



UNIT 2

EARTH'S SYSTEMS: PROCESSES THAT SHAPE THE EARTH



Unit 2: Earth's Systems: Processes that Shape the Earth

9 weeks

In this unit, students develop understandings about how the earth changes and has changed over time. Students will understand processes that shape the landscape of the Earth. Students will use evidence from fossils and patterns in rock formations to support explanations about how the landscape of the Earth or a specific region has changed over time. They will develop an understanding of fossils, how they form, and what fossils can tell us about the Earth's past. In order to describe patterns on Earth's features, students will analyze and interpret data from maps.

Students will also develop understanding about the effects of weathering or the rate of erosion by water, ice, wind, or vegetations. They will understand about the different processes that change the landscape of the Earth: weathering, erosion, deposition, and natural hazards. Weathering happens when rocks on Earth's surface break apart or change without moving anywhere. Erosion involves the movement of soil and rock by wind, water, ice and gravity and moves material from one place to another. Deposition occurs when eroded materials stop moving and begin to build up. Eroded materials are called sediments. Erosion and deposition work together to change the surface of the Earth – erosion breaks down rock and soil and moves it to other places and deposition caused the eroded sediment to build up into new landforms.

Natural hazards are the result of natural processes on the Earth such as volcanic eruptions, earthquakes, tsunamis, etc. They will understand that we cannot prevent these hazards, but we can reduce the impact of them on humans. Students will apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans.

Unit 2 Performance Expectations

- ❖ **4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.**

Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock. **Assessment Boundary:** Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.

- ❖ **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, or volume of water flow. **Assessment Boundary:** Assessment is limited to a single form of weathering or erosion.

- ❖ **4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.**

Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.

- ❖ **4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.***

Clarification Statement: Examples of solutions could include designing an earthquake resistant building or improving monitoring of volcanic activity.

Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.



In Unit 2, students will understand...

- ❖ Local, regional, and global patterns of rock formations reveal changes over time due to earth forces.
- ❖ The presence and location of certain fossil types indicate the order in which rock layers were formed.
- ❖ Rainfall helps to shape the land and affects the types of living things found in a region.
- ❖ Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- ❖ Living things affect the physical characteristics of their regions.
- ❖ The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.
- ❖ Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.
- ❖ Major mountain chains form inside continents or near their edges.
- ❖ Maps can help located the different land and water features of Earth.
- ❖ A variety of natural hazards result from natural processes like earthquakes, tsunamis, and volcanic eruptions.
- ❖ Humans cannot eliminate the hazards but can take steps to reduce their impact.
- ❖ Testing a solution involves investigating how well it performs under a range of likely conditions.

Unit 2 Essential Questions:

- ❖ How can water, ice, wind and vegetation change the land? What evidence do you have to support this explanation?
- ❖ What patterns of Earth's features can be determined with the use of maps?
- ❖ How can we reduce the impacts of natural hazards (processes) on humans?

Foundational Knowledge:

Prior to 4th grade, students should have knowledge, understanding of, and experiences with the following ideas:

- ❖ Some events happen very quickly, while other events occur very slowly over time.
- ❖ Some events occur over a time period much longer than one can observe.
- ❖ Wind and water can change the shape of the land.
- ❖ Maps show where things are located.
- ❖ Maps can show the shapes and kinds of land and water in an area.
- ❖ Water is found in the ocean, rivers, lakes, and ponds.
- ❖ Water, as part of Earth's landforms, exists as solid ice and in liquid form.
- ❖ Engineers develop solutions to prevent damage to Earth's surface.
- ❖ A variety of natural hazards result from natural processes.
- ❖ Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 4th grade. You may need to provide opportunities for students to experience these ideas as you move forward.



Unit Vocabulary:

evidence	patterns	weathering	earthquake
variables	formation	erosion	volcano
explanation	rocks	vegetation	tsunamis
analyze	rock layers	impact	flood
interpret	fossil	landscape	eruption
solution	deposition	feature	cycle

Additional Content Connections:

*These connections provide opportunities to score to other content standards with focused instruction.

ELA:

- ❖ Speaking and Listening
 - SL.4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
 - SL.4.2 Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- ❖ Writing
 - W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-ESS1-1)
 - W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
 - W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1)

Social Studies:

- ❖ Spatial Views of the World
 - G.8.4.1 Use geographic representations to examine the spatial organization of Arkansas citing relative and absolute location.
 - G.8.4.2 Use thematic maps (climate, political, topical) and other geographic representations to compare physical and human characteristics of a region to those of another region in the United States and the interactions that shape them.
- ❖ Changing Spatial Patterns
 - G.11.4.2 Analyze ways communities cooperate in providing relief efforts during and after natural and human-made disasters.

Math:

- ❖ Measurement and Data
 - 4. MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec; yd, ft, in; gal, qt, pt, c. Within a single system of measurement, express measurements in the form of a larger unit in terms of a smaller unit.
 - 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money (including the ability to make change)...Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.



Earth's Systems: Processes that Shape the Earth

Students who demonstrate understanding can:

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]

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, or volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features. [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.* [Clarification Statement: Examples of solutions could include designing an earthquake resistant building or improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1) Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. - Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. - Identify the evidence that supports particular points in an explanation. (4-ESS1-1) - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)	ESS1.C: The History of Planet Earth - Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1) ESS2.A: Earth Materials and Systems - Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1) ESS2.B: Plate Tectonics and Large-Scale System Interactions - The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2) ESS2.E: Biogeology - Living things affect the physical characteristics of their regions. (4-ESS2-1) ESS3.B: Natural Hazards - A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (4-ESS3-2) ETS1.B: Designing Solutions to Engineering Problems - Testing a solution involves investigating how well it performs under a range of likely conditions. (4-ESS3-2)	Patterns - Patterns can be used as evidence to support an explanation. (4-ESS1-1, 4-ESS2-2) Cause and Effect - Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1, 4-ESS3-2) ----- Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World - Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2) ----- Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes consistent patterns in natural systems. (4-ESS1-1)

