DCR Watersheds as Classrooms Virtual Edition

dcr Massachusetts

Watershed Model

Overview:

A watershed is any area that funnels precipitation and snow melt to a common destination. Review the water cycle, view a model of a watershed, and learn how to create your own model. Follow the rain as it moves through a watershed. Wherever we may be, it is important to consider our local, nearby watershed because what enters the water at any point in the watershed boundaries can have an impact as it travels downstream. It can impact public drinking water supplies and underground private wells. Everything we do on or to the land has potential to impact everyone downstream.

Format:

12-minute video
Part One 5 minutes Water Cycle Review & View a Watershed Model (raised relief map)
Part Two 7 Minutes Make Your Own Watershed Model

Curriculum Connections:

Grades 2-8 This virtual tour and hands on activity helps support the following:
Disciplinary Core Idea: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
2-ESS2-2 Develop a model to represent the shapes and kinds of land and bodies of water in an area.
5-ESS2-1 Use a model to describe the cycling of water through a watershed through evaporation, precipitation, absorption, surface runoff, and condensation.
5-ESS3-1 Obtain and combine information about ways communities reduce human impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.
MS-ESS2.C.3 Global movements of water and its changes in form are propelled by sunlight and gravity.
MS-ESS2.C.1 Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Optional Activity While Watching Video

Option 1: Have students check off the attached vocabulary words when mentioned in the video.
Option 2: Have students read the Pollution/Solution cards before the video and check off when mentioned during Part 1.

Assessments:

Pre-Assessment Activity:

PBS The Water Cycle Studyjams: Watch Studyjam video and answer 7 questions on the Water Cycle

Guiding Questions:

- How does water move through a watershed? What actions can we take to keep water supplies clean?
- Are you a part of the watershed? Have students explain why or why not they think that they are part of the watershed.
- If rain fell right where you are standing, which direction would it go (runoff)?
- How do trees and plants prevent runoff?
- How might heavy pollution from humans in this area affect the watershed?

Post Assessment Activity:

Diagramming*:* Have students diagram their watershed models to illustrate the water cycle concept and how water moves through a watershed. Their drawings of a watershed could include the sun, clouds, streams, forests, buildings, roads, and waterbody that water collects in. Use blue for the water and precipitation and include arrows to show the path of pollution transport. Have the students label evaporation, precipitation, absorption, surface runoff, and condensation.

Water Pollution and Solution Cards follow up discussion: Hand out the Pollution/Solution cards on page 3 and 4. Have students check which ones were mentioned in part 1 of the video. Take turns reading the solutions. If students come up with additional potential pollutants, add them on blank cards and have students think of ways to prevent pollution from getting into waterways. (Discussion starters: pool chemicals, disposable masks, pharmaceuticals, tires)

Extend the Experience:

DCR Division of Water Supply Protection Activity Guides for additional hands-on activities, vocabulary words, and word search.

Watershed Model Activity Guide This guide has instructions for the watershed model in the video to read along with plus a wax paper and crumpled paper model.

Water Cycle Activity Guide Engaging hands- on activities from easy to find materials.

Video Stormwater Pollution Prevention -14 minutes

Did you know the largest amount of water pollution does not come from businesses, municipalities, or other regulated sources? Most water pollution comes from chemicals, debris, and animal waste washed over land every time it rains.

Explore Wachusett Watershed Trip Tip

Self-guided adventure encourages families to visit the watershed on their own.

Water Pollution and Solution Cards:

Pet waste left on the ground can bring dangerous bacteria, viruses, and parasites into the water. Pick up after your pet and dispose of it properly. Dogs and domestic animals are not allowed on DCR Water Supply Protection lands.	**Road salt** can increase sodium when it gets into a drinking water supply and changes the salinity of freshwater, harmful to plants and animals. Pretreating roads and hard surfaces before snow and ice builds up can help reduce the amount of salt needed.	**Aquatic Invasive Species** Fishing and boating can cause the spread of Aquatic Invasive Species. – living things that don't belong in an area. It's important to clean boating and fishing equipment after use.
Leaky septic systems and faulty sewer lines can contaminate water. Have the system inspected regularly. Only flush wastewater and toilet paper. Throw wipes, tissues, and everything else in the trash.	**Fertilizers, herbicides, insecticides, grass clippings** are all potential pollutants from lawns. Leave a natural area in a yard that doesn't require mowing or chemicals. Don't apply fertilizers before rain, so it's less likely to runoff.	**Fishing line and trash** can be dangerous to animals that live in the water. It's important to not litter when fishing and clean equipment after use. Many fishing areas have a fishing line recycling tube.
Car washing potentially pollutes the water with oil, grease, phosphates, soaps, cleaners and road salt! It's better to wash a car on a lawn where the water can filter through the plant roots or take it to a car wash.	**Landfills** might contribute trash and leaking chemicals infiltrating into ground water. Alternatives to handling solid waste- Refuse, Reduce, Reuse, Repurpose, Recycle. Compost food scraps and yard waste.	**Trash or litter** along roadsides can enter a waterway by rain or wind. Don't litter. Participate in a clean-up event in your area.
Farms Equipment leaks, pesticides, fertilizers, parasites from animal waste, and loose soils can all wash into water. A buffer of a living fence or trees can help. This also provides shade to keep the water cool.	**Roads and parking lots** Rain runs off these hard surfaces carrying anything left on the ground. Road salt, oil, or gas can enter the water by storm drain. Plant a buffer of plants. Preserve wetlands from development. Create stormwater basins to collect and slow stormwater runoff.	**Impervious surfaces** The sun's energy evaporates water and heats surfaces. Warm stormwater runs into waterways and hurts aquatic life, called thermal stress. Plant a buffer of trees and grasses to filter and keep water shaded. Preserve wetlands from development.

