**ENVIROSCAPE**

**NON-POINT and POINT-SOURCE POLLUTION MODEL**

**Materials you will need:**

* **Enviroscape Model in Green rolling case in Sprouse’s Storage Unit. Make sure all shakers are full of cocoa or kool-aid or whatever. Blue bottle for animal waste is mixture of cocoa and water.**
* **Spray bottle full of water (3rd set of shelves on left on storage aisle)**
* **Spray bottle full of vinegar (3rd set of shelves on left on storage aisle)**
* **Paper towels and Clorox wipes**
* **Bucket to drain model in**
* **Jugs of water to fill lake each time and refill spray bottle**

**Set up:**

* **Put tube from neighborhood to roadway**
* **Put plug in lake and fill with water. Put boat in this area**
* **Put road tiles in and cars on them**
* **Put farm house and barn in farm area. Put tractor in the plowed field. Put cows on grass and one cow in the stream.**
* **Put manufacturing plant in with tube coming out of it**
* **Set up trees in forest area**
* **Put equipment in construction area**
* **Put houses and trees in neighborhood area**

**Introduction to Your Audience**

Welcome to our watershed! This colorful model is a teaching tool called the Enviroscape. Our rule today is:

*Eyes on, hands off* -- until you are invited to touch it! There will be opportunities for each of you to help tell our Watershed Story today. We will all politely take turns learning about watersheds (what are they? why are they important?), water pollution (where does it come from? what harm does it do?) and how to prevent it (what can we do? how do we do it? will it make a difference?) Ready? Let's go!

**Q: How many of you live in a watershed? Please raise your hands high.**

A: Yes, everybody lives in a watershed!

**Q: What is a watershed?**

A: A watershed is the land that water flows across or under on its way to a

stream, river, lake, or the ocean.

**Q: What watershed are you in right now?**

A: We live in the Chesapeake Bay watershed which has many smaller watersheds draining into it! Buckingham and Cumberland are also part of the James River Watershed and the James River runs to the Chesapeake Bay which runs to the Atlantic Ocean.

**Let's visit each corner of our watershed model to learn about the many different**

**land uses in our watersheds; how they can pollute water; and how we can prevent water pollution in the first place!**

**LAKE**

Pick a student and ask them what their name is. Name the Lake after them. Show the students how pretty and clean the lake is. Ask them if they would swim in it or boat in it. Do you think fish and other aquatic creatures would like to live here?

**FARM**

**FARMING**  **SEDIMENT, FERTILIZERS, CHEMICALS & ANIMAL WASTE**

**POLLUTION** - Farming can involve the use of fertilizers and chemicals. Farming involves the management of soil, water, plants and animal wastes.

**SOLUTIONS** - Keep sediment, fertilizers, chemicals & animal wastes out of our waterways in the 1st place

Pick a student and ask their name. Tell the student this is their farm.

1. Crop area

Tell students that Farmer \_\_\_\_\_\_\_\_\_\_\_ tilled his/her land to plant crops. Ask the student who you named the farm after to tell you what they are planting (corn, wheat, soybeans, hay?) Ask them to use the tractor and till up the soil. Then have them sprinkle cocoa powder on top of the soil to represent what they just tilled up.

Pick another student to make it rain on the loose soil. Student will use spray water bottle. The loose soil should combine with water and turn to brown water and run into the lake area.

Pick another student to shake some fertilizer on the area that was just tilled.

Pick another student to make it rain and cause the green kool-aid to run into the lake.

**Ask:** What could we have done differently? Well, Soil and Water Conservation Districts are here to help farmers learn best management practices or BMP’s for short. In this case to help prevent erosion, the farmer could have plowed his rows differently so that it would not be so easy for runoff to go to the lake (contour planting) Or the farmer could have done strip cropping. (Put green felt strips in between crops) Or they could plant in terraces. Or the farmer could have left a buffer of trees (riparian) or other vegetation to prevent runoff from going in the lake. (Put green felt strips on edge of crop field)

The District rents a no-till drill so that farmers don’t have to till up the soil. When soil is tilled, it makes it easier for the soil to get blown away from wind or washed away by water. We call this erosion. The no-till drill plants the seed directly into the ground without tilling up the soil.

Farmers should get their soil tested and only apply the amount of fertilizer which the soil needs.

1. Cow pasture area

Farmer \_\_\_\_\_\_\_\_\_\_\_ also raises cattle. He feeds his cattle well, and we all know that what goes in must come out.

Pick a student to make cow pods by squirting the blue bottle. Have them make a cow pod behind the cow in the stream as well.

