2nd Grade – Thematic Model – Bundle 3
Changes to the Land

This is the third bundle of the 2nd Grade Thematic Model. Each bundle has connections to the other bundles in the course, as shown in the Course Flowchart.

Bundle 3 Question: This bundle is assembled to address the questions "How do we prevent wind or water from changing the land?"

Summary

The bundle organizes performance expectations with a focus on engineering design and the study of changes to the land. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The idea that maps show where things are located and the shapes and kinds of land and water in any area (ESS2.B as in 2-ESS2-2) can connect to the idea that wind and water can change the shape of the land (ESS2.A as in 2-ESS2-1). The idea that the shape of the land can change connects to the concept that some events happen very quickly and others occur very slowly, over a time period much longer than one can observe (ESS1.C as in 2-ESS1-1).

The engineering design idea that because there is always more than one possible solution to a problem, it is useful to compare and test designs (ETS1.C as in K-2-ETS1-3) can connect to multiple science ideas, such as that wind and water can change the shape of the land (ESS2.A as in 2-ESS2-1) and that some events happen very quickly; others occur very slowly, over a time period much longer than one can observe (ESS1.C as in 2-ESS1-1). The first connection could be made by having students compare a variety of designs that are intended to prevent wind erosion of soil. The second connection could be made by having students compare designs intended to prevent danger from a rock slide.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of developing and using models (2-ESS2-2); analyzing and interpreting data (K-2-ETS1-3); and constructing explanations and designing solutions (2-ESS1-1 and 2-ESS2-1). Many other practice elements can be used in instruction.

Bundle Crosscutting Concepts

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the crosscutting concepts of Patterns (2-ESS2-2) and Stability and Change (2-ESS1-1 and 2-ESS2-1). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations	2-ESS1-1. **Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]** 2-ESS2-1. **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.* [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]**

Performance Expectations (Continued)	2-ESS2-2. **Develop a model to represent the shapes and kinds of land and bodies of water in an area.** **[*Assessment Boundary: Assessment does not include quantitative scaling in models.*]** K-2-ETS1-3. **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**
Example Phenomena	Canyons often have rivers at the bottom. Different oceans have different shapes on the map.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** ● Ask questions based on observations to find more information about the natural and/or designed world(s). Students could *ask questions based on observations* [of] ***events*** [that] ***happen very quickly*** [and] ***others*** [that] ***occur very slowly*** *to find more information about the natural world*. 2-ESS1-1 **Developing and Using Models** ● Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller) and/or patterns in the natural and designed world(s). Students could *develop or use a model to represent relative scales* [of] ***land and water in*** [an] ***area*** [according to a] ***map***. 2-ESS2-2 **Planning and Carrying Out Investigations** ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question Students could *plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence* [about the effect of] ***wind*** [on] ***the shape of the land***. 2-ESS2-1 **Analyzing and Interpreting Data** ● Use and share pictures, drawings, and/or writings of observations. Students could *share* their *writings of observations* [of] ***the shapes and kinds of land in an area***. 2-ESS2-2 **Using Mathematical and Computational Thinking** ● Decide when to use qualitative vs. quantitative data. Students could *decide when to use qualitative vs. quantitative data* [when] ***representing the shapes and kinds of water in an area***. 2-ESS2-2 **Constructing Explanations and Designing Solutions** ● Generate and/or compare multiple solutions to a problem. Students could *compare multiple solutions* (such as bridges) *to a problem* [caused by] ***the shapes and kinds of water in an area***. 2-ESS2-2

Additional Practices Building to the PEs (Continued)	**Engaging in Argument from Evidence** ● Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence. Students could *make a claim, supported by relevant evidence, about the effectiveness of a solution* [designed to prevent] ***water*** [from] ***changing the shape of the land***. 2-ESS2-1 **Obtaining, Evaluating, and Communicating Information** ● Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim. Students could *obtain information using various texts, text features, and other media that will be useful in answering a scientific question* [about ways that] ***wind can change the shape of the land***. 2-ESS2-1
Additional Crosscutting Concepts Building to the PEs	**Scale, Proportion, and Quantity** ● Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower). Students could describe how *relative scales allow* [different] ***time periods*** [such as the time over which] ***some*** [Earth] ***events happen,*** *to be compared and described*. 2-ESS1-1 **Systems and System Models** ● Objects and organisms can be described in terms of their parts. Students could communicate about how ***maps show where things are located*** and *can be described in terms of their parts*. 2-ESS2-2 **Energy and Matter** ● Objects may break into smaller pieces, be put together into larger pieces, or change shapes. Students could describe how ***the land*** *may break into smaller pieces or change shapes* [as a result of] ***wind and water***. 2-ESS2-1
Additional Connections to Nature of Science	**Science is a Way of Knowing** ● Scientific knowledge informs us about the world. Students could describe how *scientific knowledge* [about how] ***some events occur very slowly, over a period of time much longer than one can observe*** *informs* [them] *about the world*. 2-ESS1-1 **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Scientists use drawings, sketches, and models as a way to communicate ideas. Students could describe how they, like *scientists, use drawings, sketches, and models as a way to communicate ideas* [such as that] ***wind and water can change the shape of the land***. 2-ESS2-1

