

## Activity 5 Ecotoxicology: Watersheds and Pollutants

### Objectives

Students will learn about watersheds and pollutants using a model of a typical landscape. They will pollute the artificial landscape with various “contaminants” and then see what happens to the contaminants after it rains. Students will also perform serial dilutions of colored salt water and an ecotoxicology experiment that examines the response of zooplankton to varying amounts of salt.

### Terminology

Aquifer, beaker, body of water, concentration, condensation, contaminants, ecotoxicology, effluent, evaporation, feces, fertilizer, graduated cylinder, groundwater, herbicide, mortality rate, non-point source pollutants, parts per thousand, pesticide, pipette, point source pollutants, pollutant, pollution, precipitation, proportion, reservoir, river basin, runoff, serial dilution, surface water, transpiration, toxic, toxin, water table, watershed.

**Grade Level:** 3<sup>rd</sup>-6<sup>th</sup>

**Ideal Class Size:** 24 students divided into six groups of four

### Subject Areas

Life Science, Earth Science, Physical Science, Inquiry Skills, Math: (alg S1 & S4)

### Time

1 hour introduction and presentation.

1 hour activity/experiment.

### Materials

- PowerPoint presentation or slide projector w/slides
- Flip chart or writing board with erasable colored markers
- Paper towels
  
- Demonstrations
  - EnviroScape® watershed model (directions for use in Appendix A)
  
- Experiment equipment
  - Serial Dilutions
    - Table salt: 3.5g/test tube (1/pair)
    - Yellow food coloring (1 squeeze bottle/table)
    - Water bottles (1/pair)
    - 50 ml graduated cylinders (1/pair)
    - 100 ml transparent beakers (4/pair)
    - Plastic coffee stirrers (1/pair)
  - Ecotoxicology Experiment
    - “Control” beakers with fresh water and fresh water zooplankton (1/pair)
    - “Contaminant” beakers with differing salt concentrations and fresh water zooplankton (2-4 of each concentration: 3.5 grams/100ml, 2.5 grams/100ml, 1.9 grams/100ml, or 1.4 grams/100ml)

- Posters
  - Methods of Science
  - SAFE Rules
  - Metric volume Poster
  - Data Summary Table for Ecotoxicology Experiment
  - Data Summary Graph for Ecotoxicology Experiment
  
- Handouts
  - How to Make Serial Dilutions laminated directions (1/pair)
  - Ecotoxicology student data sheet (1/student)
  - Ecotoxicology word search puzzle

### **Advanced Preparation**

- 1) Pre-weigh 3.5 grams of table salt into capped test tubes (1/pair of students) to use during the serial dilution portion of the activity.
  
- 2) Obtain freshwater zooplankton or mosquito larvae from local ponds or through a biological supply company (we use *Daphnia magna*, as the large size makes them easy for students to see). You will need 10-15 zooplankton for each of the control and contaminant beakers.
  
- 3) Prepare and label “control” beakers containing freshwater and freshwater zooplankton. (1/pair)
  
- 4) Prepare and label “contaminant” beakers (2-4/class of each concentration), each having the following saline concentration: 3.5 grams/100ml, 2.5 grams/100ml, 1.9 grams/100ml, OR 1.4 grams/100ml. Contaminant beakers will need to be prepared up to two hours ahead of time to insure that the saltwater concentrations have the desired affect on the zooplankton.
  
- 5) Ensure that all materials are available for the EnviroScape® Watershed Model using the Appendix A lesson plan.
  
- 6) Copy the “Workshop Outline” on to a classroom writing board or flip chart.

### **Safety Notes**

Goggles aren’t necessary, but take care not to get salt water in eyes.

### **Background Information**

Ecotoxicology is the scientific study of how contaminants affect living organisms in their habitats. This lesson focuses on the use of ecotoxicology in identifying and quantifying unknown pollutants in watersheds.

Watersheds are drainage basins (areas of land) where surface water runs off of and drains into common collection sites such as creeks, streams, rivers, ponds, lakes, and oceans. Watersheds also include areas where surface water has seeped underground and become groundwater. Watersheds are separated from each other by landforms, such as mountains or ridgelines. Water falling on either side of the divide drains into different watersheds and collections sites (obtain a topographic map for your school from USGS and have students outline the watershed).

