ensure the material is packed firmly but not too tightly. **This funnel represents the soil through which water filters in natural areas.**
4. In the other funnel, place the pieces of concrete, to the same volume as the soil-filled funnel. Loosely crumple the old newspaper into various sized pieces and crush the plastic cups. Add the newspaper and plastic cups into the funnel. This funnel represents areas across which water drains in paved areas. The newspaper and cups



represent trash which may collect in the drains of paved areas.

5. Mix together a small amount of the garden soil with 2 liters of water and add two cups of the vegetable oil.
6. Add **1 liter** of this mixture to the pouring jug.
7. Pour the mixture into the soil-filled funnel. Record how long it takes for the water to drain through and your observations. Measure the height of the oil layer that rises to the top of the water once it has filtered through.
8. Repeat the above step for funnel filled with pieces of concrete.

**Use the following prompts to lead a discussion during and at the conclusion of the hands-on project.**

**Observations and Discussion:**

1. Describe and discuss your observations. Consider the differences between the two funnels.
2. Explain why the water from the impervious surface bottle is dirtier than that from the soil-packed bottle.
3. Describe how these different surfaces might impact a watershed in rainy and dry conditions.
4. Explain how the experiment models real systems.
5. Quantify the difference between water filtered by soil compared with water runoff from impervious surfaces. What is the difference in time for water to filter compared with runoff?