Pick the next student to make it rain. Watch the watered-down cow manure run into Lake \_\_\_\_\_\_\_\_\_.

**Ask:** What could we have done differently? Again, Soil and Water Conservation Districts are here to help farmers learn best management practices or BMP’s for short. We offer cost-share programs to help fence cattle out of streams and install automatic waterers. Put fence up and put clear water tub in pasture. Farmers can direct all wastes into lagoon/holding pond and treat biologically (or anaerobically to capture methane for power generation); compost manure and dead animals and collect runoff in lagoons/holding ponds. Research new animal waste management strategies that reduce odor and water pollution.

This type of pollution is considered non-point source pollution. There are lots of farms in this area and nobody knows exactly which farm is polluting the lake. No one can point their finger and say it was you!

**MANUFACTURING PLANT**

We people like to buy products. Industries and manufacturing plants like to manufacture. They take natural resources and make them into finished or refined products. For example, a cereal manufacture may take plants (oats, sugar cane, etc.) and turn it into Cheerios. Problem is the manufacturing process can produce by-products such as liquid effluent or pollution that is treated or not treated and then piped directly back into a waterway or gaseous effluent or pollution that is treated/not treated and released to the atmosphere through smokestacks Sometimes the liquid effluent that is released is so hot that it is considered thermal pollution.

These manufacturing plants have to get permits which allow them to pipe the pollutant into a waterway or release the pollution into the air. They are regulated at the state level by DEQ (Department of Environmental Quality) and at the national level by the EPA (Environmental Protection Agency). They are allowed specific amounts of pollutants and are fined if they go over the specified amount and get caught.

Pick a student and tell them they own this manufacturing plant. Ask them what they make (shoes, plastic toys, electrical plant, whatever). Ask their name and name the plant. Have the student who owns the plant pour sludge from the blue bottle down the hole in the top of the industrial building. Pollution should come out the straight pipe and flow on down to the lake.

**Ask:** What could we have done differently? We could have planted marsh grasses to help soak up and clean the sludge coming out of the pipe from the plant. Take the sponge and wet it, squeeze out the excess and place it right where the pipe from the industrial plant ends.

Pick another student to squeeze some sludge out of the blue bottle and watch the sponge absorb it before it can get to the lake.

**OTHER SOLUTIONS**

• Innovate and reuse effluent as another industrial input. Treat and clean with new technologies before release into the environment.

• Volunteer as a concerned citizen for the Adopt-A-Permit program to ensure compliance of permitted point sources in your watershed.

This type of pollution is called point-source pollution. We can actually point our fingers to the manufacturing plant and see the pollution being piped out into the waterway.

**FOREST**

**Ask students how many of their parents work in the logging industry.**

**Pick a student and tell them they own their own logging company. Ask their name and name the logging company after the student.**

We all need trees. Trees tame storm water, provide shade, protect us from harsh winds, give us oxygen, save us energy, help stop soil erosion, help purify water, serve as wildlife habitat, are completely renewable and serve as a major industry for lumber, paper and other natural products.

Through modern science, man has learned how to take the fiber from trees and create wonderful items that make our everyday lives better and more enjoyable. In fact, there are over 5,000 different products which come from trees. Many medicines, clothing, foods, cosmetics, paints, even some “plastics” are wood products. So the next time you use a bowling ball, put on your new rayon clothes, use a toothbrush, rinse with mouthwash, eat a cookie, or play your drums—**remember it came from a tree.**

**Ask** student who owns the logging company to cut down the trees and sprinkle loose soil (cocoa) all over the slope.

Logging timber disturbs large amounts of soil from the roads that are built through forests (especially on steep slopes) and from dragging the trees to be placed on logging trucks.

**Ask** another student to make it rain and watch the soil erode into the Lake.

**SOLUTIONS :** The logging company could have done a select cut instead of a clear cut and leave a buffer of trees to help prevent erosion. They could replant the area with trees.

**Is this point or non-point source pollution? This is actually non-point source pollution because no one can point the finger and say the sediment actually came from this site.**

**CONSTRUCTION AREA**

Choose a student and ask their name. They are the owners of \_\_\_\_\_\_\_\_\_\_\_\_\_ Construction company. Ask the student what they are building.

**“Bull dozer, bull dozer….push the soil right over!” LANDCLEARING!**

Large amounts of soil are disturbed when land is cleared to build new homes, schools, roads & shopping centers. Bare soil is unprotected soil. Stormwater erodes soil and transports it off the construction site, depositing it in waterways as sediment. Sediment fills up lakes and rivers and causes flooding. Sediment carries contaminants with it. Sediment smothers fish eggs and prevents their hatching. Sediment smothers aquatic insects that fish eat and alters the entire aquatic food chain. Sediment causes water to turn dark and turbid (unclear), absorbing heat energy and raising water temperature ( which depletes O2).