Water in the form of precipitation falls to the earth and travels over natural and man-made surfaces before it ends up in larger bodies of water as runoff. One way to get students to understand the concept of a watershed is to have them pay attention to what is going on outside their classroom on a rainy day. Surface runoff flows over a schoolyard on its way to collection sites. Which way is the water “running?” Point out puddles and explain how the land around it is like a mini-drainage basin or mini-watershed and how the puddle is considered the collection site. When the puddles overflow or the soil becomes saturated, then the water is released to “runoff” further down the watershed. Have students look for materials that were left behind by the flowing water. Twigs, leaves, oil, trash, soil, and other items may be found. Surface water leaving the school grounds may carry similar materials with it as it goes to a larger collection site in the watershed, combining with water and materials from other drainage basins.

Even though some materials may decompose, settle out, or be filtered by the soil, there will still be some materials that continue to travel long distances downstream. Some materials will nourish aquatic plants and animals, but other substances can be highly toxic. These pollutants or contaminants can harm humans and animals that drink the water, or aquatic life that lives in creeks, rivers, ponds, and oceans.

Most students know that the water flowing out of their faucets has been treated, unless they live in a house that uses a well. Almost every city in the U.S. has some kind of wastewater treatment plant. Drinking water standards are set to ensure that water is potable. The water is sampled and tested for contaminants on a regular basis. Water quality standards are established based on the assumption that water with concentrations of organic or inorganic compounds above a certain limit might cause health problems to humans and other living things.

Once contaminants are discovered, how does one go about finding the source of the problem so that it can be fixed? It is often very difficult to pinpoint the exact entry point of common chemicals such as pesticides and fertilizers into a watershed. Contaminants that are difficult to trace to one location, or “point,” are classified as non-point source pollutants. Contaminants that are easy to trace, such as sewage from a broken sewer pipe at a school or a chemical from a discharge pipe from a factory, can be categorized as point source pollutants.

Once a contaminant is found it is important to determine the amount present in the ecosystem and whether or not it will pose an immediate danger or a long-term threat. Water quality standards have been established for hundreds of chemicals and scientists like ecotoxicologists measure and report air, water, and soil contaminants in parts per million, parts per billion and parts per trillion. Although these numbers may seem like extremely small concentrations, many chemicals are so toxic that they can cause health problems at even very low levels. An interesting fact is that people can smell petroleum and petroleum products in water at concentrations as low as 10 parts per billion!

This lesson will use the example of table salt in water to demonstrate how even something as benign as salt can be toxic in high enough quantities. Students will first prepare a set of serial dilutions using standard laboratory procedures. A serial dilution is a technique used to make very dilute solutions of known concentrations of a substance. For example, to obtain a very dilute solution of salt in water having a concentration of 1 part per million (1 ppm) you could dissolve 1 gram of salt into 1,000 liters of water, but that would not be very practical. Instead,

using a series of dilutions, you could dissolve 1 gram of salt into 1 liter of water and then measure out 1 ml (1gram or 1cc) of your new salt-water solution and add it to a second liter of water creating a “series.” The final result would be a liter of salt water having 1 ppm concentration of salt in water. Students will use smaller amounts of salt and water to practice this technique.

The students will then participate in an experiment where they observe the effects of different concentrations of salt water on fresh water zooplankton. A fresh water control will be used to compare the results and all observations will be recorded and analyzed.

**Activity 5**  
**Ecotoxicology: Watersheds and Pollutants**  
**Workshop Outline**

**LECTURE AND DEMONSTRATIONS (1 hour)**

**1. Introduction (15 minutes)**

- A. Today’s Topic – Ecotoxicology: Watersheds and Pollutants
- B. Today’s Workshop Outline
- C. Review SAFE Rules
- D. Review the Methods of Science

**II. Power Point Presentation (15 minutes)**

**III. Demonstration (20 minutes)**

- A. EnviroScape® Model presentation w/ class participation

**SERIAL DILUTIONS AND ECOTOXICOLGY EXPERIMENT (1 hour)**

**I. Serial Dilution Activity (20 minutes)**

**II. Ecotoxicology Experiment (30 minutes)**

**III. Science Seminar (10 minutes)**

- A. Sharing the Results
- B. Graphing and Interpreting the Data

**IV. Close out (10 minutes)**

- A. Wrap-Up Questions

## LECTURE AND DEMONSTRATIONS (1 hour)

### 1. Introduction (15 minutes)

#### A. Today's Topic

"Watersheds and Pollutants/ Ecotoxicology" highlights the work of SREL scientists Dr. Gary Mills and Dr. Bill Hopkins. Dr. Mills studies non-point source pollution such as oil in water or sediments. He uses chemical tests to determine water and soil quality, which are measured by the amounts of pollutants in the water and soils.