Water Pollution and Solution Cards:

Canada geese, ducks, gulls, muskrat, and beaver all deposit bacteria directly into surface waters. This is dangerous for drinking water supply. Don't feed wildlife. Feeding attracts geese, ducks and gulls in large flocks. Help keep wildlife wild.	**Too many deer** in a forested area can harm the plants and trees growing and limit the forest's ability to soak up water. Deer management and forestry practices to encourage a healthy diverse forest of trees of many species and ages.	**Clearcutting** Cutting down all trees in an area or unmanaged forestry can cause erosion as rain washes soil and rocks in our waterways. Forestry management by selecting individual or small groups of trees to cut.

Vocabulary:

ABSORPTION: removal of water from the soil by roots.

CONDENSATION: formation of clouds.

EROSION: A process where rocks and sediments are picked up and moved to another place by ice, water, wind, or gravity.

EVAPORATION: Evaporation takes place when liquid turns into gas. Water leaves the Earth's surface and enters the atmosphere as a gas or water vapor.

GROUNDWATER: Water held underground in the soil or in pores and crevices in rock.

IMPERVIOUS: Not allowing fluid to pass through. Impervious surfaces are hard and usually manmade- rooftops, roads, and parking lots. Water cannot pass though and seep into the ground but runs off into storm drains and then quickly into waterways.

INFILTRATION: Absorption of water by the soil.

PRECIPITATION: The falling of water from the sky in the form of rain, sleet, hail, or snow.

RESERVOIR: A large natural or artificial lake used as a source of water supply.

RUNOFF: Excess water from rain or melting snow that runs downhill over the landscape.

SEDIMENT: The material from a liquid that settles to the bottom.

TRANSPIRATION: The process where plants absorb water through the roots and then give off water vapor through pores in their leaves.

WATERSHED: An area of land that drains to a common river, lake, or reservoir. A watershed includes everything within its borders—land, animals, plants, people, and their traditions.

Activity Instructions: Make a Watershed Model

Excerpt from Watershed Model Activity Guide

Materials:

- Tray, dishpan, cookie sheet, or lid from a bin.
- Newspaper and recycled materials
- Shower curtain, trash bag, or tablecloth
- Spray bottle
- Sponges, paper towels, or cloth napkins.
- Items to create pollution: instant coffee, tea, liquid soap, cooking oil, salt, dried
- herbs, food coloring, drink mix, *food coloring and drink mix may stain skin and clothing! *

Steps:

1. Check your recycle bin for any materials that will create the hills and valleys of a watershed. Crumpled up newspaper and egg cartons work well. If inside, place these on a tray or in a dish pan, or whatever will hold water that will be sprayed over the top. Or try creating a large model outside on the ground.
2. After creating a watershed landscape with high and low areas, cover with something waterproof. You can use a shower curtain, plastic tablecloth, or a trash bag. Tuck the covering in around the highareas and keep the edges within the tray or pan so water doesn't get everywhere.
3. Make it rain with the spray bottle, squeeze a sponge, or spoon drops of water across the landscape.
4. Notice where the precipitation is falling and pooling up in the low areas or valleys.
5. Add a challenge! Use some common items you might find in to create areas of pollution on thewatershed: tiny drops of food coloring, small sprinkle of powdered drink mix, instant coffee, tea,liquid soap, cooking oil, salt, or dried herbs and spices. All you need is a tiny bit.
6. Predict what will happen to the water that is collected at the lowest points.
7. Make it rain!
8. Stop using the spray bottle and switch to sponges and droppers. Soak up the water and cycle it through by squeezing out again.
9. Imagine the role of trees and plants in the water cycle. Make your watershed more realistic by placing a paper towel or napkin up the sides. This represents soil and plants. Let it rain again and notice what happens.

Pollution suggestions:

INGREDIENT	REPRESENTS POLLUTION
Drink mix *may stain clothing *	Toxic chemical from urban runoff
Food coloring *may stain clothing*	Virus, bacteria from animal waste
Instant coffee or tea	Erosion from construction sites
Liquid soap	Car washing
Cooking oil	Oil from motor vehicles
Salt	Road salt treatment
Dried herbs	Fertilizers, herbicides, insecticides
Bits of paper	Trash, litter
What else can you use?	Can you think of other pollutants?

Reflections:

Can the landscape be changed to stop the pollution from getting in the rivers, ponds, lakes, reservoirs, or oceans?

What role do trees play in the water cycle?

Once the water is polluted, how can it be cleaned?

It's hard to clean water once it's polluted.

The best way to protect water supplies is to keep the water, the ground, and the air free of pollutants as much as possible for clean water now and the future.

Contact Information:

Kathryn Parent
Program Coordinator, Wachusett/Sudbury Section
MA DCR Division of Water Supply Protection
180 Beaman Street, West Boylston, MA 01583
Kathryn.Parent@mass.gov
www.mass.gov/service-details/wachusett-education-programs