2-ESS1-1 Earth's Place in the Universe

Students who demonstrate understanding can:

2-ESS1-1. **Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations from several sources to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

Crosscutting Concepts

Stability and Change

- Things may change slowly or rapidly.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that Earth events can occur very quickly or very slowly.
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.
2	Evidence	
	a	Students describe* the evidence from observations (firsthand or from media; e.g., books, videos, pictures, historical photos), including:
		i. That some Earth events occur quickly (e.g., the occurrence of flood, severe storm, volcanic eruption, earthquake, landslides, erosion of soil).
		ii. That some Earth events occur slowly.
		iii. Some results of Earth events that occur quickly.
		iv. Some results of Earth events that occur very slowly (e.g., erosion of rocks, weathering of rocks).
		v. The relative amount of time it takes for the given Earth events to occur (e.g., slowly, quickly, hours, days, years).
	b	Students make observations using at least three sources
3	Reasoning	
	a	Students use reasoning to logically connect the evidence to construct an evidence-based account. Students describe* their reasoning, including:
		i. In some cases, Earth events and the resulting changes can be directly observed; therefore those events must occur rapidly.
		ii. In other cases, the resulting changes of Earth events can be observed only after long periods of time; therefore these Earth events occur slowly, and change happens over a time period that is much longer than one can observe.

2-ESS2-1 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-1. **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Compare multiple solutions to a problem.

Disciplinary Core Ideas

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land.

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. *(secondary)*

Crosscutting Concepts

Stability and Change

- Things may change slowly or rapidly.

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Connections to Engineering, Technology, and Applications of Science

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

- Developing and using technology has impacts on the natural world.

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Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientists study the natural and material world.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students describe* the given problem, which includes the idea that wind or water can change the shape of the land by washing away soil or sand.
	b	Students describe* at least two given solutions in terms of how they slow or prevent wind or water from changing the shape of the land.
2	Describing* specific features of the design solution, including quantification where appropriate	
	a	Students describe* the specific expected or required features for the solutions that would solve the given problem, including:
		i. Slowing or preventing wind or water from washing away soil or sand.
		ii. Addressing problems created by both slow and rapid changes in the environment (such as many mild rainstorms or a severe storm and flood).
3	Evaluating potential solutions	
	a	Students evaluate each given solution against the desired features to determine and describe* whether and how well the features are met by each solution.
	b	Using their evaluation, students compare the given solutions to each other.

2-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-2. **Develop a model to represent the shapes and kinds of land and bodies of water in an area.** [*Assessment Boundary: Assessment does not include quantitative scaling in models.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a model to represent patterns in the natural world.

Disciplinary Core Ideas

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- Maps show where things are located. One can map the shapes and kinds of land and water in any area.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed.

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	Students develop a model (i.e., a map) that identifies the relevant components, including components that represent both land and bodies of water in an area.
2	Relationships	
	a	In the model, students identify and describe* relationships between components using a representation of the specific shapes and kinds of land (e.g., playground, park, hill) and specific bodies of water (e.g., creek, ocean, lake, river) within a given area.
	b	Students use the model to describe* the patterns of water and land in a given area (e.g., an area may have many small bodies of water; an area may have many different kinds of land that come in different shapes).
3	Connections	
	a	Students describe* that because they can map the shapes and kinds of land and water in any area, maps can be used to represent many different types of areas.

K-2-ETS1-3 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-3. **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

The performance expectation above was 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
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended.	**ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	With guidance, students use graphical displays (e.g., tables, pictographs, line plots) to organize given data from tests of two objects, including data about the features and relative performance of each solution.
2	Identifying relationships	
	a	Students use their organization of the data to find patterns in the data, including:
		i. How each of the objects performed, relative to:
		1. The other object.
		2. The intended performance.
		ii. How various features (e.g., shape, thickness) of the objects relate to their performance (e.g., speed, strength).
3	Interpreting data	
	a	Students use the patterns they found in object performance to describe*:
		i. The way (e.g., physical process, qualities of the solution) each object will solve the problem.
		ii. The strengths and weaknesses of each design.
		iii. Which object is better suited to the desired function, if both solve the problem.