

BACK TO THE BIG QUESTION/CHALLENGE INTRODUCTION

Learning Set 1

1 class period* ►

Back to the Big Question and the Challenge

Overview

Using information and evidence from their investigations on how water flows through a watershed and how specific types of land use can affect water resources, students meet to begin to discuss and agree on preliminary recommendations for the town council of Wamego. Students update their *Project Board* with their recommendations.

Targeted Concepts, Skills, and Nature of Science	Performance Expectations
Explanations are claims supported by evidence, accepted ideas, and facts.	Students should be able to begin to draft a recommendation based on their explanations containing claims and evidence from their investigations and science knowledge.
Scientists make claims (conclusions) based on evidence obtained (trends in data) from reliable investigations.	Students should have a clear understanding of the definitions of and relationship between <i>evidence</i> and <i>claims</i> .
Water flows from higher to lower elevations in watersheds.	Water flows from higher to lower elevations in watersheds.
Flowing water transports materials.	Students should understand that the water flowing from watersheds into a river or stream, carry materials from the ground.

Materials

1 per class class *Project Board*

*A class period is considered to be one 40 to 50 minute class.

Homework Options

Reflection

- **Science Content and Process:** Write a rough draft to the Wamego Town Council explaining how one type of land use currently affects the Crystal River. *(Answers will vary but should reflect the characteristics of residential, commercial, industrial, or agricultural land use. Answers should include descriptions of amount of runoff or possible pollutants that might be produced as a result of that land use.)*
- **Nature of Science and Science Process:** Write a rough draft of a recommendation about where the town might place a new factory without harming the water used by the residents of Wamego. What might be some implications to other towns? *(Answers will vary but students should consult the map of the town on page LT 11 in preparing their draft.)*

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1 class periods* ►

Learning Set 1

Back to the Big Question and the Challenge

10 min.

Students begin to tie together what they have investigated about land use and water quality and find that the two influence each other.

*A class period is considered to be one 40 to 50 minute class.

BACK TO THE BIG QUESTION/CHALLENGE IMPLEMENTATION



Learning Set 1

Back to the Big Question and the Challenge

How Does Water Quality Affect the Ecology of a Community?

The questions you were investigating in this *Learning Set* were *How does water affect the land as it moves through the community?* and *How does land use affect water as it moves through a community?* The answers to these questions might have seemed obvious at first. Now, though, you see how complicated the system of watersheds can be. You have seen how the quality of water depends on many factors. You have seen how watersheds are linked to each other.

Watersheds are an important part of understanding how water flows. Soil and chemicals might get into the runoff and be carried to the river. You have investigated how watersheds work. You also saw how runoff moves in a watershed. You noticed that runoff always moves from higher to lower elevation. Sometimes the water pools in low areas. Other times the water continues to move through the watershed to the river.

You investigated several different types of land use. You used a stream-table model to model the land cover that could be found with each land use. The stream tables helped you see erosion, deposition, and runoff for each land cover. You noticed that the water picked up some soil and carried it to the river.

In the final section, you learned some new words to describe what you saw in your model. Your models provided the beginning of your understanding. Then you read about the different land uses. Some of the issues in the land uses were similar to each other. Other issues, like those in the industrial and the agricultural uses, were very different. In all the different land uses, runoff and erosion were very important processes. Also, each land use can introduce point-source and non-point-source pollution. You identified pollution sources for each land use. You are beginning to see the connection between land use

LT 51

LIVING TOGETHER

○ Engage

First review what students have accomplished in this *Learning Set*. They have learned what a watershed is and have investigated how the use of land affects the quality of water moving through the watershed.

△ Guide and Assess

On the board, list the terms runoff, groundwater, erosion, deposition, point-source, and non-point source pollution. Ask students to apply their knowledge of how watersheds can change. Don't discourage the use of these listed terms, but listen for students to describe concepts and not merely give definitions.



and water quality. This connection will be very important as you consider what effect the changes in Wamego might have on Crystal River.

Explain and Recommend

The *Big Question* for this Unit is *How does water quality affect the ecology of a community?* Recall that you will be answering smaller questions as you move through this Unit. Doing this will help you eventually answer the big question and address the challenge. At this point, you are not ready to answer the big question completely and thoroughly and address the challenge. But you probably have some ideas of how watershed structure, erosion and runoff, land use, and pollution sources are a part of a good answer to the big question and the challenge.

Discuss with your group what you learned and recorded on the *Project Board* that can help you answer the *Big Question* and address the *Big Challenge*. Identify answers to the *Big Question* and recommendations you might make to Wamego town council. Using a *Create Your Explanation* page, state each of your answers and recommendations as a claim. For each claim, record the evidence you have and the science knowledge you have learned. Then write an explanation that connects the evidence and your science knowledge to your claim.



