Shared Waters: Making a positive impact on our local watershed

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Preferred Citation:
Shared Waters. (2023). Shared Waters: Making a Positive Impact on Our Local Watershed. Millersville, PA: Marcum-Dietrich, N., McConnell, W., Ibrahim, A., Showalter, B., Fulton, E., & Harnish, K.

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This work was funded by the National Oceanic and Atmospheric Administration B-WET Grant NA21NMF4570498. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration.

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Lesson 9: Culminating Activity, Synthesis of Data
(1-2 days)

Overview:

This is the lesson where the rubber meets the road -Mr. Showalter 4th grade teacher.

In this lesson, students will use the knowledge and scientific data collected during the unit to spot patterns and connections. Then, they'll use their data synthesis to identify an environmental problem in their local watershed and determine what might be causing it.

Let's summarize the key points from the previous lessons:

Lessons 1-2 expanded students' understanding of the water cycle and linked it to the concept of a watershed. They identified their own watershed, gained foundational knowledge about watersheds, and located their watershed on a map. These lessons aim to activate prior knowledge, give students a meaningful reason to learn about their environment, and establish the basics for further exploration.

Lessons 3-6: From mapping pervious and impervious surfaces to modeling runoff with computer simulations to engineering an Earth filter, lessons 3-6 provided students with a clear understanding of how water and pollutants move through the watershed. To reinforce this knowledge, we'll revisit the map they created in lesson 3, which shows pervious and impervious surfaces in their local environment. (It's crucial to connect the movement of water and pollutants in their local watershed to the data they collected in lessons 7 and 8).

Lessons 7-8: Building on their understanding of water and how pollutants flow in the watershed, students conducted chemical and biological analyses of a nearby waterbody, generating real data they could analyze to draw conclusions about environmental health.

Materials:

Materials provided in the lesson 9 kit:

- **Activity 1:** n/a
- **Activity 2:** n/a

Materials you will need to gather:

- Lesson 9 slide show
- **Activity 1:** Students' science notebooks.

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- **Activity 2:** Students' data from lessons 1, 3, 5, 7, and 8; Several sheets of chart paper; Lesson 9 Anchor Chart

Learning Objectives:

At the completion of the lesson, students will be able to:

- Combine information from various investigations to draw conclusions.
- Formulate a claim supported by evidence.
- Describe the importance of skepticism in scientific inquiry (Nature of Science).
- Engage in the collaborative scientific work (Nature of Science).

Activity 1 (15 min): The Importance of Data and Multiple Perspectives

Begin this activity with the PowerPoint presentation for Lesson 9.

Ask students to write a caption for the picture or make it into a meme they will share with the class. Explain that while this is a funny picture, it relates to our watershed unit because it shows two people viewing the same data and coming up with two different interpretations. Possible questions: Do you remember this happening when we looked at data throughout the unit? Did you identify a macroinvertebrate that your classmate thought was something else?

Highlight that scientists are skeptical of both their own and others' findings. Science is a community where scientists collaborate, sharing multiple perspectives on data so that the results are as reliable as possible. What should two scientists do if they disagree on their data? Maybe repeat the study or involve more people. Sometimes, one data set isn't enough for agreement, prompting different approaches or repeating the investigation.

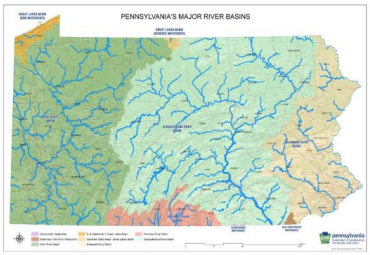
Activity 2 (45 min): Synthesis of Data

The goal of this activity is to identify an environmental issue that your students can focus on for their action plan. After this activity, your students may decide:

1. **The local watershed is HEALTHY**- Patterns and/or connections in data suggest that the watershed is healthy.
2. **A PROBLEM exists in the watershed**- Patterns and/or connections in data suggest a detectable environmental issue in your local watershed.
3. **Our findings are INCONCLUSIVE**- Patterns and/or connections in data are conflicting across data sources.

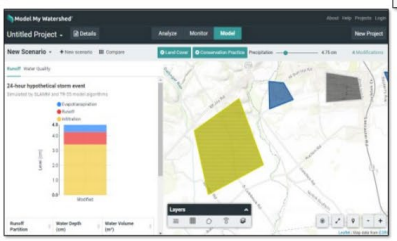
To prepare for this lesson, you must do some data synthesis on your own before leading students through it. Review the data from lessons 1, 3, 5, 7, and 8 to find any connections or patterns.

