

EnviroScape Model and Agricultural pollution

You will focus on ways to use the EnviroScape Non-Point Source Pollution and Watershed model to explain different sources of pollution and practices to reduce pollution as it relates to Agriculture.



1. Show audience how your area is set up:
 - We've got our cows in the pasture. This is our animal waste storage lagoon.
 - The house and barn are set up with a tractor in the plowed field.
2. **Turn attention to the plowed field.** Sprinkle a small amount of the drink mix onto the field portion of the model to represent **the loose soil** that is on the field.
3. Then using a different colored drink mix put some **fertilizer** on to help grow our food and fiber.
4. Discuss how the **manure** in some cases can actually be used to enrich the soil as well. Some of this liquid could be put on the field and you can discuss why manure is a very good organic fertilizer source.
5. **Next talk about what happens when it rains.** Spray a little water on the model. When raindrops hit unprotected soil, the first stage of erosion begins. This is called *splash erosion*.
6. **Spray the water a bit harder.** As more rain falls, the water starts puddling. That puddling allows the applied fertilizer to dissolve. This puddling doesn't move any soil around and it also allows that water, fertilizer, and pesticide to actually infiltrate the soil and help crops grow.
7. **Keep spraying water.** By adding more water, you can mimic a larger storm with runoff. At this point they can start to see the soil, fertilizer, and pesticides start to run into our lake and our rivers. This is typically what would be seen from conventionally tilled field. This movement of water also can carry with it the soil, fertilizer, pesticides and manure. As this water enters the lake here on the model, you can see the movement of the soil, fertilizer, and pesticides throughout the lake.
8. **Stop spraying.** As the water slows down in the lake, the soil settles out. This is the process of deposition and can cause the depth of the lake to drastically be lowered over time. The movement of soil and then the **deposition** as sediment is one of the largest forms of pollution from agriculture—and **the largest form of water pollution in Georgia**. As the soil settles it has the potential to cover lake, river and stream bottoms causing the plant and animal life to die. The fertilizers and pesticides that run off the land into the water are also pollutants that can cause excessive plant growth and potentially plant or animal kills.
9. **Turn attention to the cow pasture and stream.** Another potential source of pollution from farms is animals. If you notice on the model there are no fences around these animals. With no fences, the animals have access to the creek at pretty much any location. This allows them to get in and out of the creek wherever they would like. If we had trees on the creek bank such as a riparian area, they would tend to stay in the shaded areas longer and have a higher potential of polluting the creek. By allowing the animal's easy access to the creek, they can cause increased erosion on the banks as a result of vegetation removal. In addition to sediment, if the animals are allowed to spend long periods in the creek, they will urinate and defecate in the creek causing more water pollution problems. To show this on the model, some of the cocoa or

colored drink mix can be sprinkled on the banks adjacent to the pasture area and then water sprayed on to simulate rainfall. The sediment, urine, and feces then can move further downstream into the pond or lake.

These are some of the sources of pollution from our agriculture fields and animal areas adjacent to creeks. Typical sources of pollution on agricultural farms is: Off-site movement of

1. Soil/sediment
2. Fertilizer
3. Pesticides
4. Bacteria

Best Management Practices (BMPs)

Discuss BMPs that can be used on the land to hopefully reduce and stop the movement of pollutants offsite. To show some of the BMPs that could be used start with your cropland. As you can see the water is still puddled from when we eroded the field earlier.

