Erosion Arroyo Walk

Erosion in the Arroyo Unit, Lesson 1

Lesson Summary: Students will look for evidence of erosion and deposition in the arroyo.

Suggested Timing: 1 hour, assuming 10 minutes to walk to and from the arroyo.

New Mexico State Standards

Performance Expectation(s):
MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Constructing Explanations and Designing Solutions: Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. Developing and Using Models: Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe unobservable mechanisms.	ESS2.A: Earth's Materials and Systems: The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. ESS2.C: The Roles of Water in Earth's Surface Processes: Water's movements— both on the land and underground— cause weathering and erosion, which change the land's surface features and create underground formations.	Scale Proportion and Quantity: Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Energy and Matter: Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Evidence Statements:

- MS-ESS2-2 Evidence Statements

Santa Fe WATERSHED ASSOCIATION

ELA CCSS Connections:

- RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2)
- WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS2-2)
- SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-2)

Math CCSS Connections:

- MP.2: Reason abstractly and quantitatively. (MS-ESS2-2)
- 6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS2-2)
- 7.EE.B.4P: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS2-2)

Content Objectives and Daily Learning Targets	**Objectives:** ● I can explain what erosion is and how it happens. ● I can find evidence of erosion and deposition in the natural environment. ● I can explain that this area was deposited in the past and is being eroded in the present.
Focus Question	How do erosion and deposition change the geological features around us?
Language Objectives	● Students will apply new vocabulary to a real world situation.
Vocabulary	● **Erosion** - process in which earth materials are worn away and transported by natural forces such as wind or water. ● **Deposition** - process of laying material down or depositing. ● **Sediment** - solid material that is moved and deposited in a new location. ● **Soil** - a combination of mineral particles (i.e. parent materials such as quartz, weathered bedrock such as clays, etc.), organic material (i.e. decomposing leaves, bugs, etc.), air (i.e. minute space between mineral and organic particles), and water (i.e. moisture that displaces or shares space with air pockets). ● **Soil horizons/profile** - distinct layers in the soil that have formed over time. Layers can include organic topsoil, fine textured clays, caliche (white calcium carbonate layer in more arid regions), etc. Soil horizons can easily be seen in the exposed soil profile created by vertical eroded arroyo banks. ● **Texture** - a measure of the grittiness of soil particles ranging from small to large (i.e. clay, silt, sand, gravel, cobble, boulders) which will influence erosion processes.
Materials	● Clipboard ● Data collection sheets or science notebooks

	• Colored pencils • Pencils • Water bottle with water (at least 3-4 cups) • Optional: Buckets for students to carry materials and sit on as stools
Preparation before class	• In the class preceding, review rules for being outside and consequences for not following these guidelines. • If you are using science journals instead of the data sheets, ask students to write the questions in their journals.

Assessments (Formative/ Summative), Rubrics, Success criteria	• Data sheets
	• Success criteria:
	  ○ Students are able to describe what evidence of erosion is observed
	  ○ Students answer to the reflection questions uses reasoning based on the evidence they have observed

EL Supports	• Provide key vocabulary in the student's first language.
Culturally Relevant Strategies	• Students work together to investigate the arroyo. • Students investigate the local environment, which is an important part of the local culture.
Special Education Modifications	• Students are able to express their thinking in multiple ways, allowing them to build on their strengths.

Lesson Plan Details

ENGAGE (~10 min):	• Review rules for being outside
	• Hand out materials
	• Walk to arroyo
	• Have students add their science notebook headings, if not completed previously.
	• Have students record:
	  ○ Date
	  ○ Time
	  ○ Temperature
	  ○ Sunny/cloudy
	  ○ Location
	• Give students 5 minutes to walk the space and write, in words or pictures, observations about what they see. If this is your second visit, ask them to also make observations about what has changed.

EXPLORE (~15 min):	• Tell students they are looking for evidence of how the arroyo was formed. Have them draw and take notes on what evidence they see. Depending on your student dynamics, this can be done alone or in assigned groups of 2-3 students.

EXPLAIN (~5 min):	● Get back together as a whole group. ● Define the terms sediment, deposition, and erosion. Remind students about what they know about different geological formations and different types of rocks, especially sedimentary. ● Ask: **Where do you think that the soil we are standing on came from? What makes you say that? What evidence can you cite?** ○ Answer: Santa Fe is built on an alluvial deposit made up of sediment that washed down from the mountains. As the water flowed out of the mountains it slowed down as the land flattened. The slower water does not have the same energy to carry sediment, so the sediment settled out and over time it built up in the valley. The younger layers are closer to the surface. Look for evidence of layers in the walls of the arroyo. Discuss that if this were not eroded, these layers would become sedimentary rock over time. ● Ask students to compare the soil texture in the arroyo channel to arroyo banks. The channel will more than likely have more coarse textures (i.e. sand, gravel, cobble) than the fine textures (i.e. clay and silt) on the banks. Why? ○ As the arroyo flows, the energy of the water will transport (i.e. pick up) the finer textures, but fail to move or ultimately drop out (i.e. sediment) the heavier textures. ○ A good way to demonstrate textures in sediment is by shaking up a water bottle with different soil size classes and letting them settle out (i.e. large textures at bottom and fine textures at top). Video Example
ELABORATE (~15 min):	● Demonstrate: Using the water you brought with you, find a steep area of the arroyo with fairly loose soil. Ask students what they think will happen if you pour water there. Pour a couple of cups of water. Have students make a quick diagram, showing what happened. The water should have carried soil down stream with it. As the water soaked into the ground and slowed, the soil should have been deposited. ○ If the demonstration to move sediment doesn't work with the small volume of water poured in the arroyo, it is likely that the sediment textures are too large to be carried by the water (i.e. require a higher intensity storm, rather than a few cups of water). ● Ask students to indicate in the diagram when they saw: ○ Erosion ○ Deposition ○ Sediment ● Have students return to explore the arroyo in their journal or lab sheets to document the following: ○ Where do you see evidence of deposition? ○ Where do you see evidence of erosion? ○ If water continues to flow through this arroyo, what do you predict that it will look like in 10 years? What makes you say that?

EVALUATE (~15 min):	• Get back together as a whole class. Have students show where they see deposition, erosion, etc. Have them share questions they have about this process. • Give 3-5 minutes for a final reflection question: If there were a big rainstorm that caused this arroyo to fill, what do you think would happen? Where would the sediment that you see here go? What would the arroyo look like the next day? • Walk back to class.

Additional Sources:

- 5 Es of Science Instruction
- 5E Model of Instruction
- ISEC model of lesson sequence