FACT: Sediment is #1 pollutant in waterways.

Have student push equipment around to clear the lot for whatever it is they are building. Then have them sprinkle cocoa to represent the loose soil created by the bull dozing.

Choose another student to make it rain.

Watch as the soil erodes into the waterway.

**SOLUTIONS**

• Keep sediment and air pollutants out of our waterways in the 1st place!

• By law in VA, all sediment must be contained on construction sites that are 10,000 square feet or larger. This is overseen at the state level by DEQ. Peter Francisco SWCD reviews Erosion and Sediment plans for both Buckingham and Cumberland Counties for commercial construction projects.

 BMPs = buffers; sediment basins; silt fences.

**Is this point or non-point source pollution? This is actually non-point source pollution because no one can point the finger and say the sediment actually came from this site.**

**NEIGHBORHOOD**

We use land for our homes, front & back yards and driveways. Where might water pollution come from?

1. **Ooooh, look at the gorgeous GREEN LAWN! Why is it so green?**

Pick a student to shake green kool-aid over the grass.

**Why is fertilizer used? What does it help grow?**

Fertilizer is a mixture of 3+ plant nutrients (Nitrogen, Phosphorous and Potassium or NPK) that promote plant growth.

• **Why is fertilizer a water pollutant? What happens when it rains?**

Pick a student to make it rain and watch the fertilizer go into the lake.

People use too much fertilizer--the wrong amount. Why? (Don’t read directions; think

“more” is better)

People use fertilizer right before it rains--at the wrong time. Why? (Think it will “soak

in” better; don’t know better or oblivious to weather forecasts)

**POLLUTION**

Fertilizer is picked up by stormwater runoff, and enters waterways. If it causes plants to grow on land, what do you think it does in the water? Right, it causes plants to grow in the water. It feeds algae that bloom - die - decompose - deplete O2 = fish kills. By overfeeding our land plants, we are overfeeding our water plants and thus, suffocating fish and aquatic life.

FACT: Excessive nutrient-loading is a MAJOR problem in Virginia and across the nation! Excessive nutrients hurt the health of the environment (ecology), which in turn hurts the economy (fisheries--fresh & seafood, restaurants, recreation, tourism, jobs), which in turn hurts society (people).

**SOLUTIONS**

• Keep fertilizer out of our waterways in the 1st place!

• Use no fertilizer: Replace lawn with native plants that need no fertilizer, grasscycle with mulching mower; top-dress with compost (NPK + microorganisms).

• Use less fertilizer: Take soil test to determine amount of fertilizer needed; read and carefully follow fertilizer directions; check weather forecast for rain; plant native plant buffers along waterways to filter fertilizer runoff.

 Add BMPs = buffers; compost; soil test

1. **Look Ma! No pesky pests in our yard! Why is it PEST-FREE?**

• **Why are pesticides used? Why are herbicides used**? (To kill unwanted plants/weeds and insects & other animals)

Pick a student and have them spray vinegar bottle in the neighborhood.

• **What happens when it rains?** (Chemical residue can be picked up by stormwater)

Pick another student to make it rain and watch as the chemicals go into the lake.

**POLLUTION**

Chemicals are picked up by stormwater runoff, enter and chemically contaminate waterways and/or they soak into soil and contaminate groundwater. Persistent chemicals enter food chain, are stored in animal fat, cause physical - neurological - behavioral problems and ecological havoc.

**SOLUTIONS**

• Keep yard chemicals out of our waterways in the 1st place!

• Use no chemicals and no weed-&-feed fertilizers: Plant wildlife habitat to encourage beneficial insects and insect-eating birds & bats; use VINEGAR or use boiling water to kill weeds; hand-weed or use cardboard & newspapers to snuff out weeds; use water to get rid of yellow jackets instead of gasoline!!!!!; etc.

• Use less chemicals: Use less toxic alternatives and read the directions; check the weather forecast for rain; adopt Integrated Pest Management (introduce beneficial insects, low use of specific-target chemicals, etc.); plant native plant buffers along waterways to filter chemical runoff.

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**3. We all love our FAMILY PETS. But what do we do with dog doo?!**

 ANIMAL WASTE (add cocoa powder)

• **What goes in, must come out. Pets eat, and pets poop.**

• **What's the big ta-doo about pet doo? How is animal waste harmful?**

Pick a student and tell them they own a dog. Only they are not responsible pet owners and don’t pick up the dog mess. Have them use the blue bottle to make pet waste all over the yard.

