Classroom Embedded Assessment [CEA] Title: Riverbank Changes

a. Targeted Performance Expectation(s)

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. [*Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion*.]

b. Learning Goal(s)

1. Gather specific evidence from observation (photos). [*Science & Engineering Practice*]
2. Connect cause and effect to the changes in the situation. [*Crosscutting Concept*]
3. Create an explanation summarizing a mechanism affecting the land, including use of evidence collected during class activities. [*Science & Engineering Practice*]
4. Correctly use the concepts and terms "weathering" and "erosion". [*Disciplinary Core Idea*]

c. Instructional Context

This CEA will take place in the middle of a unit on weathering, erosion, and deposition.

B. The main instructional experiences to date are as follows:

* Introduction to weathering, erosion, and deposition using investigation stations for water, wind and ice weathering/erosion.

* Discussion of students' observations in order to clarify concepts of weathering, erosion, deposition.

* Discussion/ investigation of changes observed to connect cause and effect relationships to student observations.

* Journal entry recording; student-made teacher-approved descriptions of weathering, erosion, deposition.

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d. Student Task/Prompt – ***see end of document for exact copy of handouts distributed to students***

See end of document

e. Success Criteria

Exemplary student response:

1. Evidence: the distance between the pole and the edge of the riverbank is smaller in photo 2 compared to photo 1, and by photo 3 the pole seems to have disappeared altogether (probably fell into the river).
   Change: The amount of land on the right of the photo has shrunk a lot, probably falling into the river and being carried away. The river is either getting wider here, or maybe it is curving more to the right and wearing away that side of the riverbank.

2. Cause: The cause of this change is the river.

3. The water probably got very fast, which means it would weather (wear away) the riverbank faster. My evidence for this from the class investigations is that when we had fast-running water in the model with soil, it pushed the soil away faster than slow-running water, and faster than wind from the fan too. Once the riverbank soil was worn away, the fast-flowing water would cause erosion by carrying that soil downstream. The probably happened more between Feb. 2018 and April 2018 since that is only 2 months between those pictures, and it looks like the riverbank has worn away a lot. The other possibility, if the water wasn't particularly faster, is that there could have been lots more of it, like in a flood. In our investigations, we saw that when there was more water compared to just a little bit, even if both were moving at the same speed, more water wore away the soil (weathering) and also carried away (eroded) more soil too.

NOTE: Students might also note the steepness of the banks in photo 3 compared to photo 2 as evidence of weathering. Plus they might include gravity in the explanation as a causative agent, causing the weathered soil to fall downward and into the river, which then eroded (carried away) the soil.

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f. Next Instructional Steps

For students who had **difficulty using evidence** from the photograph: small groups, teacher-led; use I^2 data analysis strategy on photographs. Have students identify 3 things they see that they think might be related to erosion or weathering from the pictures – citing specific evidence (*sometimes they have a hard time being explicit – they notice things, but when asked what they notice will say something vague like, "I don't know. It just looks different."*). Then, have students suggest what each of the things identified mean with respect to erosion or weathering (*check that they are correctly using these concepts*). Another approach would be to review the data collected from the stations and use those station results to be clear about concepts of *evidence, cause, weathering, erosion.*

For students who had **difficulty distinguishing between weathering and erosion**: small groups, teacher-led; have students do a card sort with different images of weathering and erosion (and combinations of both – some pictures have the material still in it, such as a landslide with the rocks & soil still at the bottom, and others have that material 'missing' such as a retreated riverbank but there is no extra soil/rocks at the bottom since they were carried away). After processing several cards and discussion, have students individually create a "rule" for deciding which image depicted weathering and which erosion, and which both. Students share their rules in small groups of 3 or 4, and use them all to create a stronger "group rule." Next, students in small groups would test their "group rule" on new images and justify their choices. Could even be a small competition to see which group gets the most right – and there may likely be two or more answers for some images if the groups can successfully argue for it. For example, if one groups says a photo of old bricks, with rounded edges, and red brick dust laying below, was 'weathering' because it shows the brick-stuff being worn off, that is correct. If a second group says it is "weathering and erosion" because the brick stuff wore off, and then the wind carried some away because the pile of dust is too small to be all of the missing brick, they are also correct since they had right reasoning.

For students who **presented a strong response**, a challenge task could be to ask to use the prior investigation stations to model the situation shown in the photos. Taking before/during/after photos during their model. They investigate variables like fast vs. slow water, lots vs. little water, same with wind, 'packing' in some mud and seeing which part of the bank wears away when they run their water past it, etc. If several groups doing this, have them identify their 'best' model and why, and then each group demonstrates to rest of class their 'best' with explanation after other students have had the extra experiences above to resolve their difficulties. This brings whole class to similar place in terms of experiences, where those further ahead had extra opportunity with more free-form exploration of building a model.

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g. Student Work Samples

None available; task has been reworked.

h. Reflection and Revision

None submitted.

NOTE: Student handout pages begin on next page

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Riverbank Changes

Gabe and Dash love to fish for bass from the banks of the Licking River. However, they found their favorite fishing spot was gone from one spring to the next (May, 2017 to April, 2018).

Notice this same tall tree in all 3 pictures… evidence that these 3 photos were taken from the same location!

May, 2017

February, 2018

April, 2018

The pictures above show the same riverbank location along the Licking River in Kentucky. (https://epa.ohio.gov/pic/media/licking_river2007)

1. What specific evidence is in the photos that there was a change in this riverbank?

   Evidence: _____

   Change: _____

2. What was the likely cause of this change (or sometimes we say "…*cause of this effect*")?

   Cause: _____

3. This particular change happened pretty fast – less than a year by the dates on the photos. Write an explanation of what might have happened (which variable might have been changed) that could account for this super-fast change. In your explanation, please use the scientific terms "*weathering*" and "*erosion*", and cite evidence from your prior class explorations at the weathering/erosion investigations to support the likelihood of your explanation.

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