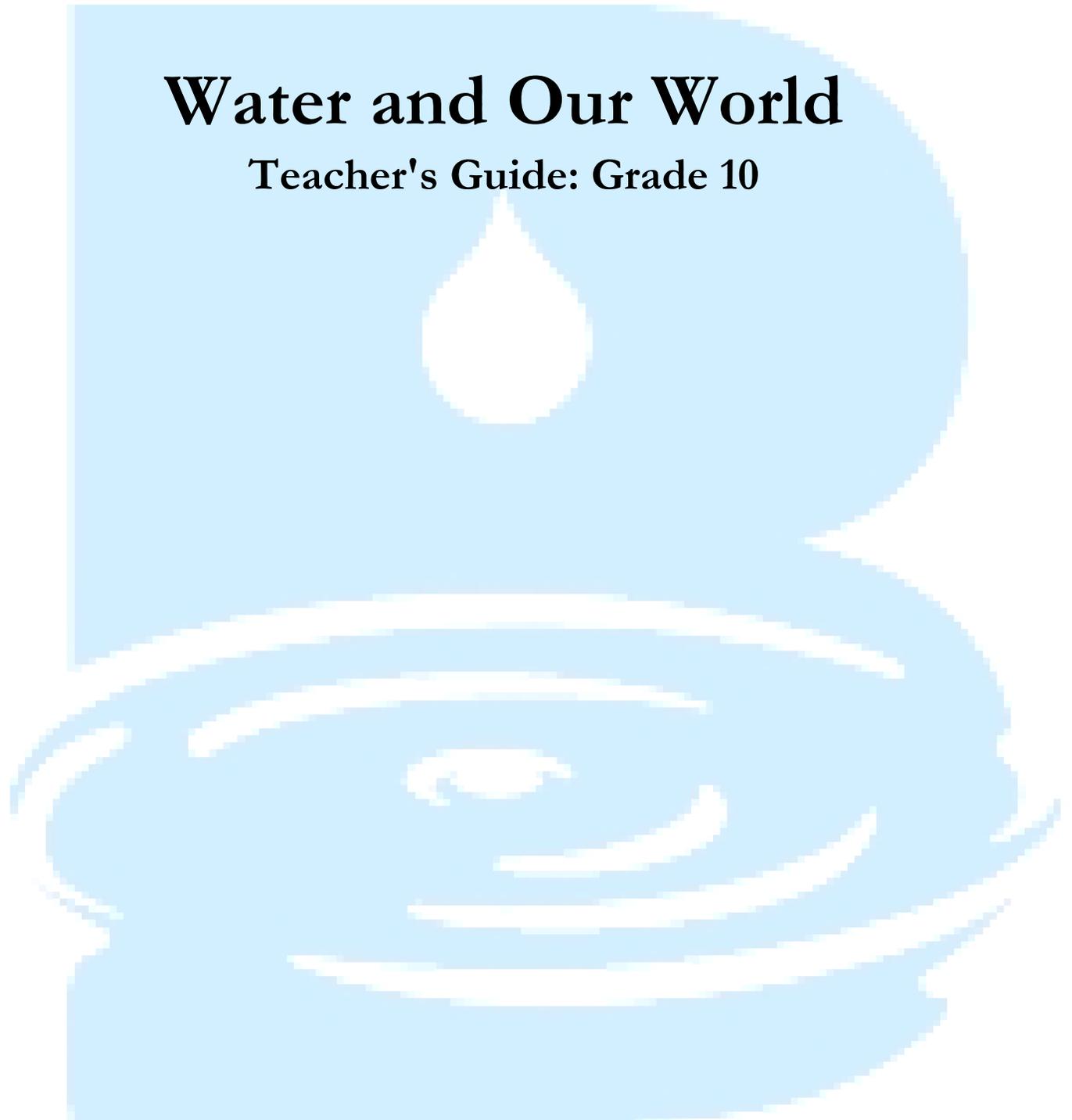


# Water and Our World

Teacher's Guide: Grade 10



Beaver **Water** District



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CHAPTER 1

# Lesson 1: Biological Testing of Water in a Stream...Bugs Don't Lie

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## Purpose

This lesson involves the investigation of water quality in a local creek. The students will perform biological tests to determine types and distribution of macroinvertebrates in a stream. This will also help determine a stream's pollution level. This information will be used to determine possible sources of pollution upstream and possible solutions.

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## Objective

- Students will learn about the types of organisms and their diversity in a stream and relate the invertebrate community to overall water quality.
- Students will be able to enter a stream and identify benthic organisms and determine if a stream's pollution levels are high or low.

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## Arkansas Framework Correlation

### Science

#### 10<sup>th</sup> Grade

2.1, 2.3, 2.7, 2.9, 2.10, 3.2, 3.3, 3.5, 3.7 - Surface water, groundwater, aquifers, solutions to water shortages, freshwater pollution, labs

2.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.10, 3.1, 3.2, 3.3, 3.5, 3.6, 3.7 - Chemical/biological water testing methods, streams, macroinvertebrates, watersheds, local concerns, global concerns, many labs, point/nonpoint pollution, solutions)

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## Problem Question

What is the role of macroinvertebrates and how does their presence help determine the quality of water?

## BACKGROUND INFORMATION

**Teacher:** Review the Arkansas Game and Fish Commission's Stream Team manual ([www.agfc.com](http://www.agfc.com)). Many water quality lesson materials and instruction are available. Also review the EPA's Protocol for Monitoring Aquatic Invertebrates at Ozark National Scenic Riverways, Missouri, and Buffalo National River, Arkansas ([www.epa.gov](http://www.epa.gov)). These sources will be helpful in learning procedures and tolerant/intolerant species of macroinvertebrates.

