



Water Lesson: Respect

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Overview

This lesson introduces youth to the concept of the hydrologic cycle and the movement of water on the planet through a group brainstorming activity. The functions of and threats to streams are also explored, particularly in the context of MONO. Concluding is a discussion relating respect to water resources. The connection is made that respecting the diversity of functions of water resources benefits society, as does respecting others.

Learning Objectives

- Understand the hydrologic cycle and how water moves on the planet
- Identify the various functions of streams as well as threats they face
- Discuss the importance of respect

Materials Needed

- Whiteboard and marker (or appropriate substitute – a transportable whiteboard might allow the lesson to be done outside).
- Writing utensils and paper for each group

General Outline

1. Brief Introduction Discussion to Respect

Youth will explore the value of Respect through a brief discussion.

2. Hydrological Cycle Group Activity

In groups youth will explore the processes that drive the hydrologic cycle by discussing responses to questions posed by the instructor.

3. MONO stream group discussion and activity

Youth will discuss where water is found in MONO, and where that water goes once it leaves the park. Youth will again assemble in groups and generate lists of functions that streams serve. Threats to streams will be discussed.

4. Concluding discussion

Youth will be led on a concluding discussion again about respect and its relation to water resources.



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Background (for instructor benefit)

With respect to matter, earth is essentially a closed system. This means the amount of matter that is on earth in any form does not leave or enter earth. Therefore, the amount of water on earth is finite. Water exists on earth in three chemical phases: solid, liquid, and gas and can transition between these phases. In the atmosphere, water exists as a gas (vapor); in glaciers, ice caps, ice sheets, icebergs, and all other snow and ice formations water exists as a solid; in lakes, rivers, oceans, wetlands, and underground, water exists as a liquid. Through various natural processes, water on earth cycles among these various phases and locations over time. This cycling process is called the hydrologic cycle.

Many water resources exist in MONO. Roughly two miles of the Monocacy River and its tributaries of Bush Run, Gambrill Run, and Harding's Run flow through the park. The Monocacy river flows to the Chesapeake Bay, which empties into the Atlantic Ocean. These rivers and rivers in general serve many functions for many stakeholders. In the 18th century, the Monocacy River helped Frederick County grow. It allowed the transport of goods via river, hydropower to grind grains, the enabled many industries to thrive. In general, streams are used for power generation, water supply (for drinking and growing crops), and recreation. Streams also support a diverse community of living species. In MONO, the streams are home to 39 species of fishes alone.

Many threats exist to streams and water resources today, particularly in urbanized and rapidly urbanizing areas like the NCR. Increased impervious surface associated with urbanization leads to increased runoff and erosion, channelizing streams. Increased runoff also introduces more pollutants and debris to water systems, which can harm biotic communities and natural processes within them. The streams within the park boundary have demonstrated signs of degradation related to these issues.

Procedure

1. Introductory Respect Discussion

- a. Ask youth: "What do you think of when you hear the word respect?"
 - i. Field and respond to all responses.
- b. Next, follow up with another question: "Do you think preservation of park resources and respect go hand in hand? Why/why not?"
 - i. Again, field and respond to all responses.



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- c. Transition to next section: “Respecting and valuing park resources is instrumental in preserving those resources. One of the resources we strive to preserve are the water resources within parks.”

2. Hydrologic Cycle introduction and activity (see example below)

Instructor should be familiar with the diagram to be constructed in this activity based on group responses: At step **e** in the procedure below, the instructor begins by writing down and circling the locations that youth groups share. Let writing space/discretion of instructor dictate number of locations written down. Next, in step **g**, the instructor will draw arrows dictating the movement of water between these locations, as instructed by youth.

- a. Divide youth evenly into groups, roughly 3-5 per group.
- b. Inform youth: “To start today, we’re going to be thinking about water. Specifically, in your groups you will discuss where it’s found on the planet, in what forms it’s found, and what happens to it.”
 - i. Distribute writing utensils and paper to groups, if necessary.
- c. Inform youth: “Each group is to make a list. In the list you will record all locations your group thinks of in which water is found on earth. For each of these locations you generate, identify what chemical phase, solid, liquid, or gas, that the water is in.”
- d. The instructor should now have a whiteboard and marker to record group list responses, eventually to construct a group generated diagram of the water cycle. Once each group has generated its list, ask each group: “share the locations your group came up with and the phase of the water in each.”
 - i. Write down and circle group responses on the whiteboard, indicating the phase of water with an S, L, or G.
- e. Next, ask the entire group: “Does water stay in these locations, or does it move around among them?”
 - i. After fielding responses, inform youth: “Water in fact cycles throughout the planet in all of these locations over time.”
- f. Next inform youth you will draw arrows depicting the movement of water between different locations based on how they instruct.
- g. After drawing each arrow, inform the group:

“water moves throughout the planet, above and below the earth. Solar energy from the sun drives this, and the movement of the water is called the hydrologic cycle. In the planet’s surface waters, solar energy from the sun causes water to turn to gaseous vapor, which evaporates into the



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atmosphere along with water released from plants, through a process called transpiration. It rises and eventually condenses, or turns from gas to liquid, into clouds. Clouds can become saturated and release water, causing it to fall to the ground in solid or liquid forms. Precipitation that intercepts land can percolate into soils and infiltrate groundwater systems. It can also runoff and enter overland water systems like oceans, lakes, or rivers. Groundwater also can feed these surface waters through seeps and springs.”

