

Waterway Wellness Exam

Science Enhanced Lesson — Grade 6



TOPIC

Water Monitoring and Watershed Health

OUR WORLD, OUR RESPONSIBILITY

6.1 The student will demonstrate an understanding of scientific and engineering practices by (a.) asking questions and defining problems.

- Ask questions to determine relationships between independent and dependent variables
- Develop hypotheses and identify independent and dependent variables
- Offer simple solutions to design problems

6.1 The student will demonstrate an understanding of scientific and engineering practices by (b.) planning and carrying out investigations.

- Evaluate the accuracy of various methods for collecting data

6.1 The student will demonstrate an understanding of scientific and engineering practices by (c.) interpreting, analyzing, and evaluating data.

- Organize data sets to reveal patterns that suggest relationships
- Compare and contrast data collected by different groups and discuss similarities and differences in findings
- Use data to evaluate and refine design solutions

6.1 The student will demonstrate an understanding of scientific and engineering practices by (d.) constructing and critiquing conclusions and explanations.

- Construct explanations that includes qualitative or quantitative relationships between variables Ask questions to determine relationships between independent and dependent variables
- Construct scientific explanations based on valid and reliable evidence obtained from sources (including the students' own investigations)
- Generate and compare multiple solutions to problems based on how well they meet the criteria and constraints

6.1 The student will demonstrate an understanding of scientific and engineering practices by (f.) obtaining, evaluating, and communicating information.

- Read scientific texts, including those adapted for classroom use, to obtain scientific and/or technical information
- Construct, use, and/or present an argument supported by empirical evidence and scientific reasoning

6.6 The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include (f) water is important for agriculture, power generation, and public health.

6.8 The student will investigate and understand that land and water have roles in watershed systems. Key ideas include (a.) a watershed is composed of the land that drains into a body of water; (b) Virginia is composed of multiple watershed systems which have specific features; and (d) natural processes, human activities, and biotic and abiotic factors influence the health of the watershed system.

- 6.9** The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment. Key ideas include (a) natural resources are important to protect and maintain; (c) major health and safety issues are associated with air and water quality; and (e) preventative measures can protect land-use and reduce environmental hazards.

EARTH SCIENCE

- ES.8** The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include (c.) weather and human usage affect freshwater resources, including water locations, quality, and supply; and (d) stream processes and dynamics affect the watershed systems in Virginia, including the Chesapeake Bay and its tributaries.

BACKGROUND INFORMATION

A watershed is an area of land from which all surface and groundwater flows from higher elevations downhill to a common body of water such as a stream, river or ocean. Communities rely on water found in watersheds, like the Potomac River, for things like drinking water and recreation. Since watersheds support the local community, it is important to understand their health. The health of a watershed impacts the level of treatment that needs to be done before and after community use of the waterways found in it. The health also impacts the amount of work the community must do to protect the water resource.

There are four factors that environmental scientists evaluate to determine the health of a watershed:

- 1. Chemistry**-The chemistry of a watershed simply refers to the chemical make-up of its waterways. Environmental scientists can tell a lot about a waterway's health by evaluating chemicals found in a waterway. Chemicals in a waterway can come from things like factories or businesses, or they can come from fertilizer and pesticides.
- 2. Biology**-The biology of a watershed refers to what is living in its waterways. Environmental scientists can tell a lot about a waterway's health by evaluating the

animals living in it (e.g. fish, bugs, etc.). Some animals are more tolerant of pollution than others.

- 3. Physical attributes**-The physical attributes of a watershed refer to the habitat around its waterways. Environmental scientists can tell a lot about a waterway's health by observing the plant and animal environment around a waterway.
- 4. Flow**-The flow refers to how water flows to and in a waterway. Environmental scientists can tell a lot about a watershed's health by observing the path water must follow to arrive at a waterway. For example, a scientist will observe if rainwater is traveling over natural terrain or a paved parking lot before arriving at a waterway. In addition, environmental scientists can tell a lot about the health of a watershed by observing the flow of water in a waterway. For example, a scientist will look to see if water is flowing rough and crashing against a bank or flowing gently.

Understanding the health of watersheds is vital for proper water protection and distribution. In this lesson, students will identify the health of a watershed and factors that influence the health of the watershed.

round head fastener or push pin per dial; best if printed on thick paper)

MATERIALS FOR TEACHER

- Handout: "Waterway Wellness Exam" teacher guide

MATERIALS FOR STUDENTS

- Handout: "Waterway Wellness Exam" student version
- Handout: "Waterway Wellness Scorecard"
- Handout: "Waterway Wellness Condition"

MATERIALS FOR STUDENT GROUP (3-4)

- 1 assembled Waterway Wellness Spin Dial (requires one

VOCABULARY

Watershed, ground water, surface water, elevation

AVAILABLE HANDOUTS

- What You Need to Know About Watersheds (teacher guide)
- What You Need to Know About Watersheds (student version)
- My Watershed

STUDENT/TEACHER ACTIONS

TEACHER ACTIVITY INTRODUCTION:

- Share with the students that today they are going to act like doctors. They are not going to act like medical doctors, rather they are going to act like environmental doctors.
- Tell the students that just like doctors examine patients, environmental scientists examine waterways. The examinations, like medical exams, involve observations and the collection of data. This helps environmental scientists assess a waterway's condition and determine its health.
- Tell the students that as environmental scientists they are going to examine four factors that contribute to a waterway's health: chemistry, biology, physical attributes and flow.
- Have students take out the "Waterway Wellness Exam" handout.
- Tell the students that before they can examine a waterway, they must first understand more about what they should be paying attention to. Review the handout to help the students understand the four waterway health indicators environmental scientists use to determine the health of a watershed.
- The handout will compare a waterway wellness exam to a patient's wellness exam. As the comparisons are made, have the students fill in the blanks on the handout.
- Optional watershed walk: After completing the waterway wellness exam handout, take students outside to walk the school's watershed. Have students look for the four factors that contribute to a waterway's health: chemistry, biology, physical attributes and flow. If you can observe an actual waterway, then you may easily be able to review all four factors. If you are not able to observe a waterway, you can likely observe physical attributes and flow. As the students observe the watershed, have them identify things in their surroundings that may impact the health of the local waterway. Ask students how different seasons, and the activities in those seasons, may also impact a waterway's wellness.

TEACHER ACTIVITY INSTRUCTION:

1. Distribute a copy of the "Waterway Wellness ScoreCard" handout to each student.
2. Distribute one "Waterway Wellness Spin Dial" to each group
3. Tell the students that doctors request patients to have an annual wellness exam so they can monitor a patient's health. If a patient is in poor health, then a doctor will request more frequent visits
4. Share that similarly, an environmental scientist monitors a waterway's health through regular exams. For this activity, share that the students are going to "visit" a waterway three times throughout the year. Each time, they will visit the waterway at the same location and monitor the same four health indicators: chemistry, biology, physical attributes and flow
5. Share with students that since they can't visit a real waterway to take samples of each health indicator, they are going to use a spin dial to get a score for each factor. The spin will represent an environmental scientist's sample results
6. Share with the students that each spin will give them a health score between 1 and 10. A score of 1 is very poor and a score of 10 is excellent.
7. Have the student groups complete Step 1 on the "Waterway Wellness ScoreCard" handout and log the results
8. After student groups complete step 1, share that medical doctors often compile and reflect on data from patient exams. Similarly, environmental scientists compile data from a waterway before drawing conclusions
9. Have the student groups complete Step 2 on the "Waterway Wellness ScoreCard" handout and log the results
10. After student groups complete step 2, share that doctors will interpret results from multiple exams to determine the health condition of a patient. Share that similarly, environmental scientists will interpret the data from their samples to identify the health condition of a waterway
11. Have students complete Step 3 on the "Waterway Wellness Scorecard" handout and log the results
12. After step 3, students should have identified the health condition of their waterway. Health will be one of five conditions, ranging from very poor to excellent
13. Share with the students that once a doctor determines the health of a patient, a doctor must research causes and cures. Similarly, an environmental scientist works to detect the reason for a waterway's health condition. In addition, a scientist must work to develop solutions to improve or maintain the health of a waterway.

14. Distribute the “Waterway Wellness Condition” handout to each student. Have student groups find a description about their waterway health condition on the handout
15. Have students read about their waterway’s symptoms. After reading about their group’s waterway condition, they may want to read the descriptions for other conditions. As they read descriptions for other conditions, student groups can note factors that contribute to the waterways with poor vs. excellent health.
16. Students should note that heavily populated areas contribute to poor waterway conditions. Students should also note that heavily forested areas contribute to excellent waterway conditions.
17. In addition to a watershed’s surface, human actions can influence the condition of a waterway
18. Have students brainstorm ways to cure, improve or maintain the condition of their waterway and note the ideas on the handout
19. Once students complete this handout, you can have student groups report out to the entire class their waterway’s health condition, the cause and the actions to improve or protect the health of the waterway.

TEACHER ACTIVITY INSTRUCTION:

- Remind students that watersheds, like the Potomac River, are a main source of drinking water for the Virginia community.
- Unhealthy watersheds make it challenging for organizations like Fairfax Water to treat drinking water, Virginia American Water to distribute water and AlexRenew to treat water after it has been used.
- Share that, collectively, everyone in the community can do their part to protect local waterways.
- Remind students of the actions they shared to protect or maintain their waterway’s health. If time allows, brainstorm any ideas that were not mentioned

ASSESSMENT

QUESTIONS

- What are the four health indicators that environmental scientists use to identify the condition of a waterway?
- What actions can be taken to protect a stream’s health?

JOURNAL/WRITING PROMPT

- If you conducted a waterway wellness exam in your neighborhood’s watershed, what do you think the health condition would be? Write about its condition and ways to improve or protect its health.

EXTENSIONS AND CONNECTIONS

- Conduct a lesson about macroinvertebrate and how the collected species help determine the health of a waterway.
- Identify the watersheds around the school. Research the condition of local waterways and discuss the factors that might be contributing to the condition.
- Reach out to AlexRenew or Virginia American Water to discuss how they work to protect local watersheds.

STRATEGIES FOR DIFFERENTIATION

- Instead of using a spin dial to gather scores for a waterway, visit and conduct real sampling at a local creek or stream.