Dr. Hopkins studies the effects of contaminants on organisms. He performs biological tests to determine the effects of contaminants on animals that live in wetlands. Some of his investigations are on zooplankton.

Dr. Hopkins studies the movement of contaminants through food chains, especially the uptake of contaminants by predators from their diet (e.g., snakes). He focuses primarily on sublethal toxicity rather than lethal. Lethal means it could kill you, but sublethal means it wouldn't kill you right away. You could still have some harmful effects that could show up, such as changes in behavior, problems with reproduction, effects to offspring. etc. Dr. Hopkins examines many types of reptiles and amphibians to see if the animals can reproduce and if there are any effects on developing offspring.

#### B. Today's task list / workshop outline

#### C. Review SAFE Rules

#### D. Review the Methods of Science

### II. PowerPoint Presentation (15 minutes)

#### A. Introduction to PowerPoint Presentation

Now we are going to share with you a PowerPoint presentation about two SREL researchers: Dr. Gary Mills and Dr. Bill Hopkins. They think that there is nothing more enjoyable than going out into the field to look for and analyze contaminants and their effects on living organisms.

### III. Demonstration (20 minutes)

#### A. EnviroScape® Model presentation with class participation

*[Refer to Appendix A for complete directions on how to conduct this demo.]*

## SERIAL DILUTIONS and ECOTOXICOLOGY EXPERIMENT (1 hour)

### I. Serial Dilutions Activity (20 minutes)

*[Students will work in pairs to conduct serial dilutions. They will be practicing their measuring skills to perform serial dilutions that simulate procedures used in ecotoxicology. Each pair will need a test tube containing a pre-measured amount of salt (3.5g), a 50 ml graduated cylinder,*

*four 100 ml transparent beakers, a water bottle full of water, a stirring stick, and a few drops of yellow food coloring that the teacher will bring around as needed.*

*Introduce the students to their equipment and demonstrate a serial dilution using the laminated “How to Make Serial Dilutions” direction sheet.*

*After the serial dilution activity, collect all the materials and tell the students that they will now study the affect of different concentrations of salt water on fresh water zooplankton that were prepared using the same procedures they just completed.]*

## **II. Ecotoxicology Experiment (30 minutes)**

*[Students will again work with a partner, but they should each receive their own copy of the “Ecotoxicology Procedures and Data Sheet.” Each student pair should receive two beakers: one labeled CONTROL that will contain fresh water (0 PPT g salt/100 ml water) and 10-15 freshwater zooplankton, and a second beaker labeled CONTAMINANT with a salt concentration of 35 PPT (3.5 g salt/100 ml water), 26 PPT (2.6 g salt/100 ml water), 19 PPT (1.9 g salt/100 ml water), OR 14 PPT (1.4 g salt/100 ml water) and 10-15 zooplankton.*

*Students will be instructed to follow the procedures on their data sheet, answer all the questions based on their observations, record their findings, analyze their data, and graph their results.]*

## **III. Science Seminar (10 minutes)**

### **A. Sharing the Results**

*[Take this time to transfer student results onto a large classroom graph.]*

### **B. Graphing and Interpreting the Data**

*[Engage the students in a conversation analyzing their results using the graphed data.]*

## **IV. Close out (10 minutes)**

### **A. Wrap-Up Questions**

*[Take a minute to answer questions the students may have come up with during the activity, and to assess their comprehension of the material covered.]*

## **RESOURCES**

EnviroScape® Watershed Model by JT & A, Inc. 14524-E Lee Road, Chantilly, VA (703) 631-8810, FAX ((703) 631-6558, email: [info@enviroscapecom.com](mailto:info@enviroscapecom.com) Web: <http://enviroscapecom.com>

EnvirosScape User’s Guide: Water Pollution: It Begins With You Environmental Resource Guide: Non-point Source Pollution Prevention, Grade 3-5 by Air & Waste Management, Public Education Program, Air & Waste Management Association, One Gateway Center, Third Floor, Pittsburgh, PA 15333

You can make your own Watershed Model by following the directions on pages 212-214 “Wetland in a Pan” in WOW! The Wonders of Wetlands, Environmental Concern, Inc., P.O. Box P, St. Michaels, MD 21663-0480

