

Elementary Climate Change and Unit: Lesson 3

Title of Lesson: How do pollutants move in a watershed?

Grade Level: 2

Subject: How pollutants move in a watershed.

Source(s) of the lesson:

http://www.iwla.org/docs/default-source/how-to/how_to_build_model_watershed.pdf?sfvrsn=4

<http://pubs.usgs.gov/circ/2005/1280/pdf/cir1280.pdf>

<http://mysticriver.org/>

<https://www.neponset.org/>

Essential Question(s):

Are you part of an ocean habitat?

Massachusetts Curriculum Frameworks Science Standards:

2-ESS2-3: Use examples obtained from informational sources to explain that water is found in the ocean, rivers and streams, lakes and ponds, and may be solid or liquid.

2-LS2-3 (MA): Develop and use models to compare how plants and animals depend on their surroundings and other living things to meet their needs in the places they live.

Content Objectives: Students will be able to:	Practice Objectives: Students will be able to:	Language Objectives: Students will be able to:
Explain how pollution on land can cause damage in rivers, lakes, ponds, and oceans.	Use a model to simulate pollution (practice 2)	Describe their observations orally.
Describe how using fertilizer can impact rivers, lakes, ponds, and oceans.	Analyze the effects of pollution on a watershed using a model (practice 4)	Describe scientific concepts orally and in writing.
	Communicating observations of change using spoken language (practice 8)	

Important Vocabulary: pollution, pollutant, runoff, fertilizer, algae.

Materials Needed:

- Watershed models from lesson 1 (for each group)
- Spray bottles with water (for each pair of students)
- Piece of artificial turf (for each group)
- Toy dogs (2 for each group)

- Chocolate sprinkles
- Lime gelatin mix
- Picture of a dog park
- Picture of eutrophication
- Map of lower Charles River Watershed (see attached)
- Map of Neponset River Watershed (see attached)
- Map of Boston area of Mystic River Watershed

Background Information for Teacher: In a watershed, water picks up pollutants as it flows. There are many types of pollutants that can be picked up on land. However, this lesson focuses on just two: animal waste and fertilizer. Like the earth materials observed in the previous lesson, pollutants can end up in bodies of water. This is known as nonpoint source pollution, which can have a variety of harmful effects on aquatic ecosystems. Animal waste may contain harmful pathogens that could kill fish and other aquatic life. Fertilizer can cause eutrophication, which is the overgrowth of algae, plants, and/or other photosynthetic aquatic organisms. These organisms tend to deplete the oxygen in the water, which often causes death to aquatic animals.

Background Information the Student Needs to Access the Lesson: In the two previous lessons, students learned that water and solid earth materials, like soil, are transported in a watershed. It would also be helpful if students had some prior knowledge about pollution. In addition, if you taught *New Plants Investigation 1*, students have been exposed to fertilizer. They may even have observed algae growing in the damp soil of the brassica planters.