1. **Using some of the clay** in your model kit, roll a small log and put across the end of the field next to the lake. What this will do is actually make a small dam. This small dam on a working farm would cause the formation of a small wetland just upstream of your pond, right on the end of your field.
2. **Make it rain.** The dam will catch the water to form a small wetland. As you can see here, some of the water is getting past the dam, but as you set-up your model, you can better form the clay to stop water flow under the dam. This small wetland will allow you to initially catch any water draining from the field and allow you to discuss how wetlands are used as a means to provide some treatment of the water prior to release into the pond. This treatment could consist of sedimentation of soil and removal of nutrients through plant uptake or denitrification processes. *(Takes the dam out)*
3. **Add a small felt strips to the end of the field.** Another way to reduce sediment and nutrient movement off-site is through the use of vegetation in areas where water flows. . You can take the back off of the strips and use them as filter strips which would be placed here at the end of the field. These strips are called **vegetative filters**. This should work the same way as the wetland dam. It would stop the liquid from flowing into the pond or at least slow it down to the point where the soil settles out and then you can further discuss how vegetated filters work. The grasses and the roots of the trees and the grass in that filter strip take up the nitrogen, slow the water down enough so that deposition can occur *(in this case it is good for building a bank)*, and reduce the amount of pollution moving to the pond.
4. You can also talk about looking at the cropland itself is residue management as one of the NRCS practices, or **conservation tillage**. Conservation tillage allows the farmer to grow rye, or wheat, or another cover crop during winter time on the bare land. The purpose of this residue or mulch on the ground is to help increase water retention, help water infiltration, decrease water runoff, build organic matter in the soil, build the living community in that soil, and a multitude of other benefits
5. For the animal BMPs, again you can see here we just have animals roaming free. Typically there would be a fence here. **Add a fence to keep the animals confined** to the pasture with only limited access to the water. **Place a tree in the cow field** to provide shade and to encourage the cows to get out of the water more quickly.

EnviroScape Model and Construction Pollution

You will be using the EnviroScape Non-point Source pollution watershed model to show pollution sources and identify ways we can deal with pollution on the construction site located on the upper corner of the model near residences. You will show how construction can negatively effect the health of our watershed and some practices we can use to ensure the safety of our rivers, lakes, and streams.



Show your audience how your section is set up:

- We will focus on our construction site. As you can see we've got our construction equipment represented here with an excavator on site.
 - Sprinkle a little powdered drink mix on brown area to represent loose soil. This soil comes from the removal of grass and some of the vegetation that takes place when a piece of land is being cleared for construction.
1. **Spray a little water on the soil area.** If we get a little bit of rain you'll see where that water starts to accumulate and it starts to move the soil across the ground. At this point when water hits the ground it is called "splash erosion". Splash erosion looks like a little bomb hitting the ground. It hits that soil at such a high velocity that it actually causes the soil to move.
 2. **Spray a bit harder.** Now when we get just a little more rain you can start to see that soil moving a little further. If someone is building a house in this empty lot for instance and we already have a street paved, any additional water causes this soil to run straight downhill.
 3. **Keeping spraying and allow water to run down street to storm drain tubing.** If we get enough rain then that sediment will get pushed through our storm water drain and out into our rivers and creeks that go down into our lake. So from our construction site, that's really one of our main sources of pollution, this exposed dirt that gets dislodged when it rains and flows down into our gutters and streets and into our storm water drain which empties out towards our rivers and lakes.
 4. If we are dealing with a construction site that is anywhere above an acre or more of disturbed surface has to get what they call an NPDES Permit and that's a National – Pollutant- Discharge- Elimination- System Permit. This allows the construction site to release a certain amount of pollutants into the water system, but not enough to severely disrupt the health of the watershed.

To cut down on these pollutants a site could use some **Best Management Practices, or BMPs**, to reduce the flow of soil getting into our rivers. Some of those are Bio Retention Ponds, Storm Water Ponds, or vegetated filters that can be placed around the system.

1. Let's take a look at a **vegetated buffer**. Instead of clearing the land all the way to the street the construction company could plant or leave in vegetation in this area. This won't necessarily stop all the erosion, but it will certainly cut down on it. It will slow down that water enough where there is some deposition of sediment in the vegetated filter strip. Unfortunately on a construction site this may be very narrow and may not stop much of the water flow. Once the filter gets overloaded with sediment, it can't stop any more of the sediment that flows through. Luckily this is not the only practice we can use.

2. They could put in a **storm water retention pond**. There is a small indentation in one area of the construction site. This is lowest most point on this construction site and would make an optimal place for building a storm water retention pond. A storm water detention pond slows that water down to allow the sediment to settle out. Then the clean water, which gets separated out from the sediment, can be put back in some source such as a storm water drain.
3. Another onsite thing they could do is build a **bio retention pond**. In a bio retention pond you would have a medium that would allow the water to slowly release out of the pond and go to the storm water system. A bio retention pond would slow the water down, hold it in place, and allow small amount of sediment to settle out. These ponds could become small natural habitats that allow animals and vegetation to thrive off the cleaned water. A rain garden is a good example of this.