How to Make a Watershed Model

<http://www.cnr.vt.edu/dendro/forsite/2002presentations/watershedmodel.htm>

Texas Natural Resources Water Commission –Wetlands/Watershed Model

<http://www.tnrcc.state.tx.us/exec/sbea/tes/lessons99/wetlandwatershed.html>

**Contact Organizations for more information on Ecotoxicology and Watersheds**

- Adopt-A-Watershed, P.O. Box 356, Hayfork, CA 96041
- American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235  
[www.awwa.org](http://www.awwa.org)
- E2: Environment & Education, P.O. Box 20515, Boulder, CO, 80308-3515  
[www.enviroaction.org](http://www.enviroaction.org)
- Groundwater Foundation, P.O. 22558, Lincoln, NE 68542-2558 [www.groundwater.org](http://www.groundwater.org)
- Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878-2983  
[www.iwla.org](http://www.iwla.org)
- U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460  
[www.epa.gov](http://www.epa.gov)
- Water Environment Federation, 601 Wyeth Street, Alexandria, VA 22314-1994  
[www.wef.org](http://www.wef.org)

## APPENDIX A

### EnviroScape® Watershed Presentation in 20 Minutes

#### Materials

- EnviroScape® Watershed Model by JT & A, Inc. 14524-E Lee Road, Chantilly, VA (703) 631-8810, FAX ((703) 631-6558, email: [info@enviroscapecom.com](mailto:info@enviroscapecom.com) Web: <http://enviroscapecom.com>
- Seven index cards labeled as follows: feces, fertilizer, pesticide, herbicide, soil, motor oil, and precipitation.
- Pollution spoons - 30 total: five labeled feces, five labeled fertilizer, five labeled pesticide, five labeled herbicide, five labeled soil and five labeled motor oil
- Powdered colored drink mixes: brown (cocoa), yellow (lemon-lime), red (fruit punch), orange (orange)
- Pollution shakers (4), each labeled: fertilizer, pesticide, herbicide, and soil
- Lake props: toy insect, fish, amphibian, alligator, fresh water plant, seahorse, crushed tin can, piece of Styrofoam, plastic six-pack ring, plastic baggie, golf ball, and a very small used paint can.
- Catch basin (should fit under the lake hole in the model)
- 16 oz spray bottle full of water
- 2 8-oz squirt bottles with narrow tips
- Large flat table, at least 2' X 3' that can get wet. Larger is better.

#### Time requirements

Approximately 20 minutes. Can be extended to 35 if all the points are made and questions answered.

**Age range:** 7 years old to adult

**Class size:** 6-30

#### Advanced preparation

- 1) Set up model as per model directions
- 2) Fill labeled “pollution” shakers with dry drink powders: “soil” brown (cocoa), “fertilizer” yellow (lemon-lime), “pesticide” red (fruit punch), “herbicide” orange (orange)
- 3) To make the “motor oil,” dissolve cocoa powder in water at a ratio of 1 part cocoa:4 parts water; make enough to fill one 8-oz squirt bottle.
- 4) To make the “feces” dissolve cocoa powder in water at a ratio of 1 part cocoa:2 parts water; mix until smooth and fill the other 8-oz squirt bottle
- 5) Place all the lake props into the catch basin and place the catch basin underneath the lake hole in the model. Make sure the hole is plugged.

#### I. Beginning the Activity

##### A. Classroom preparation

*The model is small so you will have to have the students arrange their chairs in several rows of semi-circles around the model so that everyone will have a better chance of seeing. Students in the back row can stand up.*

## B. Before introducing the model

*Just before introducing the EnviroScape® Watershed model tell the students you need their help for the presentation. Randomly pass out the following items, have students memorize their “pollutants” and hold onto whatever you gave them until you ask for the items:*

- 1) Six pollution cards labeled: feces, fertilizer, pesticide, herbicide, exposed soil, and motor oil
- 2) One precipitation card.
- 3) Plastic spoons labeled with Non Point Source (NPS) pollution:  
*To figure out how many and which type of spoons to pass out you will need to count the total number of students minus six (cards) and divide by six. Your answer will tell you how many of each type of pollution spoon to pass out. If you have 30 students – 6 cards = 24 students ÷6 = pass out 4 of each type of spoon.*
- 4) Two Point Source (PS) pollution items: a golf ball and very small empty can of paint.

## II. Introduction to the EnviroScape® Watershed model

Welcome to our town! This model represents a watershed. A watershed is all the land in a specific area that water runs off of and into local bodies of water, like this lake, and is also all of the ground water in the area that you can't see.

Let's take a closer look at our model.

