

Unit IV. Problems and Solutions

Lesson II. Where the River Meets the Sea

Lesson Objectives

- Students will be able to identify and distinguish between point, and non-point source pollution.
- Students will understand the roles played by sediments, nutrients, metals and pesticides in water pollution.
- Students will be able to explain ways in which the public can help reduce water pollution and how new environmental laws are created.

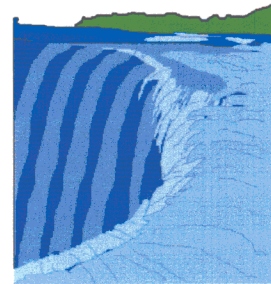
Vocabulary words: point source pollution, metals, nutrients, pesticides, pelagic, benthic

Polluted Runoff

Many people are not aware that pollutants washed “away” by runoff often end up in lakes, rivers and, ultimately, in our oceans. Stormwater runoff often gets little or no treatment before it enters natural waters, so it is important for everyone to be aware of what they may be adding to the pollution problem.

While it is easy to identify pollution from **point sources**, like industrial discharge pipes and agricultural drainage canals, the total amount of

pollution from **non-point sources**, like yards, really adds up, as well.



Pollutants affect the entire aquatic environment. They can affect conditions in the water column, known as the **pelagic** environment, as well as the bottom, or **benthic**, environment.

Sediments

Sediments, the minerals or organic materials (soil and sand) that are deposited by air, ice and water, are often washed to natural waters from areas where digging has occurred. Coarser sediments, like sands and pebbles, can settle out relatively

quickly to cover benthic plants and animals. Fine sediments, like silts and clays, can stay suspended in the water for days or weeks or even longer. This **turbidity**, or cloudiness of the water, can shade benthic seagrasses and algae.

Controlling erosion, or scouring, in areas where soil is being disturbed for construction, agriculture or other activities can prevent excess

sediments in our waters. Plants and artificial erosion controls, like silt screens, can also keep sediments in place.

Nutrients

Nutrients, like nitrogen and phosphorous, may be good for our lawns, but they can cause problems when they accumulate in natural waters. The buildup of nutrients to unnatural levels is called **eutrophication**. When runoff carries nutrients into natural waters, they cause increased growth in suspended single-celled algae, known as **phytoplankton**. This increased algal growth also prevents sunlight from getting to the seagrasses and algae that would normally grow on the bottom. Such algal blooms often cause a temporary increase in animals that eat the algae. Once the nutrient levels decrease, this extra productivity ceases and the algae

and animals begin to die. The end result is an anoxia, fish kills, and unpleasant odors.

Eutrophication can also lead to unnaturally dense or frequent blooms of harmful algae. Red tide is probably the best known of these, but recent years have seen unexpected levels of a variety of toxic species.

Everyone can do their part to prevent eutrophication by not using excess fertilizer on their lawns and by using landscape plants that do not need as much fertilizer and water. We can also select detergents that do not contain large amounts of phosphate.

Metals and Pesticides

Metals and **pesticides** are particularly dangerous to living organisms, because they can be concentrated by a process called **biological**



magnification. When an animal eats another animal or plant, it uses much of the mass of its food for energy. Unfortunately, many of the metals and pesticides that may be present in the food can't be metabolized. As a result, the pollutants just keep building up. In high-level predators, like some fish and birds, pollutants may have been concentrated through several trophic levels. It is in these animals that we

often find high levels of metals, like mercury, and pesticides, like DDT. These pollutants also may attach to clays, which then settle to the bottom. In many areas, the bottoms of bays and other water bodies have stored large amounts of harmful pollutants.



In addition to environmentally friendly industrial and agricultural practices, we can all do our part to keep metals and pesticides out of the aquatic environment.

Older house paints often contain lead, and many antifouling boat paints contain organic tin compounds and copper. Special care should be taken in the disposal of these chemicals. Some keep metals and pesticides out of the

aquatic environment. Older pesticides last much longer in the environment than is necessary. When we must use pesticides, it is best to select ones that break down rapidly.

The key to reducing the amount of pollutants carried by run off is an awareness that the ocean starts in our backyards. In many areas, students are taking the lead in raising the public consciousness of the effect that polluted runoff has on the aquatic environment. Working with local environmental agencies, classes and individual students are marking storm drains to let people know that pollutants don't just disappear. Other students are helping plant shorelines to stabilize sediments that might, otherwise, end up in the aquatic environment. Students are also participating in the restoration of wetlands that help to purify runoff before it gets to the sea.