EnviroScape Model and Industrial Stormwater Pollution

You are going to use the EnviroScape non-point source pollution watershed model to concentrate on the industrial site in the upper corner of model.



Show you audience how it is set up:

- The industrial plant could be any industry within your town or community. But for fun, let's make it a **chocolate factory**. Point out the discharge storm drain.
 - You can take the bridge out so your audience can see the trench or the ditch that runs from the factory to the creek.
1. **Discuss the industry.** If an industry discharges anything from the plant itself, it must receive an NPDES permit (**National Pollution Discharge Elimination System permit**), which will allow them to discharge a given amount of whatever they produce, in this case -- chocolate syrup. With the permit they can discharge limited amounts of chocolate syrup per liter per day into the creek. Whatever syrup they discharge is factored into the TMDL or the Total Maximum Daily Load for that specific creek receiving that load from the factory. The **Total Maximum Daily Load** is the largest amount of pollutants a water source can take in without disrupting the overall health of the waterbody.
 2. **Now let's say there has been a leak at the chocolate factory!** Something happened to one of the pipes in the facility while no one was watching, the pipe broke and the contents ran into a drain that discharges to the stormwater drain.
 3. **You can demonstrate the leak.** As you can see, the factory has a hole in the top of the building. Use the green drink mix with water to make a "sludge" and with a pipette squeeze some of the sludge into the hole. Now as you can see, some of that liquid will run out of the pipe in the back of the industry, through our ditch, and down to our creek. Obviously, that is not going to be good for the health of our lake.

So what are we going to do about this pollution?

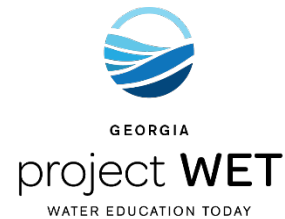
1. **Point to the cars on the EnviroScape model**, and say someone notices that there is a discoloration in the creek and a smell of chocolate when they get near it.
2. At this point, one of the things this person could do is call **the local office of EPD** and let them know there is a green substance in the creek. From that point, an environmental agency person could test the creek water. In order to find the source of the green liquid, they would check the water or soil to determine where it starts and stops. By walking the creek starting at the pond and moving upstream, they notice that discoloration stops at the pipe coming from the industry. There's green in this case below the pipe coming from the industry and it is clear above the pipe. They would follow that trench up and notice the industry has a leak coming out from the pipe in the back. This identifiable source of pollution is called point source pollution. **Point source pollution** can be remembered as something you can point to and identify as a cause of pollution.

3. Industries are permitted to discharge a given amount of material with their NPDES permits and that given amount of material meets the requirements of discharges to the creek if the creek can assimilate that material, assuming that it's nontoxic and does not disrupt the overall health of the system.
4. **From there you go back to the agricultural site.** If these cows are just allowed to walk in the creek, they could and would drink some of the water in the creek, which contains chocolate syrup. Cows may not like chocolate syrup. Depending on the compound in the water, this could make the cows sick. (tip a cow over in creek)

Again, industry is part of a watershed and is a form of point source pollution because we can look at it, point to it, and identify it as a direct cause of pollution.

EnviroScape Model and Residential Pollution

You are going to use the EnviroScape non-point source pollution watershed model to look at pollution prevention, pollution sources, and how we use BMPs in and around an urban or suburban community.



Explain the setup to your audience:

- As you can see we have the model set up here with our four houses, we've got some trees growing in this little neighborhood, and golf course.
- We will look at potential sources of pollution and how can we control them, where does it go.
- We will also look at how our actions on the urban landscapes relate directly to the water quality in our creek and our lake here on the watershed.

Some of the main sources of pollution for the urban landscape is fertilizer, pet manure if not properly cleaned up, and yard clippings in and around our neighborhoods.

