

Reading Rivers Over Time

Geology Grade Levels 3-6

Objectives: In order to understand the essential question of “How does the earth’s surface change over time?” students will explore images of rivers over time, observe changes in the rivers, and generate a list of questions about how rivers change. Teams of students will then select an “investigable” question and design an investigation to address the question using classroom river models. Finally, students will return to the images of rivers in order to explain them using their new-found knowledge. *Time Needed: 8 hours*

Vermont’s Framework of Standards and Learning Opportunities:

7.15 The Universe, Earth and the Environment

7.1 Scientific Method, 7.2 Investigation, 7.3 Theory

2.1, 2.10, 2.12 Reasoning and Problem Solving

Grade Level Expectations:

Science 5-6:47 Processes/Change over Time within Earth Systems (slow and fast geologic changes)

Science 3-4:47 Processes/Change over Time within Earth Systems (landforms and water)
Comparing local landforms with models created in the classroom.

Materials & Resources:

Landscape Change Program Archive, www.uvm.edu/landscape Images: For example, LS01442_000 and 001; LS01464_000 and _001; LS01459_000 and _001.

River Cutters, Great Explorations in Math & Science, Lawrence Hall of Science: Berkeley.

Investigation Report Template (below)

Presentation Planning Template (below)

Activities:

<p>1. Hook Your Students</p> <p>Students view sets of <i>Landscape Change Program</i> images depicting rivers over time and describe their observations. Students then generate a list of questions prompted by the images.</p>	<p>4. Culminating Activity</p> <p>Student teams jigsaw and return to a set of <i>Landscape Change Program</i> images. Using new knowledge, each team presents to the class their explanation of how and why the rivers in their images are changing over time.</p>
<p>2. Introduce Concepts</p> <p>Teams of students pick an “investigable” question and design an investigation to address the question.</p>	<p>5. Assessment</p> <p><i>Formative:</i> Student observations and questions; team investigation designs. <i>Summative:</i> Student reports, final presentation.</p>
<p>3. Apply Skills</p> <p>Teams of students use river models made from diatomaceous earth to carry out their investigation. Students document process and findings in a report.</p>	<p>6. Extensions</p> <p>Students make a series of field visits to a local stream or river. Students submit photographs to LCP, along with written descriptions that summarize the landscape changes observed.</p>

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Lesson Plan Details

A note on adapting this unit for different grade levels: Depending on students' prior experience with science inquiry, 3rd and 4th grade teachers may wish to adapt this unit. Rather than having teams of students developing their own river model investigations, you might carry out one investigation with the entire class as a participatory demonstration. Each student can still record each step of the process and complete the *Investigation Report Template*. As the culminating activity, rather than having students create team presentations, you might have students brainstorm in teams, then complete the *Presentation Planning Template* as a final assessment.

Lesson One

Materials: Sets of LCP images, LCD projector

1. Display an LCP image of a river for all students to see (e.g. LS01442_000). Have students take turns describing all of the observations they can make about the image. You may wish to record these observations. Tell students when the photograph was taken and ask them to imagine what the river might look like if someone went back to the same spot to take a photo today. Would it look the same? Would it have changed? You might take some predictions.
2. Display an accompanying LCP image taken at the same spot later in time (e.g. LS01442_001). Tell students that this photograph was taken in the same spot and what year it was taken. Again, ask them to take turns describing all of the observations they can make about the image. If students start to venture explanations, you might remind (or introduce, as the case may be) students about the difference between observations and inferences, and ask the students to save any potential explanations until all observations have been made. Once students have exhausted the possible observations, ask students if they can summarize how they think the river changed from the first photo to the second.
3. Do the same thing with the remaining sets of images. (Three or four sets is probably ideal; you'll want to include at least one set that demonstrates erosion and one that demonstrates deposition.)
4. As questions emerge throughout this lesson, record them. These questions will form the basis for the next lesson. Tell students that they will be creating models of rivers to try to answer their questions.

Lesson Two

Materials: List of student questions, sample river model (basin, diatomaceous earth, watering can)

1. Remind students of the list of questions they generated. Tell them that they'll be creating models of rivers to try to answer their questions.
2. Tell students that scientists often generate lots of questions, then sort through them to identify which questions they can investigate ("investigable" questions). Often this involves turning a "why" question into a "what" question. Show the students the sample river model and tell them that scientists often use models to help them understand something. We'll be using the river model to help us understand rivers better. Demonstrate how water can be fed into the river bed to simulate a river. Ask which questions on the list we might be able to explore using the river model. Make a

list of these investigable questions. If students get stuck, refer them back to the model by asking how we could use the model to figure out the answer to that question. (Note: Depending on the class, you may wish to select the investigable questions yourself from the student list and present them to the students. Selecting investigable questions is a worthy, but often demanding, process.)