If you find any interesting facts, or have any questions that you would like to share with the staff at Project Oceanography, please feel free to call us live during the broadcast at 1-888-51-OCEAN. Or, e-mail us at pjocean@marine.usf.edu We will answer your questions either via e-mail, or on the air during a broadcast. Visit our website at <http://www.marine.usf.edu/pjocean>



modified from the Center for Marine Conservation <http://www.cmc-ocean.org/>

Top Ten

Ways You Can Reduce Pollution

1. After enjoying the beach, make sure you return home with all of your trash. If someone else leaves trash behind, pick that up too.
2. Give old toys to a friend, relative, or charity such as Goodwill or the Salvation Army so others can enjoy them as much as you did.
3. Refuse to buy food and toys that are packaged in a lot of extra paper, plastics and polystyrene. Especially avoid products that are known to cause harm to marine wildlife such as six rings. Buy sodas separately or in large containers instead of in six packs.
4. Talk to your parents about buying school paper and notebooks made with recycled paper. Paper which is labeled "100% post-consumer" recycled is the best choice because that means the paper has already been used once. When shopping for toys, look for ones made out of recyclable materials or recycled plastic.
5. Educate others! Tell your friends about pollution and talk about what they can do to help. Teach them how to reduce, reuse and recycle.
6. Help your family or school recycle glass, metal, paper and plastics. Ask your teacher to help locate the nearest recycling center.
7. Join an environmental club in your town or school. If there is not one already, start your own.
8. Bring a lunch box or reusable lunch bag to school instead of using paper bags. Ask your parents to use a reusable sandwich container for lunch, or wash and re-use plastic bags.
9. Throw trash in trash cans. Heavy rains can carry trash from your streets into storm drains which empty into streams and rivers. Eventually, street litter can reach the ocean.
10. Participate in local storm drain stenciling and beach cleanup projects to reduce the amount of trash reaching the ocean.





Activity I: Pollutant Runoff

Fill in the following table by discussing and checking off the types of pollutants that would likely be found in runoff from each of these sources in your area.

	STREETS	HOUSEHOLDS	YARDS	AGRICULTURE	INDUSTRY
Sediments					
Nutrients					
Metals					
Pesticides					
Other Chemicals					

Activity II. Marine Pollution and the Legislature

Modified from the Center for Marine Conservation. <http://www.comc-ocean.org/splashclas/SC4.html>

Background and Objective: To solve environmental problems we sometimes need to create new laws. Making laws is the job of the United States Congress in Washington, DC. Do you know how new laws are made? First, any member of Congress, in either the Senate or the House of Representatives, may introduce a bill (that's an idea for a law). Then, a committee gathers information about the bill and debates whether it should become a law. If the bill passes the committee, it is sent to either the Rules Committee in the House of Representatives (if the bill was originally introduced in the House) or to the floor of the Senate (if it was introduced in the Senate). Next, all the Members of the House and the Senate debate the bill. If the House and Senate pass different versions of the same bill, Members of Congress meet to work out the differences. Later, Congress votes on the new bill, if it passes, the bill is sent to the President, who can either sign it into law, or veto (not approve) the bill. Making laws in Washington is not easy! But, Congress has passed many laws to protect our environment. Below you will find four environmental problems. Can you match each problem with the law that was passed to solve it?

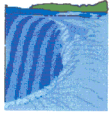
Directions: On the following page there is a law and description of that tries to correct a the stated problem. Cut and paste them into the boxes below.

The Problem	The Law	What It Does
1. Trash thrown off ships by people can litter beaches and harm sea animals.		
2. Sea turtle populations are so low that they could become extinct.		
3. Polluted run-off can make drinking water and beaches unsafe.		
4. Some dolphins and whales were being killed in fishing nets.		



Creates new programs to control run-off and other water pollution from cities.	Shrimpers must use special gear in their nets to protect sea turtles from getting trapped.
People can be fined \$500,000 for throwing plastic and other trash into the ocean.	MMPA: Marine Mammal Protection Act this law works to protect whales and seals from harm.
CWA: Clean Water Act: an important law to restore the good quality of our country's waters.	Creates new programs to stop the accidental entanglement of whales and seals in fishing nets.
MPPRCA: Marine Plastic Pollution Research and Control Act: a law to keep plastic out of the ocean	ESA: Endangered Species Act this law works to protect animals and plants whose populations are low.

Student Information Sheet II



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Controlling erosion can prevent excess sediments in our waters. Plants and artificial erosion controls, like silt screens, can keep sediments in place.

Metals and Pesticides

Metals and pesticides are particularly dangerous to living organisms, because they can be concentrated by a process called biological magnification. When an animal eats another animal or plant, it uses much of its food for energy. Unfortunately, many of the metals

and pesticides that may be present in the food can't be metabolized. As a result, the pollutants just keep building up in the animal. And are then passed to the next animal that eats it. There are few solutions for removing the existing build up of metals and pesticides.

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