Watershed Experience Trailer: Enviroscape

Note:

Use remote buttons to activate exhibit. Button **#1** *activates stormwater runoff. Button* **#2** *activates lightning and thunder. The same remote is used for the Enviroscape AND the Rainfall Simulation.*

To fill the lake, make sure the 'Waterbody Drain' is closed (located outside the trailer, on the driver's side). If the drain is closed, you will see the blue lever handle outside while standing next to it.

Materials:

- Enviroscape Model
- Remote
-Spray bottle with clean water
-Towels to dry enviroscape after the event.
    *a special cleaner and towel are used for the glass

Objectives: The Student Will Understand:

- Know what a watershed is
- Know what nonpoint source pollution is
- Discover how pollutants affect the water and life in it
- Understand best management practices to help reduce pollution
- Explore how nonpoint source pollution gets into the water supply
- Describe how best management practices can reduce pollution
- Understand how best management practices and education can reduce nonpoint source pollution

Part 1 – Introducing a Watershed

For this lesson, talking points will be in normal font and instructions for exhibit will be in italics.

A watershed is an area of land from which water runs off of and travels to a specific stream or outlet. The stream, lake, river, ocean, pond, or basin that the water runs into is called the waterbody. Every point of land is in a watershed and water dropped anywhere within will drain into a water body. Water is carried into the waterbody by gravity and is called runoff. A watershed and a waterbody are interconnected, since water from the watershed travels to the waterbody and anything that happens in the watershed can affect the waterbody.

If it rains on you, or your home, you live in a watershed.

If students have trouble with the definition of watershed, have them cup their hands and explain how they now have made a tiny watershed in their hands. If time allows, spray a bit of water on their hand and show them how it rolls down to the lowest point and collects. This is now their watershed's waterbody.

In Texas we have 210 watersheds, each of which might have sub-watersheds. These 210 watersheds are located in 25 river basins (these are just bigger watersheds). All of Texas is part of an even larger watershed that covers 2/3 of the USA and drains into the Gulf of Mexico and Atlantic Ocean.

What waterbody do you think the other 1/3 of the USA drains into?

What major river do you live by? Great! We live in the Trinity River Basin.

Show the group the small watershed that is in the Watershed Experience Trailer. Talk about the water cycle on the wall, and how water moves through this watershed. Point out the farmland, meadow, sub-urban, and urban settings within our watershed. If available, show a map of the watershed that you are teaching in, or where the students come from.

Tarrant Regional Water District (TRWD) has four reservoirs, or lakes, that we own and operate, reaching almost 2 million residents with drinking water.

There are two types of pollutions, point and non-point source pollutions. Point source pollution is pollution that flows directly and completely from a specific point, such as an industrial or sewage plant or storm drain. The owner of the point source pollution can be fined if they produce too much pollution.

Examples of the point source pollution on the model include the industrial plant (has the parking lot) and Sewer (large circles next to the river). Refer to the wall opposite the enviroscape in the Watershed Experience Trailer (WT).

The other type of pollution is non-point source pollution, which is pollution that is created by many different human and other activities all over the watershed and is then carried into the waterbody during rainfall. For example, one dog pooping in a back yard is not so bad, but imagine

how much poop all the dogs in Tarrant County would make in one day. How about in one week? How about in one year? What if all of that went into the lake? Non-point source pollution is not regulated and probably comes from everyone around the model today.

Background: watersheds vs. water catchment

Urban development and flooding

Urbanization can have a great effect on hydrologic processes, such as surface-runoff patterns. Imagine it this way: in a natural environment, think of the land or soil in the watershed alongside a stream as a sponge (more precisely, as layers of sponges of different porosities) sloping uphill away from the stream. When it rains some water is absorbed into the sponge (infiltration) and some runs off the surface of the sponge into the stream (runoff). We try to mimic these pre-development conditions with Low Impact Development (LID) or Green Stormwater Infrastructure (GSI).

Factors affecting infiltration and stormwater runoff

Precipitation: The greatest factor controlling infiltration is the amount and characteristics (intensity, duration, etc.) of precipitation that falls as rain or snow. Precipitation that infiltrates into the ground often seeps into streambeds over an extended period of time, thus a stream will often continue to flow when it hasn't rained for a long time and where there is no direct runoff from recent precipitation.

Soil characteristics: Some soils, such as clays, absorb less water at a slower rate than sandy soils. Soils absorbing less water result in more runoff overland into streams.

Soil saturation: Like a wet sponge, soil already saturated from previous rainfall can't absorb much more ... thus more rainfall will become surface runoff.

Land cover: Some land covers have a great impact on infiltration and rainfall runoff. Vegetation can slow the movement of runoff, allowing more time for it to seep into the ground. Impervious surfaces, such as parking lots, roads, and developments, act as a "fast lane" for rainfall - right into storm drains that drain directly into streams. Agriculture and the tillage of land also changes the infiltration patterns of a landscape. Water that, in natural conditions, infiltrated directly into soil now runs off into streams.

Slope of the land: Water falling on steeply-sloped land runs off more quickly and infiltrates less than water falling on flat land.

