

DRAFT

9/13/2007 Enviroscope

Activity Description

This activity teaches students about an aquifer and how here on Cape Cod, everything we do effects everyone else's drinking water.

Take Home Message

Some people may not be aware of the damage they are doing to the aquifer and watersheds. A few careless mistakes can damage an entire neighborhood.

Massachusetts Frameworks

Earth Science

Earth Material #1 and #4

Supplies

- The Enviroscope board
- houses
- toys and dinosaur
- kool-aid, pesticides for farm
- hot chocolate mix, represents soil and poop
- food coloring, red – for shoe dye, blue – for motor oil
- 2 containers, 1 pail for clean water , large purple tarp bucket (empty first) for wastewater
- 5-6 spray bottles, for the rain storm
- green sugar, fertilizer for the gold courses
- small sponges, for the hay bails

Set-Up

Put the landscape top over the clear plastic square groundwater base. As you are standing behind the model, the ocean will be at the front, the farm in the top left corner. Pour some clean water in the right and left sides of the reservoirs in the base. Add one drop of red food dye to the left reservoir. On each side of the landscape top are two holes. Run the plastic tubes with the weights runs up through the holes, the weights keep the bottoms of the tubes in the reservoirs. Attach a yellow spray trigger on top each tube, the one near the houses represents the drinking well, the one near the farm represents an irrigation well.



Set up continued-

Test the spray nozzles, prime if needed. In the pond/ocean make sure there is a rubber stopper in the hole. Fill the pond/ocean with clean water. Place an empty oblong plastic dish underneath the stopper to catch water when you drain the model. Fill up each of the water bottles (one per student), and prime nozzles, set on a mist. Have the landscape figures and contaminants organized and ready to go. Make sure to fill any contaminant bottles if needed. Keep your eyes on the small parts, especially the cars so they don't get lost or wander into a student's pocket.

Background Science and Vocabulary

Watersheds

A watershed is all the land area where the surface and groundwater flows to a common place. On Cape Cod, most water in a watershed flows through the ground, not at the surface. Streams, ponds, lakes, estuaries, and coastal bays on Cape Cod collect water from the ground and from surface runoff. Groundwater flows slowly and continuously toward sea level along the least resistant route. Surface water runoff makes up a relatively small contribution to watershed flow on Cape Cod, usually as runoff from impermeable areas or when the ground is saturated during heavy rains or snowmelt.

Another way to envision a watershed is like a funnel; or drainage basin where groundwater and surface water drain into a common collection site. Watersheds are separated from each other by landforms (ridge lines) or by groundwater divides at the highest elevation of the groundwater lenses. Water falling on each side of the divide drains into different watersheds and collection sites. Eventually, the groundwater and surface water on Cape Cod collect in coastal bays and estuaries.

On the surface, watersheds are separated from each other by areas of higher elevation called ridge lines or divides. Near the divide of a watershed, water channels are narrow and can contain fast-moving water. At lower elevations, the slope of the land decreases, causing water to flow more slowly. As smaller streams merge together, the width of the channel increases. Eventually, water collects in a wide river that empties into a body of water, such as a lake or ocean.



From an aerial view,
patterns in

resemble a network similar to the branching pattern of a tree. Tributaries, similar to twigs and small branches, flow into streams, the main branches of the tree. Streams eventually empty into a large river, comparable to the trunk. Like other branching patterns, the drainage pattern consists of smaller channels merging into larger ones.

drainage
watersheds

Pollution

One of the greatest threats to public health for Cape Cod is groundwater pollution. Some contaminants are toxic, colorless, and odorless. When deposited on land, these substances may find their way to Cape Cod's sole-source aquifer by dissolving and /or moving with the water. Pollution can originate from a distinct point source, such as a gasoline spill, or from a broad range of non-point sources. The most common sources are waste disposal (sewage/septic and household), road runoff, spills, household cleaners and solvents, commercial/industrial process chemicals, mining operations, and agriculture (herbicides/pesticides, fertilizers). The highly permeable soil that promotes good rainfall infiltration also lets contaminants infiltrate easily, making it vulnerable to surface spills and contaminants. When pollutants leach into the groundwater, it becomes a plume of contaminated groundwater, which migrates with groundwater flow.

Human and animal waste is high in nitrogen, which becomes primarily nitrate when discharged into water. In surface water, the nitrates interact with plants and algae, stimulating growth sharply. The algae grow rapidly, and after their short life cycle, they die and decay. The process of decomposition consumes oxygen in the water, leaving little for the native plants and animals. The process of nutrient enrichment and its consequent water quality problems is called eutrophication. In groundwater, excessive nitrates can cause health problems serious to infants. Whether released through an on site-septic system or from a sewage treatment plant without tertiary treatment capabilities, wastewater released to our groundwater has detrimental impacts wherever it goes.