Lesson 1
Watershed Map

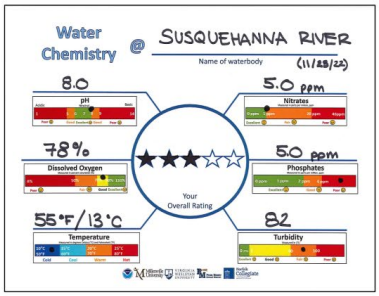


Lesson 3
School Yard Map

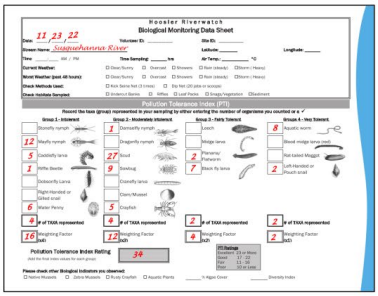
Lesson 5
Model My Watershed



Lesson 7
Water Chemistry



Lesson 8
Macroinvertebrates



Put students in small groups and give each group data from Lessons 1, 3, 5, 7, and 8. Explain to the students that today, we're going to be scientists using our data to make decisions about our environment's health. For this activity, it is important to model a possible thinking process behind finding connections and/or patterns in data.

Sample Finding: Your students identified large areas on your school map from lesson 3 as impervious. They also observed areas of soil erosion during the walkabout and high turbidity levels in data from lesson 7. Students may find a *connection* between impervious surfaces, observations of sediment erosion, and high turbidity data. (A Detectable Problem Exists)
Sample Finding: All chemical water quality parameters register in a healthy range, but no species of macro-invertebrates that are known to be highly sensitive to DO levels were found. (Findings are Inconclusive)

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Data Synthesis Process:

Step 1. Gather Your Data: First, get in small groups. Each group will get a special packet with all of your data from Lessons 1, 3, 5, 7, and 8. Lay them out on your desk so everyone can see them.

Step 2. The Big Picture: Remember our anchor charts from those lessons? Make sure they're in a spot where you can all see them. They're like our treasure maps of data!

Step 3. Focus on the Mission: Today's mission is about connecting the dots. We're going to look closely at all of our data and try to make decisions about the health of our watershed.

Step 4. Think Like a Scientist: Pick one thing in your environment to focus on. It could be something like the grass in the soccer field, the playground, or even the water in the local stream. Now, with your team, use your data to talk about what you noticed in Lesson 1 (Who are our upstream and downstream neighbors?), Lesson 3 (Where are the impervious places in our schoolyard?), Lesson 5 (What improvements can we make to our school yard?), Lesson 7 (What does the chemistry of our local water tell us about the health of our watershed?), Lesson 8 (What lives in our local waters, and what does that tell us about the health of our watershed?)

Step 5. Share Your Scientific Thinking: As you're talking, make sure to explain your thoughts out loud, like, "I think the pond water was different because it's near the playground, and maybe stuff from there gets into the water." This way, we all get to hear how you're connecting the clues. Remind students that there's no right or wrong here. We're all just exploring and using data to see what interesting stories we can uncover about our schoolyard and the health of our watershed.

Sample Discussion - "Our group noticed this (pointing to map) a large area of impervious surface right next to the area where we observed some erosion in our schoolyard map. Do you remember this? That dirt, or sediment, would likely go right into the sewer that leads to (Stream A). I started thinking: did we notice an issue with that in the chemical water quality analysis? So, I went to our chemistry data... what data do you think I looked at that might connect with dirt entering the stream? That's right, turbidity!! And guess what? High turbidity levels were measured in our stream, making an interesting connection between data sources. Could this erosion be washing into the stream and harming our watershed health?
I wrote in my science notebook: Conclusion: Because there were impervious surfaces next to an area of erosion, I think dirt from our schoolyard is entering the stream through the sewer. Also, our stream's turbidity levels were higher than normal. This suggests runoff from our schoolyard may be negatively impacting the stream."

Step 6. Discuss as a Class: After looking at all our data, does it show an environmental problem? Or does everything seem okay? Sometimes, the information might not match up. If so, what additional information do we need?

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Step 7. Make a Claim: Together, we'll decide on a statement that summarizes our findings. This statement is called a "claim." It's like saying, "Here's what we think is happening based on our evidence."

Since __(write one finding)__, **Also,** __(write another supporting finding)__. **we think** __(write your conclusions)__.

Ex. **Since** we found evidence of erosion on campus and **also**, high turbidity levels in our stream, **we think** that erosion from our campus is negatively impacting the stream's turbidity levels.

Step 8. Prepare for Action: This claim will help us get ready for Lesson 10, where we'll create a plan to help or learn more based on what we've found.

Possible Extension:

Having students independently review the data before breaking into small groups may be meaningful.

Possible Differentiation Adaptations:

Some small groups may need assistance finding patterns in data. While circulating the room, you can narrow the data students must use. For example, if you know, there are patterns to be found in pH and impervious surfaces—due to pine trees around the schoolyard - then you can have certain tables narrow their focus to the types of trees they saw in the walk around the schoolyard activity and the pH data.

Assessment:

1. Why is it important for scientists to work with other scientists?
2. What patterns did you see in the data?