*[Point out the areas on the model as you refer to them.]*

- we have a cozy neighborhood with some pets in the back yard,
- a construction site where someone is going to build a new home,
- a lovely green golf course,
- a Waste Water Treatment/Drinking Water Treatment Facility,
- a clear-cut forest where the trees will be used to make paper,
- a factory that produces paint,
- a farm with some cows and crops,
- roadways, bridges, and ditches,
- and a wetland area that has creeks and rivers draining into a lake.

*[Ask the students if this town looks like their town.]*

## III. Polluting the EnviroScape® Watershed model

There is something missing from our model – people! I need a few people to help me put the finishing touches on our watershed model so it will look lived in.

Will the students with the spoons that have the word “feces” written on them please hold them up. *[Ask them to define the word. Then you define feces as animal wastes and tell them how it contains live bacteria referred to as fecal coliform. If it gets into the drinking water it can make people very sick. Collect the feces spoons and ask the student with the “feces” card to come up front.]*

*Student #1 is given the FECES dispenser and asked to liberally spread feces around the model everywhere they think it could be found. Then they can sit down. [the Wastewater Treatment plant, the farm from the cows, in the creeks and ditches from wild animals, the golf course from geese, and people's yards from pets.]*

*[Continue collecting spoons, describing the pollutants, and having the students with the NPS pollution cards come up and pollute the model.]*

*Student #2 is given the FERTILIZER dispenser and asked to liberally spread fertilizer around the model where they think it could be found. [Golf course, yards of homes, forests, farm. Fertilizer can be organic or man-made and consist of chemicals that provide nutrients to plants. Too much in the wrong place can be a real problem.]*

*Student #3 is given the PESTICIDE dispenser and asked to liberally spread pesticide around the model where they think it could be found. [Lawns and homes, pets, golf course, crops, cows, at the factory. Pesticides are usually man-made chemicals that are used to kill pests such as insects and rodents. Too much in the wrong place can be lethal.]*

*Student #4 is given the HERBICIDE dispenser and asked to liberally spread herbicide around the model where they think it could be found. [Lawns by homes, businesses, factories, golf course, crops. Herbicides are usually man-made chemicals that are used to kill unwanted plants more commonly know as weeds. Too much in the wrong place can be a problem.]*

*Student #5 is given the MOTOR OIL dispenser and asked to liberally spread motor oil around the model where they think it could be found. [The teacher drives the mini model car ALL OVER the roads and driveways of the model while she runs “errands.” Have the student follow the “leaky” car around the neighborhood with the squirt bottle of “motor oil” leaving a drippy trail everywhere. Have the student add some motor oil by the farm tractor, near some other cars, down the storm drain and along the fence line. Motor oil is a petroleum product, is not miscible with water, and can cause lots of problems in the environment.]*

*Student #6 is given the EXPOSED SOIL dispenser and asked to liberally spread soil around the model where they think it could be found. [It should be sprinkled everywhere there are brown spots on the model like the construction site, sides of creek beds, the clear-cut forest, row crops on the farm. Exposed soil runs off the land and into local waterways causing silting problems.]*

#### **IV. Making it Rain**

It looks like our town is pretty well lived in now. Our crops are looking a little dry so maybe we should make it rain. Who has the precipitation card? *[Have the student come to the front and ask them to name some different types of precipitation.]*

*Student #7 is given the PRECIPITATION spray bottle (16 oz exactly) and asked to make it rain. Have the student gently spray rain all over the model for a minute or so. Have other students share their observations. Note run off direction, erosion, and color of lake water. While there is still water in the bottle, thank the rainmaker and have them return to their seat.*

It looks like our land is good and saturated. What would happen if we got a huge rainstorm when all the land is already wet? *[Take the top off the bottle and pour the remainder of the water all over the model making thunderstorm noises. A 16-oz spray bottle is just the right size to fill up the model's lake without it overflowing.]*

*[At this point in the demo all the spoons and NPS pollution cards should be collected. Only the golf ball and the paint can are still being held by two students.]*

## V. After the Rainstorm

*[Unplug the lake and allow all the water to drain into the catch basin underneath the model. You may need to tilt the model forward to get every drop of water and pollution. Plug the hole back up. Place the catch basin items, one at a time, back into the lake as you discuss their significance. Ask the students with the golf ball and the paint can to place their items into the lake at this time.]*

Wow! What a huge storm! It was so big that it even washed a golf ball and a paint can into the lake. What other litter items are in here? Styrofoam, plastic soda can rings, a plastic baggie, a tin can. Styrofoam isn't biodegradable and will be around a long time, and so are these plastic rings. Animals, like baby turtles think items like this baggie are food and they try to eat them and choke. Make sure you cut the rings before you throw them away. This tin can could have been recycled.