1. **Shake a little of the drink powder onto lawns and the golf course** to represent fertilizer and herbicide that home owners use to make their lawn look pretty and free of weeds. Every once in a while we accidentally get some of our chemicals off our grass and in the street, which can cause problems when it rains.
2. **With the spray bottle, "rain" on the urban area a little.** As you can see, after we spray a little water on our houses and landscapes, you can see the color starts to show up. With a little rain, the formation of the colored drops on the model indicates that the fertilizer or herbicide we put on our yards is actually starting to dissolve. In our lawns, the fertilizer and herbicide will infiltrate in the soil surface and help the grass grow and help control the weeds.
3. **Direct the spray to run the colored water down the street.** However, when it leaves our lawns then we start getting problems as you can see here we got some of the fertilizer in the street. This fertilizer that did happen to get into the street, as we get rainfall, will run down our curbs and along our street and go straight to our storm water drain system.
4. **Continue to spray the model with water to mimic a large storm with runoff.** That water then starts moving down towards the storm water drain, taking some sediment, fertilizer, and herbicide from our lawns with it. This water will typically then go down our storm drain and if you notice, will start coming out of the storm drain here. In most communities storm water drains are disconnected from the wastewater treatment plants and **directly connects to the creeks and rivers.**
5. **Hold up drain stickers.** In some communities different groups such as 4-H, Girl Scouts, Boy Scouts, community groups, youth groups, and others have gone around and put little stickers with fish on some of the storm drains saying things like, "No polluting, drains to waterways," or "Only rain down the drain". So look for those stickers and what that tells us is that these storm drains are directly connected to our creeks and river systems. What goes into these storm drains will run into our natural waterways.
6. **Continue to add water from the storm.** You can see it start to come out of our storm drain here and straight into our river. There is no cleaning of that water so if we put too much

fertilizer, too many herbicides, on our property, that water, especially if we get heavy rains, can wash off into the storm drains and get into our creeks and river systems.

7. **Sprinkle on some chocolate jimmies.** Another source of pollution in our urban setting is animal manure from our dogs and cats and even from wild animals. If we don't properly clean up, especially after our personal animals, that can, just like our fertilizer, run down into our storm drain and to our ponds, lakes, and creeks.
8. **Sprinkle colored candies on streets near houses.** A third source of pollution can be grass clippings in the summer and leaves in the fall. A lot of people leave them on the curb side of the street when they're done with their yardwork. With a heavy rain and we have yard waste on the street side of the curb, those organics, those grass clippings and those leaves, will run down into our storm drain as well. That waste will make it down to our waterways and once that organic matter gets into our water body, bacteria in the water use oxygen in the water to break down the organics. This depletes the oxygen supply in the water. Without oxygen in the water, the fish don't have any oxygen to breathe or have less oxygen in the water which can lead to fish kills.

Best Practices for homeowners.

1. Clean up animal manure the best we can.
2. Put the fertilizers or herbicides on the yard where they're designed to be used and only use as much as you need.
3. Don't put grass clippings or yard waste on the street side of the curb. Instead leave it in the yard, a compost pile or place in paper bags for pick up.

EnviroScape Model and Highways, Roads and Parking Lots



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project **WET**
WATER EDUCATION TODAY

You are going to focus on a few ways to use the EnviroScape Non-Point Source Pollution and Watershed can be used to explain different sources of pollution and practices to reduce pollution as it relates to Highways, Roads and Parking Lots.

Explain the setup to your audience:

- Point out the roads and parking lots on the model.
 - Sprinkle some colored candies and drink mix on areas to simulate trash, oil, antifreeze from vehicles
1. **Make it rain with squirt bottle** and have them watch the water as it runs off the streets, parking lots and land. It will pick up soil and contaminants and possibly carry them directly to a waterway. This is called **Runoff**.
 2. **Ask: What's happening?**
 - Highways, roads, and parking lots – paved surfaces collect oil and antifreeze from vehicles and other contaminants such as trash, salt used to melt ice. Rain can carry these contaminants to the water body or they can seep into groundwater.
 - Water that comes from paved surfaces is often heated and may enter a waterway at a temperature that is harmful to aquatic life.

Best Practices

1. Permeable surfaces can replace solid surfaces on parking lots, driveways and sidewalks to allow ground absorption and prevent excess oils from washing off into the waterways. Plants along the water's edge can then help slow down and cool runoff water.
2. Citizens that change their own oil can use drop cloths or tubs to contain it then recycle at participating service stations.
3. Citizens can organize a cleanup through Rivers Alive to pick up trash and discarded items in waterways and along roads.