There are several good sources for this topic:

[www.bwdh2o.org](http://www.bwdh2o.org)

[www.epa.gov](http://www.epa.gov)

[www.agfc.com](http://www.agfc.com)

<http://www.k12science.org/curriculum/waterproj/index.shtml>

**Student:** In Northwest Arkansas, there is an abundance of material related to this topic in the newspaper. The students will need some background on stream pollution and the consequences of pollution. The students will also need instruction on stream anatomy and pollution-sensitive invertebrates. Sampling methods and pollution sources will also need to be learned.

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## Keywords

- Macroinvertebrates: small organisms found under rocks and leaf packs that indicate water quality
- Intolerant species: macroinvertebrates that cannot survive (tolerate) in higher levels of pollution
- Tolerant species: macroinvertebrates that can survive (tolerate) higher levels of pollution
- Point pollution: pollution coming from a specific source that can be identified clearly. (Ex. Pipe discharging directly into a stream)
- Nonpoint pollution: pollution from an unknown source that is washed into surface water by rainfall (Ex. Runoff from a cow pasture or parking lot)

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## Timeline

- **Day 1:** Give students background in class about local water quality issues, terms, and procedures.
- **Day 2:** Have students investigate a ditch, creek, stream, or any surface water to find macroinvertebrates. The students can just turn over rocks or collect with kicknets and seines.
- **Day 3:** Accumulate data from stream findings and make determination of stream health.

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## Materials

- Macroinvertebrate flash cards
- Kick or D nets
- Seines (500  $\mu$ m), panty hose tied between sticks have been used

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## Teacher Preparation

Find a local water source to conduct testing. Prepare material and space according to the 7 E's instructions (page 9). Detailed background information and worksheets on this subject can be found at [http://www.bgsd.k12.wa.us/hml/jr\\_cam/macros/resources.html](http://www.bgsd.k12.wa.us/hml/jr_cam/macros/resources.html).

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## Additional Resources

Resources for materials not included:

**UA Center for Math & Science Education**

<http://www.uark.edu/~k12info/>

479.575.3875

**Northwest Arkansas Education Co-Op**

<http://starfish.k12.ar.us/web/>

479.267.7450

**Beaver Water District**

[www.bwdh2o.org](http://www.bwdh2o.org)

479.717.3807

Know of other resources? Please let us know!

[education@bwdh2o.org](mailto:education@bwdh2o.org) or 479.756.3651

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# 7E's Biological Testing of Water in a Stream...Bugs Don't Lie

## Elicit

Read news articles about water quality in your area. Have students brainstorm possibilities that may be causing these problems. The students will also have to brainstorm within their group to determine all possible sources of pollution upstream.

1. Read an article (<http://www.epa.gov/>) to the class about pollution levels in a body of water downstream from your location. Discuss the article and the impacts of humans on water quality.
2. Discuss where your drinking water comes from and who impacts the land around your water source. Explain "Everyone lives downstream."

## Engage

Have students look at macroinvertebrate identification sheets or flashcards and determine pollution tolerant and intolerant species.

3. Hand out a macroinvertebrate information sheet available from:
  - a. [www.learnnc.org/media/lessons/.../Macrokey.ppt](http://www.learnnc.org/media/lessons/.../Macrokey.ppt)
  - b. <http://www.iwla.org/>
  - c. <http://people.virginia.edu/~sos-iwla/Stream-Study/StreamStudyHomePage/SOS.HTML>
  - d. [http://www.bgsd.k12.wa.us/hml/jr\\_cam/macros/resources.html](http://www.bgsd.k12.wa.us/hml/jr_cam/macros/resources.html)
4. Explain the pollution tolerant and pollution intolerant sections of a macroinvertebrate sheet.
5. For a truly inquiry based lesson, allow students to first go out and collect whatever macroinvertebrates they can find and have them identify and sort as pollution tolerant or intolerant. Have students present their determination of stream health based on their findings. Then proceed with following steps. After the second round of sampling, have the students compare their results to their initial findings.
6. Show invertebrate flashcards ([www.flinnscientific.com](http://www.flinnscientific.com)) or online pictures (previous websites mentioned) of actual organisms.
7. Explain possible sources of pollution upstream (point/nonpoint/urban/agricultural)
8. Describe stream anatomy (riffles, runs, pools).
9. Describe where to find the macroinvertebrates.

## Explore

Take students to a local water source and:

10. Assign small groups and their sampling materials and move the class to the stream.
11. Have students collect organisms from the streambed in the riffles.
12. Return to the classroom and have groups count and identify their collection.

## Explain

Have students determine the outcome of their discovery.

13. Based on their knowledge of tolerant and intolerant species, have the groups present their findings with a graph of tolerant/intolerant species per each testing site and make a determination of stream quality. Have students brainstorm possible sources of pollution upstream from your testing location and determine a hypothesis.

## Elaborate

Review the EPA protocol for biological testing. There is much more detail involved in this type of monitoring. This lesson is a very basic way to introduce biological testing to students. This lesson is designed to spark their interest. True biological testing is much more involved.

## Evaluate

- Students will be evaluated in the field by their collection techniques and participation with their group.
- Students will be evaluated in the class by their presentation and unit test.

## Extensions

This is a small lesson that will mean more to students once chemical testing is introduced. This information leads to a study of watersheds and possibly Karst Topography. Riparian zone and its function are also connected to this activity.