Script/Activity Procedure

- Introduce yourself to the kids and get their names. Hold up the water bottles and ask if anyone knows that they might be for. You are looking for them to say rain (or snow)
 - Give the students the water bottles
 - Explain that the water bottles are going to be the rain. Explain that when you say start raining they are to spray the board wherever you tell them to and stop when you say stop. Make sure they listen, they may get carried away!
 - *If you find you have a large or rowdy group, you can have them make a rainstorm with their hands each time and you can spray. This saves you from getting soaked.*
 - **Ask the students, where does the rain go?**
 - Have them practice raining and show them that the rain sheets off the land, soaks into the ground (aquifer and drinking water) and moves toward the ocean.
- **Ask the students if they know anything about the earth when the dinosaurs were here.**
 - You are looking for things like clean water, air, and land
 - Grab the dinosaur and walk around the clean lake and land
 - If the students haven't already said it explain that the land, water, and air was very, very clean, when the dinosaurs were here.
- **Ask the students what happens to dinosaurs.**
 - You want them to say that they die. Ask who comes after the dinosaurs die.
 - Have the dinosaur die and bring out the houses and farm
 - Explain that people built lots of things that started making the land and water not as clean
 - Point out the two wells and ask the students what they think they may be used for.
 - House Well – cooking, cleaning, lawns
 - Farm Well – crops and animals
 - Next put out the factory
 - Explain that all of these caused the land to change. More people means more changes to the environment
 - Bring out the car and let one of the kids drive the car to a house
 - While the kid is driving, say that he notices he needs an oil change and when the kid parks the car at the house say he changes his oil in the yard
- As the oil is being changed say that he drops some on the ground. **Ask the kids if they know what is going to happen to that oil.**

- Put a drop of food coloring next to the car
 - Explain that this is the oil that leaked
- Have the kids rain on the oil spot
 - Explain that the runoff is what happens when it rains
- **Ask the kids if they have ever been to a construction site, ask what they see a lot of.** You want them to say dirt and sand and debris.
 - Sprinkle Cocoa on the construction site
 - Explain to the kids that this is the sand and dirt that they see at a construction site. Then talk about the construction site and put cocoa mix all over the site
 - Have the kids make it rain and ask what is happening?
 - Explain that when it rains the sand and dirt can flow into the river and then flows down to our pond
- **Ask the kids if they have ever been on a farm? What does a farmer do the fields?**
 - Put green sugar on the fields and more cocoa near the animals
 - Explain that they fertilize their lawns and the manure from the animals is left on the ground.
 - Have the students make it rain again
 - Let them see again how all of this flows into the river and eventually will reach our nice clean pond.
 - This is a good point to check in our “clean” pond and see how clean it really is
- **Ask if the kids like shoes? See if any of them have red shoes on.**
 - Move over to the factory and explain that it makes Red Shoes.
 - Put red dye in the shoe factory
- Talk about how the factory owner throws the old dye (it was the wrong shade of red) in the well so that people cannot see it. **Ask where that dye goes once in the ground**
 - Pump water out of the well on each side of the model- spray into a clear cup, one for each side
 - Ask the kids which they would want to drink from and why one is pink
 - Explain that it is the dye from the factory that caused the water to be pink
 - Also explain that the dye hasn’t reached the other well yet so it isn’t contaminated – Chemicals move underground like water. If you dump chemicals in the ground they can end up in your drinking water.
- **Ask the students if they can think of ways we could have protected the environment of this little area a little bit better**
 - Explain to them that they and their families can do the following:
 - Professionally change the oil so it doesn’t go all over the ground
 - Less fertilizer on the golf course
 - Hay bails to protect the construction site
 - Less fertilizer on the fields
 - Move the animals back away from the stream
 - Professionally haul the dye away from the factory

Clean-Up

During the Festival

- After each group you will want to thoroughly spray down the top and remove all the houses, farms, and extra toys you added.
- Drain the pond so it is not dirty water anymore
- Dry off the top with paper towel
- After a few groups you may need to empty the water in base. You can do this into the purple bucket used for the tarps.

After the festival

- At the end of the day, you will thoroughly spray down, clean and dry the top of the enviroscape.
- Empty the base rinse it well and completely dry it as well.
- Make sure all the toys are clean and dry as well.

- Put the toys, spray pumps, water bottles and other parts back where they came from, including the rubber stopper. Make sure that you don't lose anything, there are so many small parts.
- Fill out the inventory list
- Pack up the enviroscape back in the green case

* Special Note, try to encourage as much hands on participation as is appropriate for the age group and size of the crowd. In addition to being the rain, you can give students roles to play (farmer, factory worker, construction worker, etc) and have them sprinkle on the contaminants.