3. Once the list of questions has been narrowed to the investigable ones, students can then be placed in research teams. Each research team will have a different question to focus on. (Again, depending on the class you may wish to create the groups or you may feel comfortable giving students some choice. One method for choice is to draw student names out of an envelope and allow them to choose which question they'd like to work on. Once a question has four students working on it, that group can be considered full.)

Lesson Three

Materials: *Investigation Report Templates*

1. Student teams design investigations to address their investigable question. Each student should complete the Question, Hypothesis, and Procedure section of the *Investigation Report Template*. (Note: If this is students first experience with designing investigations, you may wish to design one investigation as a class to carry out as a participatory demonstration.)

Lesson Four

Materials: *Investigation Report Templates*, river models (basins, diatomaceous earth, watering cans)

1. Student teams conduct investigations using river models made of diatomaceous earth. Each group should have a work space, a good size basin in which to build a river bed, diatomaceous earth to construct the river bed, and watering cans or other means of feeding water into the river bed.
2. Each student should complete the Results section of the *Investigation Report Template*.

Lesson Five

Materials: *Investigation Report Templates*

1. Student teams should discuss what conclusions they can draw from their investigation. Each student should complete the Conclusion section of the *Investigation Report Template*.
2. Give teams a chance to share their investigation with the rest of the class. Ideally, teams should show each other their models and how they manipulated them. If you have time, allow students to ask questions of each other. (Note: The two fundamental processes at work with these models, and with rivers, are erosion and deposition. As you see students describing these phenomena in their models, you might wish to attach these terms to the phenomena. If students haven't identified these phenomena, this would be an appropriate time to use an activity to teach these concepts explicitly.)

Lesson Six

Materials: Sets of LCP images, *Presentation Planning Templates*

1. Jigsaw student research teams to form new teams that have representatives from different research teams. (Ideally the new teams would have a representative from each research team, but this may not be possible, depending on the size of class. Three to four students is an ideal team size.)

2. Present each group with one of the sets of LCP slides that students viewed at the beginning of the unit (students may view these on computers or on high quality hard copies).
3. Tell them that their task is to look at the images once again and to use the knowledge that they gained from their investigations to try to explain what happened, how the river changed over time. They'll present their explanation to their classmates in a Geology Symposium. Present and post the criteria for the presentation.

Criteria:

- Each team member must have a role in the presentation.
 - The presentation must show audience the images and specify what changes took place in the river over time.
 - The presentation must suggest an explanation for how these changes took place.
 - The presentation must provide evidence from student investigations to support explanation.
4. Have students begin by choosing the special role they'll play on the team. Each person must have a role.

Roles:

- Timekeeper
 - Recorder
 - Focus-keeper (reminds the group if they wander off-task)
 - Materials manager (keeps track of everything the group needs)
5. Once students have roles, give them the *Presentation Planning Template*. Give students the remainder of the session to finish the template. Each student should complete and hand in their copy of the plan. Circulate to coach the teams.
 6. Once you sign off on the team's plan, they can start to develop any materials they need for the presentation and practice delivering the presentation.

Lesson Seven

1. Student teams develop any materials they need for the presentation and practice delivering the presentation.

Lesson Eight

Materials: Student self-evaluations.

1. Student teams present. Begin by asking students to remind each other what a respectful audience looks like and sounds like. Post the list they generate. If you have time, allow students to pose questions to each other following each presentation.
2. Take a moment to celebrate the students' work!

Investigation Report Template

Question (what you want to know):

Hypothesis (what you think the answer to the question might be):

Procedure (what you do to test your hypothesis):

1.

2.

3.

-
-
-

Results (what happens when you carry out your procedure):

Conclusions (what you've learned about your question):

Presentation Planning Template

Name: _____

Look at your images. Find which one is older and which is newer. Compare them.

Fill out the following chart. You must list at least two changes. You can do more if you wish.

Be specific!

DESCRIBE Describe changes that took place in the river between the first and second photo.	EXPLAIN What do you think happened to cause this change?	EVIDENCE What evidence do you have to support this explanation? (Hint: Think back to your river model investigation.)