Water & Watersheds

Topics: Water cycle, watersheds, water usage

NEW YORK STATE | Department of Environmental Conservation

GRADE LEVEL: Middle School

Big Ideas:

- The water cycle is a complex, multi-step process.
- Everyone lives in a watershed.
- Watersheds provide critical environmental services and drinking water for many people.
- Water is one of the major sources of change in our land.
- Water transports material through the watershed.

Learning Objectives: *students will be able to…*

- Develop a model to describe the cycling of water through the watershed.
- Analyze and interpret watershed data.
- Utilize a model to determine how land use changes impact the water cycle.
- Describe the availability of water on Earth.
- Calculate their own water footprint and explain how the concept of "virtual water" applies to their life.

New York State Science Learning Standards:

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.

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Key Understandings:

- Water transports material through the Hudson River watershed and estuary.
- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- Ecosystems are dynamic in nature; their characteristics can vary over time.
- Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Essential Questions:

- When rain falls to the ground around your home or school, where does it go?
- How does water move in a watershed? How does geography influence the boundaries of a watershed? What factors influence the quality of water in the watershed?
- How can people reduce their impacts on their local watershed and water supplies?

Students will know…

- What a watershed is.
- A watershed divide marks the boundary between different basins of water collection.
- Changes to the ecosystem affect populations.
- Key vocabulary terms.

Vocabulary:

- Conservation: the preservation or efficient use of resources.
- Estuary: a body of water in which fresh and salt water meet.
- Gravity: the gravitational attraction of the mass of the earth, the moon, or a planet for bodies at or near its surface.
- Sustainability: avoidance of the depletion of natural resources to maintain an ecological balance.
- Virtual water: the volume of water used to produce consumer products.
- Water cycle: continuous circulation of water from water bodies and the land to the sky and back again.
- Water footprint: measures the amount of water used to produce each of the goods and services we use.
- Watershed: the area of land from which water drains into a body of water.

Learning Plan: We recommend doing these lessons in sequential order; however they can be done as individual lessons. Lessons have multiple links (videos, songs, diagrams, activities) that can be used at the teacher's discretion depending on class time.

Pre-assess: What is a watershed? Use informational surveys/questionnaires/inventories, K-W-L or I notice/I wonder to assess students' prior knowledge, have students write or draw in response to the essential questions. Ask students to draw/map the water cycle and/or their watershed and write down anything they feel like they don't know about the Hudson River.

Progress Monitoring: Formative assessment and teacher feedback should be ongoing throughout the lessons. Teachers should develop assessments based on their individual class needs. Think-pair share, exit tickets, interactive discussions, questions and listening, informal observations, quizzes and student work samples can all be used.

Lesson 1: Understanding Our Water Footprint- Students build awareness of their direct and indirect water use. Note: We recommend lesson 1 (2 days) and if time allows do all 3 lesson units to take a deeper dive (5 days).

- Video: Where Does Our Water Come From and Where Does it Go?
- Water Resources and Water Footprints
- Find out your Water Footprint
- Extension - Water Filtration Challenge OR Build Your Own Water Filter
- Extension- Have student research where their drinking water comes from (school and home)

Note: Encourage your students to think about what 'wasting' water really means. For example, letting the water run while you brush your teeth isn't much of a waste of water, but rather a waste of energy, if you have a well and septic system. Water just cycles from the ground and back to the ground. However, if on

public water, the water is moved from one place to another and there are possible losers and gainers of water. Water just recirculates around the world and isn't really 'lost' or 'created.' Think about bottle water, the system where the water comes from to bottle is losing water, and the wastewater or septic system that is the recipient of sewage is the gainer.

Lesson 2: What is a Watershed? – Students watch a video, then describe how the water cycle has been altered due to human actions. Students discover how water flows around their school and understand how watersheds affect water quality.

- Video: What is a Watershed?
- What's a Watershed (reading & reflection questions) & Watersheds Activity
- Water Cycle & Land Use (reading & reflection questions)

Lesson 3: Watershed Address- Students watch a video, then become familiar with their local waterways and illustrate how they are connected to their local environment.

- Video: What is a Watershed?
- Watershed Address Lesson and Presentation
- River Runner: Online interactive shows where raindrops end up within the watershed
- Extension - Online Watershed Interactive

Lesson 4: Model Your Watershed- Students watch a PowerPoint presentation then develop a model watershed using an online application to investigate how land cover impacts water quality and how to reduce human impact.

- Model Your Watershed (Student Lesson Plan)
- Model Your Watershed PowerPoint (email hrteach@dec.ny.gov for PowerPoint with voiceover. PowerPoint not needed to complete lesson, but can be helpful to teachers as a guide)
- Model My Watershed Interactive Webpage

Lesson 5: Do We Have a Right to Clean Water? Students investigate the impacts of the Flint water crisis through storytelling and address water sustainability and the role of civic responsibility during a human rights crisis.

- Do We Have a Right to Clean Water Student Activity
- The Fall of Flint Photo Essay
- Learning and Teaching About Environmental Justice and the Right to Clean Water

Note: People need to manage water, whether it's for wildlife and fish, wastewater to serve communities, or protect drinking water for people to drink. There is an entire field of water resource professionals, and, in some places like the west, it's a big deal to allocate water for people, agriculture, nature, etc. Have students research water careers or bring an expert in to talk with the class about opportunities for different career paths.

Lesson 6: Trees, Plants, and Other Buffers- Students are introduced to nature's filtration systems and the role trees play in watershed protection.

- Trees, Plants and Other Buffers Student Activities (pg. 20-21)

Teachers: Would you like to visit us at Norrie Point environmental education center, or have an educator visit your classroom in-person or virtually? Contact us to schedule a program: hrteach@dec.ny.gov

Resources:

Websites:

- Waters and Watersheds (NYSDEC)
- Clean Water for the Hudson River Estuary
- NYC Soil and Water Conservation District Resources for Educators
- Orange County Water Authority Education
- NYC-DEP-Education Curriculum Guide
- NYC-DEP Education Resources
- Wallerstein Collaborative for Urban Environmental Education and Sustainability
- EPA Watershed Information
- River Runners
- National Geographic
- Water Education Resources
- Precipitation Education (NASA)
- The Water Cycle (National Oceanic and Atmospheric Administration)
- Water Websites for Kids
- River of Words - annual international poetry and art contest for K-12