Communicate

Share Your Explanations and Recommendations

Share your claims, recommendations, and explanations with the class. If your classmates disagree with any of your claims or recommendations, discuss the evidence you have and the science knowledge that support them. Try to come to agreement. You can help one another revise your claims or recommendations to better match your evidence and science knowledge.

Update the Project Board

Add new claims and the evidence that goes with them to the *What are we learning?* and *What is our evidence?* columns. Add recommendations the class agrees on and the evidence that supports them to the *What does it mean for the challenge or question?* and the *What is our evidence?* columns.

LT 52

Project-Based Inquiry Science

Explain and Recommend

10 min.

A recommendation is a claim in which a suggestion is made based on evidence and science knowledge.

○ Engage

Tell students that they are going to meet in their groups for 10 minutes to utilize the evidence they have from *Learning Set 1* investigations and science knowledge. In their groups, they will begin forming an explanation that will be the basis of recommendations to the Wamego town council at the end of the Unit. Because they have just completed first Learning Set, they do not have a complete picture on which to base recommendations, but this will be a start.

△ Guide

Remind students that a recommendation is a kind of claim that suggests what to do when a certain situation occurs. Record this general formula for students to refer to as they begin to plan their recommendations to the town of Wamego. Review each example so that students understand how to use the formula.

When a particular situation occurs, *do* or *try* the following or *expect* to see the following take place. For instance:

- When you are crossing the street, [*do*] look both ways to make sure the traffic has stopped.
- When the temperature is very warm and the dog is panting hard, *try* to remember to keep his water dish filled with cool water.
- When you see lightning in a summer sky, *expect* to see rain and hear thunder.

Students should also make use of a *Create Your Explanation* page to organize their thoughts. Because there are many things for students to coordinate as they begin pulling concepts together, assist by tying together what they need to do.

TEACHER TALK

“Your group investigated how water and specific land uses affect each other. The results of your investigation has given you evidence on which you can base a claim, such as, As water rushed over bare agricultural land, the runoff eroded loose soil. Use a Create Your Explanation page to construct an explanation. Your explanations should contain science knowledge.

Remember that your explanation needs to contain a claim supported by evidence and science knowledge in a logical way. Watch to make sure that there are no opinions in your explanation or claim.”

◇ Get Going

Tell students that they have 10 minutes to construct their explanations in their groups and then each group will present their explanations and recommendations to the class.

Communicate

20 min.

Share Your Explanations and Recommendations

META NOTES

It might be easier for students to keep track of claims, evidence, explanations, and recommendations if they have a separate *Create Your Explanation* page for each investigation.



Communicate

Share Your Explanations and Recommendations

Share your claims, recommendations, and explanations with the class. If your classmates disagree with any of your claims or recommendations, discuss the evidence you have and the science knowledge that support them. Try to come to agreement. You can help one another revise your claims or recommendations to better match your evidence and science knowledge.

△ Guide

Encourage students to ask questions of the group presenting their explanations. Model the kinds of questions students might ask. This will help the presenters talk in terms of claims based on evidence and help listeners recognize how to use evidence and science knowledge effectively to come up with conclusions that the class can agree upon.

◆ Evaluate

Listen to verify that students present claims that are based on evidence and science knowledge and not on opinions. Listen for clearly stated recommendations that relate the evidence students present to the *Big Question* for the Unit, *How does water quality affect the ecology of a community?*

META NOTES

As students proceed through *Learning Sets* 2 and 3, they will have opportunities to revise their explanations and recommendations.

Update the Project Board

Add new claims and the evidence that goes with them to the *What are we learning?* and *What is our evidence?* columns. Add recommendations the class agrees on and the evidence that supports them to the *What does it mean for the challenge or question?* and the *What is our evidence?* columns.

LT 52

Project-Based Inquiry Science

Update the Project Board
5 min.

After the class has agreed on claims and recommendations that they can make at this point in the Unit, draw their attention to updating the *Project Board*. Ask students what claims they can add to the *What are we learning?* and *What is our evidence?* columns. Have them add evidence to the *What does this mean for the challenge?* column.

Teacher Reflection Questions

- During this implementation, students were asked to agree on recommendations based on evidence from the investigations completed during this learning set. How difficult was it for students to agree as a class on these recommendations or did they agree too easily?
- Were students motivated by the investigations in this learning set? What can you do to increase this motivation the next time you teach this learning set?
- How can you increase student participation in discussions? What are you doing to keep the same students from being the only ones who respond in a discussion?

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