

Stormwater and Pollution Experiment

Pollution in the Arroyo Unit, Lesson 2

Lesson Summary: Students will investigate how stormwater carries different types of pollution into our arroyos and waterways.

Suggested Timing: 1 hour

New Mexico State Standards

Performance Expectation(s): MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Science & Engineering Practices:

[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. Apply scientific principles to design an object, tool, process or system.

Disciplinary Core Ideas:

[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.

Crosscutting Concepts:

[Cause and Effect](#): Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

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. (MS-ESS3-3)
- 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. (MS-ESS3-3)

Content Objectives and Daily Learning Targets

Objectives:

- I can use a model to explore a complex environmental issue.
- I understand how stormwater carries pollutants into arroyos.
- I can explain how different types of pollution interact with the environment in different ways.

Focus Question

How does stormwater move different types of pollution through an arroyo environment?

Language Objectives	<ul style="list-style-type: none"> • Students will express their thinking in writing and orally. • Students will use key vocabulary to explain their thinking.
Vocabulary	<ul style="list-style-type: none"> • Arroyo - a dry creek, stream bed, or gulch that temporarily or seasonally fills and flows after sufficient rain. • Insoluble - lacking the ability to dissolve. • Invisible pollutants - pollutants that are too small to see, but could be mixed in with the water or air. • Microplastics - tiny pieces of plastic that are less than 5mm in length. • Nonpoint source - pollution from multiple sources. • Point source - pollution from a single source. • Pollution - the introduction of harmful materials into the natural environment that will have negative effects. • Soluble - the ability to dissolve. • Visible pollutants - pollutants that are visible to the human eye.
Materials	<ul style="list-style-type: none"> • Arroyo model from Unit 1 Erosion activities • Soluble chemicals, such as salt, epsom salts • Insoluble chemicals, like oil • Trash, including plastic, paper, etc • Watering can • Spray bottle • Water • Lab sheets or lab notebooks
Preparation before class	<ul style="list-style-type: none"> • Collect materials or assign students to bring materials they want to test into class
Assessments (Formative/ Summative), Rubrics, Success criteria	<ul style="list-style-type: none"> • Lab report • Discussion participation • Lab participation • Success criteria: <ul style="list-style-type: none"> ○ Students are able to develop procedures to test pollutants, carry out those procedures, and synthesize their results. ○ Students can use the evidence they observed to come up with solutions to pollution issues.
EL Supports	<ul style="list-style-type: none"> • Provide key vocabulary in both languages • Encourage students to use diagrams and bilingual labeling • Think-pair-share
Culturally Relevant Strategies	<ul style="list-style-type: none"> • Students investigate an issue that is in their local environment. • Students work with classmates to identify challenges. • Students practice social and academic skills they will need.
Special Education Modifications	<ul style="list-style-type: none"> • IEP modifications should be followed • Student groups should be carefully planned



	<ul style="list-style-type: none"> ● Students should be provided with additional assistance, including providing them with printed vocabulary
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Lesson Plan Details

ENGAGE (~10 min):	<ul style="list-style-type: none"> ● Project or print a Google map showing the terrain of the area where you are investigating the arroyo. Have students look for roads, parking lots, or other potential sources of pollution. Ask students in lab groups to brainstorm as many sources of arroyo pollution as they can think of and where each comes from. ● Have them share what they brainstorm with the class. ● Discuss if these are point-source or nonpoint source pollutants.
EXPLORE (~15 min):	<ul style="list-style-type: none"> ● Hand out the materials and instruct students that they will be testing 3 types of pollutants with their erosion model from Unit 1. ● Let students know they will be testing a soluble substance, an insoluble substance, and trash as pollutants in the model. Make sure they understand these terms. ● Have students create a procedure to follow testing the different pollutants, making sure they specify the amount of water they will use, etc. ● Ask students to predict how the different types of pollution will interact with water and soil. ● Have students carry out their experiment and record all of their observations.
EXPLAIN (~10 min):	<ul style="list-style-type: none"> ● Get together as a whole class and ensure students understand the following concepts: <ul style="list-style-type: none"> ○ Soluble vs Insoluble - things that dissolve vs things that won't dissolve. For example, salts will dissolve in water becoming part of a salty solution while oils will not dissolve and stay separate. ○ Micro plastics - tiny pieces of plastic that are less than 5mm in length. These tiny pieces may not be visible and can accumulate in water to be ingested by aquatic life. ○ Stormwater drainage - the network of structures, channels, and underground pipes that carry stormwater to ponds, lakes, streams and rivers. In Santa Fe the arroyos become part of the channel system and stormwater eventually flows into the Santa Fe River and on to the Rio Grande. ○ Erosion and sediment pollution - <ul style="list-style-type: none"> ■ Naturally occurring clays in sediment are very small and carry a negative charge which means that they attract positively charged heavy metals (see below). The clays can settle in water bodies (e.g. rivers and lakes) where the metals become soluble. ■ Too much sediment can ultimately fill in reservoirs and thus stored water capacity and hydro-power is



	<p>diminished.</p> <ul style="list-style-type: none"> ■ Sediment can bury cobble in river bottoms where fish lay eggs and benthic macroinvertebrates live....leading to death of those organisms. ○ Nonpoint source vs point source pollution - pollution that does not come from a single source vs pollution that's origin is a single identifiable source. An example of nonpoint-source pollution could be the accumulation of substances on the roadway that runs off in a storm. An example of point source pollution could be a manufacturing facility that is releasing hot water from its manufacturing process into a waterway. ○ Dumping - the act of illegally discarding materials anywhere that it is not permitted. We should always leave our natural environment the way we found it. ○ Infrastructure - the structures that we have to create our city. This includes roads, buildings, power supply, schools, sewage systems and drainage, communication systems, etc. All of the things we need to function as a community. ● Ask students to find real world analogues to the model. They should identify where the pollution would come from and how it could impact the environment.
ELABORATE (~15 min):	<ul style="list-style-type: none"> ● Complete the reflection section of their lab handout. ● Ask students to examine the different sources of pollution and look for solutions. Have them consider the potential cost and work related to prevention versus clean up.
EVALUATE (~10 min):	<ul style="list-style-type: none"> ● Have students clean up. ● Have each lab group present their solutions to the issues.

Additional Sources:

- [5 Es of Science Instruction](#)
- [5E Model of Instruction](#)
- [ISEC model of lesson sequence](#)