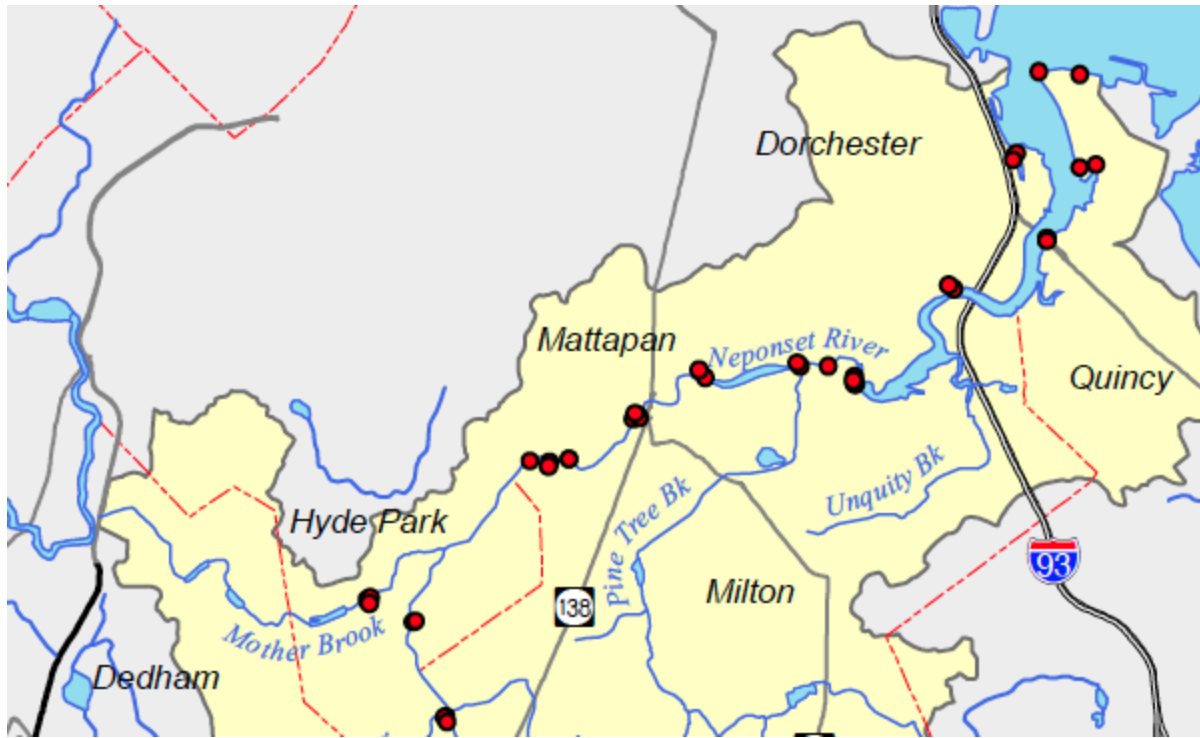
Lesson Structure

<p>Lesson Launch (Do Now)</p>	<p>Review the concept of a watershed from the 2 previous lessons. Ask, <i>What types of materials can move in a watershed?</i> They should know that water and solid earth materials, like soil, are carried in a watershed.</p>
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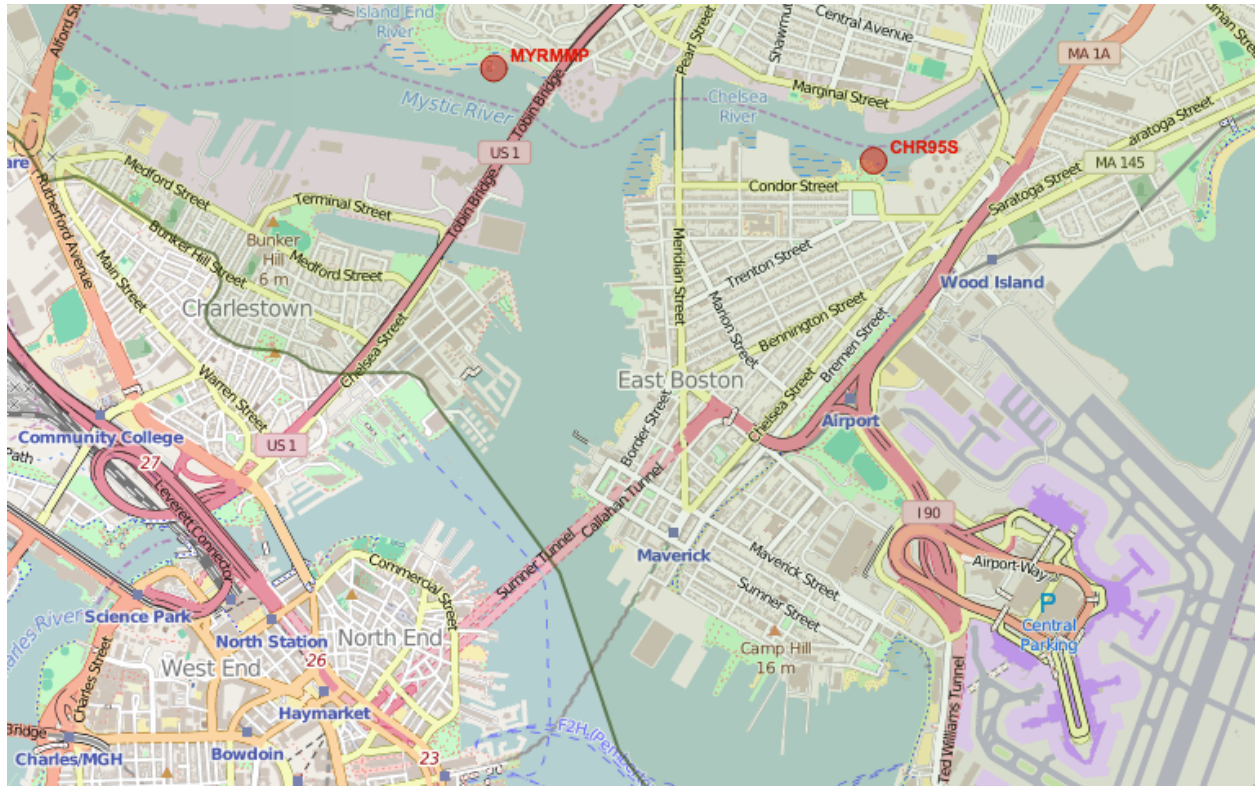
	<p>Tell them that today they will continue to explore materials that are moved in a watershed. They will be focusing on pollution.</p>
<p>Background Instruction (pre-activity)</p>	<p>Ask students what they know about pollution. Have them discuss with partners and share with the class. Say the word pollutant. Have students repeat it and count the syllables. Tell them that a pollutant is something that humans release into the environment that is harmful to nature in some way.</p> <p>Ask for examples of pollutants. For each pollutant, ask what makes it harmful. Why is it a problem?</p> <p>Tell them that they will be adding pollutants to their watershed models and seeing what happens to them when it rains. There are many types of pollution. They will only be focusing on two of them.</p> <p>Show the children a picture of a dog park. Ask how they think dogs and their owners cause pollution. The children will surely say, "The dogs poop on the ground!" Confirm this by showing them the brown sprinkles and toy dogs. Tell them that dog poop is one of the pollutants they will be modeling. On your demonstration watershed model, place two toy dogs and a pile of brown sprinkles in a small area. Tell students that this is the dog park.</p> <p>Show students the lime gelatin mix. Tell them that the other pollutant is fertilizer. If students have done <i>New Plants</i>, they should be familiar with it. Ask what fertilizer is for. Confirm that it contains nutrients and people use it to help plants grow. Tell them that like the dog poop, this is not real fertilizer. It's a model that will help them see the effects of fertilizer in a watershed. Also show them the small pieces of turf that will represent a garden. Place the turf on the demo model. Sprinkle it generously with gelatin.</p>
<p>Activity</p>	<p>Break into watershed model groups of four. Tell them that in each group, one pair will create the garden with fertilizer, and the other will create the dog park with waste. Give each group a watershed model, 2 toy dogs, a piece of turf, a container of sprinkles and a container of gelatin. Allow some time for the creation and pollution of the gardens and dog parks. Circulate, making comments such as, "That's a lot of fertilizer!" or, "That's a lot of pollution from those dogs!"</p> <p>*For management purposes, you may want to collect the pollutant containers prior to giving out the spray bottles.</p> <p>Now it's time to make it rain! Go over how to make it rain and the rules and procedures regarding the usage of spray bottles. Distribute 2 spray bottles to each group.</p> <p>Circulate around the room. Encourage them to rain on the polluted</p>

