Erosion Mitigation Walk

Erosion in the Arroyo Unit, Lesson 3

Lesson Summary: Students will return to the arroyo to look for ways that erosion is being stopped or mitigated.

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-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

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.	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. ESS3.C: Human Impacts on Earth Systems: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	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. Cause and Effect: Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Evidence Statements

- MS-ESS2-2 Evidence Statements
- MS-ESS3-3 Evidence Statements

ELA CCSS Connections:

- WHST.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Math CCSS Connections:

- 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
- 7.RP.A.2: Recognize and represent proportional relationships between quantities.
- 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.
- 7.EE.B.4: 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.

Content Objectives and Daily Learning Targets	**Objectives**: ● I can find evidence of erosion control in the natural world. ● I can identify what is and is not working with erosion control. ● I can record data for later use.
Focus Question	What evidence can I find of erosion mitigation?
Language Objectives	● Students can apply new vocabulary to a real world situation. ● Students can accurately express what they notice with oral and written language.
Vocabulary	● **Crossvanes and rundowns** - boulder structures that are cemented or loosely fit together with the intention of preventing downcutting (i.e. entrenchment of the channel). They might be placed down channel from a culvert or bridge where water flow has been constricted and thus becomes more erosive. ● **Deposition** - process of laying material down or depositing. ● **Erosion** - process in which earth materials are worn away and transported by natural forces such as wind or water. ● **Gabions** - the wire baskets filled with cobble to help armor banks, prevent channel entrenchment, or protect utilities (e.g. sewer lines). ● **Mitigation** - something done to reduce the impact of a hazard. ● **Stormwater** - surface water in quantities large enough to run off resulting from heavy precipitation. ● **Wier** - typically a concrete structure that creates a "U" shape across the channel to prevent the deepening and widening of the channel.
Materials	● Science journals or data collection sheets

	● Clipboards ● Pencils ● Colored pencils ● Bottle of water for whole class or per pair of students for engage
Assessments (Formative/ Summative), Rubrics, Success criteria	● Data collection sheets or journal Success criteria: ○ Students recognize erosion mitigation examples ○ Student diagrams are clearly explained using evidence they 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 (~15 min):	● Review rules for outdoor labs. ● Walk to the arroyo. ● As a whole class or in pairs, have students find example areas that look similar to their model from the previous lesson. Have students pour water onto the area and answer the following. Thinking back about our model from yesterday, what patterns do you notice about how the model and the real arroyo erode? Be specific.
EXPLORE (~15 min):	● Explain that mitigation is what people do to reduce the impact of a hazard. For example, if you live in an area with earthquakes you will build using materials that can survive an earthquake. ● Have students explore the arroyo. Ask them to look for where they see erosion being mitigated. Where is this mitigation successful? Where is it failing? If they are still having trouble, point out an example, such as man-made structures in or around the arroyo that are slowing or directing the flow of water. ● Have them record what they notice in their journals or handouts.
EXPLAIN (~10 min):	● Come back together as a class. ● Ask students to share what they noticed. Walk to the different structures they are talking about and discuss what the students notice. ● Look at how the different structures work. Do they spread the water out? Slow it down? Provide large structures that are hard to erode? How are plant roots used to slow erosion? ● Define stormwater. Discuss how impermeable surfaces and storm

	drains empty into the arroyos and can make the issues more serious.
ELABORATE (~10 min):	● Ask students about the challenges of mitigating erosion in the channel versus in small tributaries that feed the arroyo. ○ Would it be easier to slow and infiltrate water in a small upland channel or in the larger arroyo? Can we mitigate flooding and erosion in the arroyo by working in upland areas? What if we captured the stormwater from a parking lot or street (i.e. the origin of excess runoff) in a rain garden (i.e. shallow depressions that retain and infiltrate stormwater) before it entered the arroyo? ● Ask students to make a list of the mitigation techniques that they see as being the most effective. Ask them to discuss if these would work in a small rain event versus an event with large amounts of stormwater. ● Have them choose 2-3 structures that they would like to test the next day using models.
EVALUATE (~10 min):	● Ask them to look at where they would recommend that additional erosion controls were built. ● What would they build? ● Let students know they will test these in the next class. ● Walk back to class.

Additional Sources:

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