



Environmental Literacy Model

Title	PIERS Soil Habitat Issue Investigation Unit
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School, District	Garrett and Allegany Counties, Maryland
Audience (grade, course)	GR 2, 4 or 5 (originally GR 2 prior to adoption of NGSS)

Curriculum Anchor

Defining the Learning Objectives and Curriculum Connection

Curriculum indicators, performance expectations, and/ or student learning objectives.

NGSS

PE 2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

SEP. Constructing Explanations and Designing Solutions

DCI ESS2.A. Earth Materials and Systems

CCC. Influence of Engineering, Technology, and Science on Society and the Natural World

PE 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.

SEP. Planning and Carrying Out Investigations

DCI ESS2.A. Earth Materials and Systems

DCI ESS2.E. Biogeology

CCC. Cause and Effect

PE 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

SEP. Developing and Using Models

DCI ESS2.A. Earth Materials and Systems

CCC. Systems and System Models

MD E. Lit. Standards

(1) Environmental Issue Investigation & Action. Environmentally literate students investigate environmental issues in order to develop and implement local actions that protect, sustain or restore the natural environment.

(2) Human Dependence on Earth Systems and Natural Resources. Environmentally literate students construct and apply understanding of how Earth's systems and natural resources support human existence.

Students will understand that:

- Soil provides an important habitat for plants and animals.
- Soil is an important natural resource.

Students will know that...

- Soil is different at different locations.

- Soil differences can be determined by looking at its color, texture, reaction with water and remains of living things.
- Soil provides a habitat for many organisms. That is, organisms get food, air, water and shelter from soil.
- Most of the food that we eat depends on good soil—we grow vegetables on it to eat and to feed the animals that we eat. Also we build houses, roads, etc. on soil.
- Plants are necessary to maintain good soil because they keep it from being washed away by rain or blown away by wind.

Students will be able to...

- Collect sample of soil for analysis.
- Describe/compare soil properties.
- Conduct a science investigation including making and recording observations and measurements; calculating changes in amounts; and summarizing findings.
- Identify and use map elements.

Describing the Local Context

The life-relevant issue that will serve as the context for learning.

Students will hypothesize whether soil in their schoolyard is “good” in terms of meeting organisms’ needs, they will determine soil quality across the schoolyard, and then they will determine where they should improve the soil and add plants in their schoolyard.

Identifying the Driving Question

A broad, open-ended, life-relevant question that is based on the standards/learning objectives. Guides inquiry for the investigation(s), prompts the development of actionable claims.

Students will use models and readings to understand why soil is important and how to determine whether it is good or poor quality. This will lead them to the driving question: Is our schoolyard soil good or poor?

issue Investigation

Asking Questions, Defining Issues and Problems

Students define the issue, problem, or phenomenon to be investigated and develop supporting questions that are relevant for investigation.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
Students discuss the needs of living things. This discussion leads students to ask the question: Why do we need soil?	Students examine the characteristics of good and poor soil, which leads them to ask the question: Is our schoolyard soil good or poor?	Once they determine the quality of soil across their schoolyard, students ask the question: Where should we improve our schoolyard soil?

Planning and Conducting Investigations

Students plan and conduct investigations and classroom activities (indoor and outdoor) that actively address students' supporting questions. Students collect data that will be used to inform actionable claims.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<ol style="list-style-type: none"> Students list reasons why humans and other organisms need soil (e.g., place to grow vegetables or to hide). Students list the four basic needs of all organisms – food, water, air, and shelter – and draw lines to connect each reason they listed in the first step to the corresponding basic need. Students read excerpts from <i>Jump into Science: Dirt</i>, and note any organisms and their uses of soil from the story that they had not previously listed. Students discuss how soil is a natural resource and consider how much good soil is available for organisms to use. 	<ol style="list-style-type: none"> Students hypothesize whether soil in their schoolyard is “good” in terms of meeting organisms’ needs. Students read an excerpt from <i>Jump into Science: Dirt</i> on soil type. Then use containers of sandy soil, clay soil, mixed soil and pictures from the reading to review these three soil types and determine which is the best for meeting organisms’ needs. Students collect soil samples from different locations in the schoolyard and compare their samples to the “known” soil types to determine if their soil is good (mixed) or poor (sandy or clay). 	<ol style="list-style-type: none"> Students’ review their schoolyard soil results and discuss how they could possibly improve and protect soil in the schoolyard. Then they read about ways to improve soil in another excerpt from <i>Jump into Science: Dirt</i>. Students create a model in which balls represent soil, students holding balls represent plants, and other students represent wind/rain taking balls that are not held by students to test their ideas of how to protect good soil.

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Analyzing and Interpreting Data

Students analyze data through graphs, models, and other methods to reveal patterns and relationships. Students synthesize and apply evidence from their investigations to draw conclusions that address the supporting questions.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<p>Students manipulate a simple model (using an apple) to demonstrate the amount of good soil on Earth available for growing food for humans.</p>	<p>Students review all the data for their schoolyard soil sample and determine which known soil (sandy soil, clay soil, mixed soil) is the best match to their sample and answer the research question (Is our schoolyard soil good or poor?) for their soil type/location.</p>	<p>Students discuss their findings and determine that they could add good soil to where it is poor, and that they need to add plants to keep the soil from getting washed away by rainwater or getting blown away by wind.</p>

Constructing and Communicating a Claim

Students draw on the conclusions from their investigations to make a claim about the driving question and communicate these evidence-based claims to internal and/or external audiences.

Issue Investigation 1	Issue Investigation 2	Issue Investigation 3
<p>From the model, students conclude that the amount of good soil for growing food is limited.</p>	<p>Students share their results with the rest of the class to see if all locations have the same soil.</p>	<p>Students map good/poor soil in their schoolyard and use their maps to select a location where they think good soil and plants should be added.</p>

Stewardship and Civic Action

Identifying Solutions

Students identify and explore solutions that directly address the problem, challenge, or opportunity reflected in their claim. Students use decision making processes to identify the solution(s) to implement.

As a class, students determine the best location on the schoolyard to improve the soil and protect it with plants. They mark this location on a paper map of their schoolyard and discuss the best way to implement this schoolyard enhancement.

Designing a Plan and Taking Informed Action

Students design a plan for implementing solutions through informed action in their classrooms, schools, and/or communities. The plans should include criteria for determining the extent to which the action successfully addresses the problem, challenge, or opportunity reflected in the claim. Students implement their plans.

Students develop a detailed plan for improving their schoolyard soil, which they can present to their principal or school board. With permission, students implement their plan.

Evaluating Action

Students reflect on the action and determine the extent to which it successfully addresses the problem, challenge, or opportunity reflected in the claim. Students communicate their findings and share proposals for sustaining or extending the action.

Students complete the “Reflections” questions at the end of their “student report” (i.e., worksheet) without teacher’s guidance (except to clarify questions as necessary).

For subsequent academic years, students may examine the effectiveness of previous soil improvement efforts and either maintain, replace, or expand upon them (e.g., weeding gardens and replacing plants that have died; planting a fruit tree).