	<p>areas of the models as well as the clean ones. Make sure that they are observing the changes in the model and not merely playing with the water. Ask questions such as, “What is happening to your model?” “What is the rain doing to the fertilizer?” “Where is the pollution going? Why?” “What is happening to the river? To the ocean? Why?”</p> <p>Clean Up: After about 5 minutes of raining, tell them that the rain has stopped and it’s time to clean up. Enlist a lot of student helpers. Collect the spray bottles, toy dogs, and turf. Walk around with a basin to empty the dirty water from the models into. This water can safely be poured down a drain. Have additional helpers collect the models and wipe off the remaining pollution.</p>
<p>Discussion/ Debrief</p>	<p>Ask students what happened to the pollutants on land. They should reply that they ended up in the river and the ocean.</p> <p>Ask, <i>How did the pollutants end up in the ocean?</i> (The rainwater carried it.)</p> <p>Explain that in a watershed, runoff is rainwater that flows from the land into a body of water. Have students say “runoff,” count the syllables, and tell what it means. Explain that runoff often carries pollutants, like animal waste or fertilizer, into the water.</p> <p>Ask what the runoff did to the bodies of water in their models. Confirm that the water “became dirty,” “changed color,” etc. Ask if this dirty water is a problem. Confirm that it isn’t good for the fish and other living things that use the water.</p> <p>Ask what happened to the water when it became contaminated with fertilizer. Confirm that the water turned green.</p> <p>Show students a picture of eutrophication (it’s not important that students learn this word). You may wish to use the attached picture from the Mystic River, and mention that it was taken not too far from Boston.</p> <p>Ask them what they see. Tell them that this is water that became contaminated with too much fertilizer. Have them remind you what people use fertilizer for, and ask them what they think happened here.</p> <p>Fertilizer is indeed used to help grow plants. The fertilizer caused too much algae, which is a living thing similar to a plant, to grow in the water. Ask what the problem with so much algae might be. Explain that the algae makes it hard for the fish and other aquatic living things to get the oxygen they need.</p> <p>Show one of the attached watershed maps. If you are in North-East Charlestown or East Boston, show the Mystic River map. If you are Hyde Park, Mattapan, or South-East Dorchester, show the Neponset</p>

	<p>map. Otherwise, use the Charles River map.</p> <p>Help students find the approximate location of your school on the map. Ask them what river the runoff in their neighborhood most likely drains into. Tell them that watersheds are named for the bodies of water they drain into.</p> <p>Ask them where their watershed's river drains into. Confirm that it's Boston Harbor, which is part of the ocean!</p>
Formative Assessment	<p>EXIT TICKET</p> <ol style="list-style-type: none">1. Jake lives next to the Charles River. This afternoon, he let his dog go to the bathroom in his yard and didn't clean it up. When his neighbor asked him about it, Jake said, "It's my yard. I'm not polluting anywhere except my own yard. I'm not hurting nature." Is Jake correct? A. Yes B. No What should he tell his neighbor?2. One day Michael was walking and he saw a pond. The water in the pond appeared to be bright green. Why do you think the water was green?







Eutrophication: Mystic River Algal Bloom