Pick another student to make it rain. Watch as the pet waste gets into the lake.

**POLLUTION**

People have all kinds of pets--dogs, cats, horses, goats, pot-bellied pigs, chickens, etc. Pet wastes contain nutrients and pathogens. Pet waste outdoors is picked up by stormwater runoff, nutrients and pathogens enter and contaminate waterways and/or percolate into soil and contaminate groundwater.

FACT: Pet wastes from many individual yards and mini-farms add up to a BIG water quality problem. Again, excessive nutrient-loading is a problem locally and across the nation! Pathogens contaminate shellfish, pose a risk to swimmers, and close entire beaches.

**SOLUTIONS**

• Keep pet wastes out of our waterways in the 1st place!

• Clean up after your dog while on a walk and in your yard. Carefully wrap waste in plastic and dispose of in the garbage.

• Plant native plant buffers along waterways to filter animal waste runoff.

**4. Wow! This CLEAN HOUSE is clean as a whistle.**

**Why do we use strong household cleaners? What makes them strong?**

• **What warnings are found on cleaners? What does the "skull & crossbones" symbol mean?**

**POLLUTION**

Toxic chemicals, paints & solvents can be harmful to plants, wild animals, pets & people. Problems arise with improper storage, leaks & spills; improper disposal down sink drains, stormdrains, or when chemicals are directly poured onto soil.

**SOLUTIONS**

• Keep household chemicals out of our waterways in the 1st place!

• Use no toxic chemicals: Replace with environmentally friendly cleaners.

• Use less chemical cleaners: Read labels and avoid cleaners with "skull & crossbones".

• Dispose of chemicals properly at a household hazardous waste collection site.

• Never dump chemicals down a stormdrain!

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**5. Gentlemen…start your GAS-POWERED ENGINES! Each race leaves a trace….**

**Pick a student to squirt brown soy sauce (oil)**

**Pick another student to squirt red kool-aid (gasoline, brake fluid, antifreeze),**

**Pick a student to squirt green kool-aid (nitrogen oxides from vehicle emissions) Pick a student to shake white salt to driveways & roads**

**What happens when it rains? What comes out of a tailpipe? Can air pollution become water pollution?**

**What goes up, must come \_\_\_\_\_\_.**

**Now pick a student to make it rain and watch as pollutants get in waterway.**

**POLLUTION**

Vehicles that burn fossil fuels release by-products as emissions through the tailpipe. These polluting gases in the air "rain" back to earth and enter streams, lakes, rivers, wetlands and oceans.

FACT: Recent research indicates mobile source emissions from gas-powered vehicles may account for 1/3 of the nutrient-loading of nitrogen in our waterways.

People use toxic chemicals & solvents to clean and maintain their cars, boats, AFVs, etc. These cleaners and chemicals either leak from the vehicle onto the driveway where stormwater runoff washes it into storm drains or ditches which empty untreated into waterways; or these cleaners/chemicals are dumped directly into stormdrains or ditches; or these chemicals are poured onto soil where they contaminate groundwater.

FACT: One quart of motor oil poured down a storm drain contaminates 250,000 gallons of clean water.

**SOLUTIONS**

* + Keep vehicles properly maintained so they do not leak.
  + Drive your vehicle less by carpooling, walking, bike-riding, or taking mass transit.
  + Maintain the vehicle(s) you own with less toxic fluids, cleaners and solvents.
* Recycle used motor oil at businesses that offer this service. Properly dispose of other automotive fluids at hazardous waste collection sites.
  + Wash your vehicle on grass or vegetation instead of a paved surface. Use less toxic soaps and waxes. Visit a car wash that recycles and/or treats its wash water responsibly.
* Use sand or ash instead of road salt

**Are the pollutants in the neighborhood point or non-point source pollution? This is actually non-point source pollution because no one can point the finger and exactly who the pollution came from.**

RUNOFF FROM MOUNTAIN

Show students the large drainage ditch just below the neighborhood. Tell them there is a mountain over above this ditch and water runs down it so quickly that all the grass planted on the ditch banks keeps getting worn away so that the ditch banks are bare.

Give the bag of rocks to a student and ask them to put them in the ditch to slow the water down.

This material is known as rip rap. It is a good way to slow water down and help filter out pollutants before it gets to a waterway.

Ask students to look at the lake. Ask them if they would like to swim or boat in it now. Ask them if they think the fish and aquatic life in the lake is happy with their water quality.