Evapotranspiration: Some infiltration stays near the land surface, which is where plants put down their roots. Plants need this shallow groundwater to grow, and, by the process of evapotranspiration, water is moved back into the atmosphere.

Part 2 – Running the Experiment

Make sure the Waterbody Drain is closed. Click buttons #1 and #2. Button #1 turns on the 'rainstorm', while button #2 activates the stormwater runoff across impervious surfaces. ***Only keep the experiment running for ~15 seconds*** *so you do not run out of water during long events.*

After all the water drains into the lake, talk about the following questions:

a. Where does the pollution come from in real life?

b. What is in the waterbody to begin with?

c. How did it get into the water body?

Make sure that students have answered the worksheet questions.

Have the students

d. Pick one of the pollutants talked about today that they think they make be inadvertently spreading.

e. Have the students write a 100-word essay on the that pollutant that included information on

i. How it gets into a waterbody

ii. How it moves within the waterbody (is it biomagnified, absorbed or just coating)?

iii. How that pollutant harms aquatic life?

iv. How can they prevent themselves or their family from spreading that pollutant?

Ask: What surfaces did we see affect stormwater runoff? That's right! The Native Tallgrass Meadow slowed and dissipated the runoff.

Ask: Does any part of the enviroscape look like where you live?

Ask: Do you live in a watershed?

Ask: Is any stormwater cleaned or filtered before it reaches our drinking water supply lake?

Part 3 – Best Management Practices

Best Management Practices (BMPs) are activities, systems and procedures to help reduce NPS. They will not eliminate all the NPS in a watershed, but they can greatly reduce it. Most BMPs are pollutants and site specific, since no one BMP will deal with all types of pollution. BMPs not only help reduce NPS, but also help retain water in the watershed. When it rains in an urban area, water can quickly rush into drainage and waterways, resulting in flooding and damage to the plant and animals living in the area. BMPs can help slow the movement of water, reducing flood and helping some water stay in the watershed,

where it can help plants and organisms. This can also help people. For example, both Houston and New Orleans are now below sea level partly because so much water has been drained from the area the ground is sinking and reducing in size. During summer droughts, soils begins to shrink and crack due to the lack of water and can damage the foundations of homes across Texas.

Optional:

Hand out the sheets with pictures of BMP for each type of pollutant to the students. Have them pick the BMP for each of the following:

Pollutant	*BMP*
Oil from Cars	*Education*
Soil from Construction or Farming	*Vegetation, Terraces, Hedge Rows, Berms*
Paint Spills	*Vegetation, Education*
Too Much Fertilizer	*Vegetation, Education*
Manure	*Fence in Cows, Vegetation, Manure, Containment*

Part 4 – Education along with BMP

Best Management Practices with NPS education and outreach can greatly reduce NPS pollution. Right now, you are part of that NPS education and outreach. By learning how harmful NPS can be, people will want to try to stop polluting and by learning how to stop, they can reduce pollutants even more. Education and outreach can also include signs, programs at city hall or the library, programs at school, booths at festivals, books, pamphlets, websites, and more.

Ask: Have you ever learned how to reduce pollution or save water in your schools? What did you learn? Great! Those are BMPs!

Assessment:

1. Hand out the cards again and/or have the students consider how education would each of the following situations

a. *Situation 1 – Oil*

i. Assume that Roy's son had just seen this presentation and asked his dad to fix the car in order to save the birds. Dad fixes car.

ii. no oil

b. *Situation 2 – Dirt*

i. Assume that Clay decides to be a green business and not only blocks the dirt but also finds ways to reduce the amount of loose dirt, like only clearing the area he will be working on soon.

ii. Only ¼ tablespoon of the "dirt" reaches the lake or river.

c. *Situation 3 – Paint*

i. Assume that the local kids had learned about how harmful paint could be and not only did not spill the paint, but left a note for Peggy to remember her paint.

ii. no "paint" gets left in the watershed.

d. *Situation 4 – Fertilizers*

i. Assume one of the neighbors saw an article in the paper about how bad spreading too much fertilizer can be for the environment and in cost. He tells everyone else. They still put on fertilizer but everyone tries to put a bit less.

2. *Compare the bottles of polluted water (FOG, "flushable wipes", etc.) to the jar of clean water. If available, use the third jar, fill with clean water and toilet paper at the beginning of the day. Students will be able to visualize what breaks down in the black water, vs what doesn't break down in nature or our drinking water supply.*

Lesson adapted from Meadows Center for the Environment EnviroScape lesson plans.

<u>TEKS</u>

Science 8.1A, 8.2A, 8.2B, 8.2C, 8.2D, 8.2E, 8.3A, 8.4A, 8.4B, 8.11B, 8.11C

Aquatic Science 1A,2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 3A, 4A, 5B, 5D, 6A, 9C, 11B, 12A

Biology 1A, 2E, 2F, 2G, 2H, 3A, 11B, 12F

Chemistry 1A, 2E, 2F, 2G, 2H, 2I, 3A, 10A, 0B Earth and Space Science 1A, 2E, 2H, 2I, 3A

Environmental Systems 1A, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 3A, 4E, 5B, 9A, 9B, 9C