What else is living in our watershed? *[Pull out the plants and animals one at a time and explain their situation in the watershed.]*

- Insect – represents a large portion of the base of the food chain. The insects that aren't killed by pesticides develop a resistance and stronger, more lethal, pesticides must be manufactured. Some alternatives are to diversify plant crops and to encourage indigenous natural predators to help keep the insect population down.
- Fish – represents a large portion of the food chain for animals and humans. If there is too much silt from soil erosion, fish can't see to catch their food and they can't breathe because their gills get clogged. Fish also absorb lots of toxins from the environment, like mercury from coal burning processes and improper disposal of batteries, thermometers, and thermostat switches.
- Amphibian – represents a wetland creature that needs both land and water for its life cycle. Amphibians spend their adult lives on land that provides food and shelter (not a parking lot); adult amphibians then return to the water to lay eggs, which hatch and develop into larvae that breathe through gills. Amphibians at all life stages are very sensitive to toxins.
- Alligator – represents another wetland creature and a tertiary consumer, or the top of the food chain, like humans (baby alligators eat insects.) If they don't have an abundance of healthy fish to eat and a safe place to nest, then our watershed is not healthy.
- Water plant – need fairly clear water to thrive. If there is too much silt in the lake, then no sunlight can get to the plants and they can't photosynthesize. There are a lot of animals that eat water plants and use them to lay their eggs and hide from predators.
- Seahorse – to remind us that all run off eventually ends up in the ocean. What is the name of the largest body of water we live near? (the Atlantic Ocean) What is the name of the watershed that South Carolina is a part of? (the Atlantic Watershed)

## VI. Categories of Pollutants and Water Quality

So what is left in our catch basin? (*dirty water*) What can you tell just by looking at the water – without having it analyzed? (*it's full of lots of different substances*) If you were paying attention during the demo you might infer that the water is full of pesticides, herbicides, fertilizers, motor oil, feces and soil. Let's see if we can figure out where it came from.

### A. Non-Point Source Pollution

Who does this spoon belong to? [*Randomly choose one of the pollution spoons you collected from the students during the demo. Hold it up so the students can see it. Several students will raise their hands. None of them will be able to definitively claim it as their own.*] Are you sure? Well, it must belong to one of you, but I just can't POINT to one student and know for sure where that it is yours, or yours, or yours. This kind of pollution is called NON-POINT SOURCE pollution because I just can't point to a single source and tell where it came from.

Ask the students to name all the non-point source pollutants that were found in the watershed: fertilizer, pesticides, herbicides, soil, motor oil, and feces, as well as tin can, plastic baggie, etc.

### B. Point Source Pollution

Let's take a look at this golf ball and this paint can. Who did the golf ball belong to? [*everyone will point at the person who held the golf ball*] Where, on our model, do you think it originated? (*the golf course*) And how about the paint can--who did it belong to? [*everyone will point at the person who held the paint can*] And where, on our model to you think it originated? (the paint factory)

There sure is a lot of POINTING going on here! The golf ball and the paint can are categorized as POINT SOURCE POLLUTANTS because we can POINT to the SOURCE of the pollution. A golf ball seems harmless until it is in the wrong place. How can we help keep the golf balls out of the lake? (fences erected like in Japan)

How can we keep the paint cans out of the wetlands? [*Tell the students that "in 1972 the Environmental Protection Agency (EPA) passed The Clean Air and Water Act." This was a law that made it illegal for companies to dump too much pollution directly into the air or water. Before then factories dumped so much pollution into the waterways that some rivers even caught on fire!*]

## VII. Preventing Non-Point Source Pollution

So now that we've solved the golf ball and paint can problem, how are we going to clean up the rest of this mess? Do you think NPS pollution is hard to clean up? After all, we do get your drinking water from places like this lake and the ground water underneath the watershed and we want it to be nice and clean.

*[50% of all pollution is NON-POINT SOURCE POLLUTION and is caused by regular people just like you and me, but that there very few laws that prevent us fromover- using fertilizers, pesticides, or herbicides in our houses and on our lawns. Suggest a few ways that non-point source pollution can be lessoned by doing simple things like: bagging their pet's feces, putting in rock gardens instead of lawns, using a fly swatter instead of a can of insecticide, and taking motor oil to the recycling station.]*

In the meantime, remember that you may only add a tiny little spoon of pollution to the environment, but all those little spoonfuls add up to a big mess!