- h. Inform youth together they constructed a diagram modeling this cycling of water on the planet.

3. Stream group activity and discussion

- a. Ask youth: “We’ve looked at how water moves on the scale of the planet, but what about here at MONO? Where is there water, and how does it move here in the park?”
 - i. Field all responses. Youth should identify the river/streams on the park.
- b. Inform youth: “the park has an abundance of water in its streams and the river. The Bush, Gambrill, and Harding’s Run creeks are free flowing tributaries to the Monocacy River. In total, there are roughly 2 miles of the Monocacy flowing through the park.”
- c. Ask youth: “where do the tributaries and Monocacy river here on the park eventually flow?” Field responses and then inform/reiterate: “The Monocacy River is the largest tributary to the Potomac River, which empties into the Chesapeake Bay, which ultimately leads to the Atlantic Ocean.”
- d. Divide youth again into evenly sized groups. Inform youth: “this time in your groups, you will be generating a list of functions that streams or rivers perform. This can be anything: for example, a function of a stream could be how it is used by a certain organism; or, a function could be a physical change a stream makes in an environment.”
- e. After each group has generated its list, ask each group: “please share and explain the functions your group came up with.”
 - i. After fielding and responding to all groups’ responses, share with youth the following functions of streams:
 - Streams supply drinking water to humans



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- They supply water to irrigate and water our crops – in fact, in the late 1700s, this area in Frederick county would've used water to irrigate crops like corn, orchard fruits, oats, rye, and potatoes.
 - They provide power/electricity through hydropower
 - They provide opportunities for recreational and commercial practices
 - They provide habitat for a variety of aquatic life – in fact the streams in the park are home to 39 species of fish alone.
- f. Inform youth: “while streams have many functions, they face many threats that can impact how healthily they perform these functions.”
- i. Next, ask youth: “Does anyone know of any ways in which streams are harmed and the nature of the harm caused?” Field and respond to all responses.
- g. Inform youth: “Streams can be harmed in a variety of ways, and many streams suffer as a result of changes associated with increased human development and urbanization. Increased impervious surface area that comes along with urbanization increases runoff into streams from precipitation events, which carries pollutants and degrades water quality, which can harm biotic communities.”
- i. Emphasize to youth: “these issues have been apparent in streams within the park. Levels of dissolved oxygen in park streams are less than desirable, and levels of nitrogen pollution exceed desired levels. The location of MONO in the developing NCR contributes to these observed trends.”
- h. Transition: “In the face of these threats that streams face, it is the NPS mission to preserve the waterways of MONO because they are fundamental natural resources related to the battle of Monocacy.”

4. Concluding group discussion

- a. Inform youth: “Respecting the diversity of functions that streams and water resources perform motivates their preservation.”



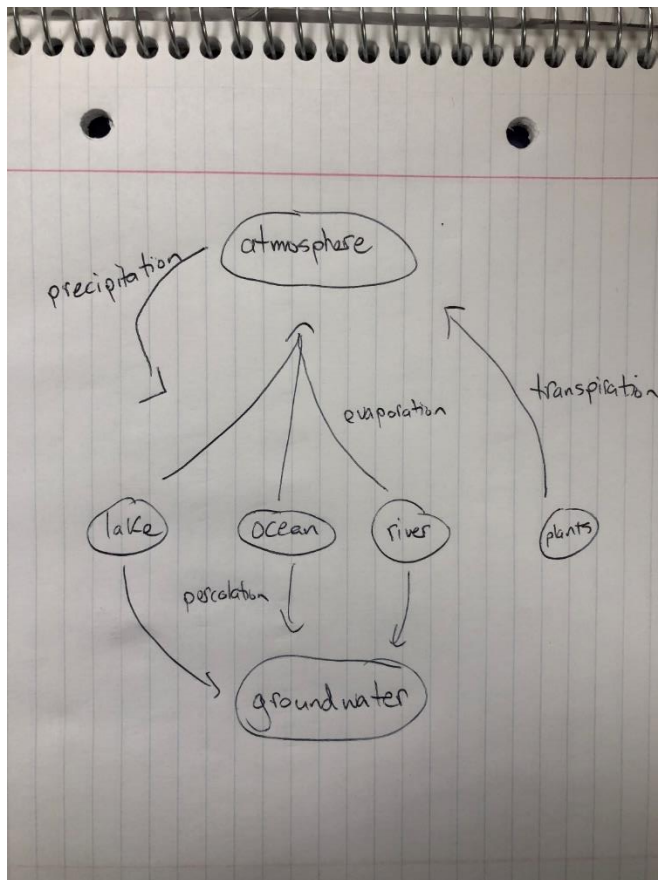
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- b. Follow up by asking youth: “How might respecting the diversity of functions that others play benefit our society?”
 - i. Field and respond to responses.
 - ****KEY POINT TO EMPHASIZE IN DISCUSSION:** “Respecting the diversity of others promotes an environment in which they can uniquely contribute to the public well-being. This benefits all who work and interact together.”*



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Example of Hydrologic Cycle Activity Web



Circled items will be locations groups provide at which water is present on earth. Arrows will be drawn between locations to represent the movement of water. Next to the arrow, the process or a description of how water changes locations can be written (based off groups' input).

References

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