3rd Grade – Topic Model – Bundle 3
Environmental Change Over Time

This is the third bundle of the 3rd Grade Topic 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 question "how do we know the environment used to be different?"

Summary
The bundle organizes performance expectations with a focus on helping students build understanding on how the climate affects organisms over long periods of time. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and recognize that instruction is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs
The idea that some kinds of plants and animals that once lived on Earth are no longer found anywhere (LS4.A as in 3-LS4-1) connects to the idea that when the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die (LS2.C as in 3-LS4-4). And environmental changes can connect to the concept that climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years (ESS2.D as in 3-ESS2-2). Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next (ESS2.D as in 3-ESS2-1).

The engineering design idea that the success of a designed solution is determined by considering the desired features of a solution, or criteria (ETS1.A as in 3-5-ETS1-1), could connect to multiple science concepts, such as that scientists can make predictions about what kind of weather might happen next (ESS2.D as in 3-ESS2-1), and that populations live in a variety of habitats and changes in those habitats affect the organisms living there (LS4.D as in 3-LS4-4). The first connection could be made by having students consider the criteria for a solution to a problem caused by bad weather, and the second connection could be made by having students consider the criteria for a solution that mitigates the effect on organisms when a habitat changes.

Bundle Science and Engineering Practices
Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of asking questions and defining problems (3-5-ETS1-1), analyzing and interpreting data (3-LS4-1 and 3-ESS2-1), engaging in argument from evidence (3-LS4-4), and obtaining, evaluating, and communicating information (3-ESS2-2). 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 (3-ESS2-2 and 3-ESS2-1), Scale, Proportion, and Quantity (3-LS4-1), and Systems and System Models (3-LS4-4). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations	3-LS4-1. **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [*Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*] 3-LS4-4. **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [*Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.*] 3-ESS2-1. **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [*Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.*] 3-ESS2-2. **Obtain and combine information to describe climates in different regions of the world.** 3-5-ETS1-1. **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
Example Phenomena	There are some patterns in rocks that look like the skeletons of unfamiliar animals. Stores sell more heavy coats in the fall than they do in the spring.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** ● Ask questions about what would happen if a variable is changed. Students could *ask questions about what would happen* [to] ***the organisms living in*** [a] ***habitat*** *if* ***the temperature of the habitat*** changes. 3-LS4-4 **Developing and Using Models** ● Identify limitations of models. Students could *identify limitations of models* ***of an area's typical weather conditions***. 3-ESS2-2 **Planning and Carrying Out Investigations** ● Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. Students could *make observations to test a design solution* [to a problem related to a] ***change in habitats that affects the organisms living there***. 3-LS4-4 **Analyzing and Interpreting Data** ● Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns. Students could *represent data in tables or various graphical displays reveal patterns in fossil evidence about the types of organisms that lived long ago*. 3-LS4-1

Additional Practices Building to the PEs (Continued)	**Using Mathematical and Computational Thinking** ● Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems. Students could *describe or graph quantities to address scientific questions* [about what happens to] ***organisms when the environment changes***. 3-LS4-4 **Constructing Explanations and Designing Solutions** ● Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. Students could *use evidence to support an explanation* ***about the types of organisms that lived long ago and also about the nature of their environments***. 3-LS4-1 **Engaging in Argument from Evidence** ● Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions. Students could *respectfully provide and receive critiques from peers about a proposed model [of] an area's typical weather conditions and the extent to which those conditions vary over years.* 3-ESS2-2 **Obtaining, Evaluating, and Communicating Information** ● Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. Students could *communicate scientific and/or technical information—including various forms of media as well as tables, diagrams, and charts*—[about why] ***scientists record patterns of the weather across different times and areas***. 3-ESS2-1
Additional Crosscutting Concepts Building to the PEs	**Scale, Proportion, and Quantity** ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. Students could describe the importance of *using standard units to measure and describe physical quantities* ***of weather*** [such as such as inches of rain and feet of snow], ***and to record patterns of the weather across different times***. 3-ESS2-1 **Systems and System Models** ● A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. Students could describe ***organisms that lived long ago and their environments*** as *a system*. 3-LS4-1 **Stability and Change** ● Some systems appear stable, but over long periods of time will eventually change. Students could describe organisms that lived long ago and their environments as a system that eventually changed over long periods of time. 3-LS4-1

Additional Connections to Nature of Science	**Scientific Knowledge is Based on Empirical Evidence** ● Science findings are based on recognizing patterns. Students could communicate that *science findings* [about how] ***change in habitats affects organisms living there*** *are based on recognizing patterns*. 3-LS4-4 **Scientific Knowledge is Open to Revision in Light of New Evidence** ● Science explanations can change based on new evidence. Students could identify how *science explanations* ***about an area's climate*** *could change* [if] *new evidence* [were found]. 3-ESS2-2

3-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-1. **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [*Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*]

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

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.

Disciplinary Core Ideas

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. *(Note: moved from K-2)*
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.

Crosscutting Concepts

Scale, Proportion, and Quantity

- Observable phenomena exist from very short to very long time periods.

- - - - - - - - - - - - - - - - - -

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems.

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	Students use graphical displays (e.g., table, chart, graph) to organize the given data, including data about:	
		i.	Fossils of animals (e.g., information on type, size, type of land on which it was found).
		ii.	Fossils of plants (e.g., information on type, size, type of land on which it was found).
		iii.	The relative ages of fossils (e.g., from a very long time ago).
		iv.	Existence of modern counterparts to the fossilized plants and animals and information on where they currently live.
2	Identifying relationships		
	a	Students identify and describe* relationships in the data, including:	
		i.	That fossils represent plants and animals that lived long ago.
		ii.	The relationships between the fossils of organisms and the environments in which they lived (e.g., marine organisms, like fish, must have lived in water environments).
		iii.	The relationships between types of fossils (e.g., those of marine animals) and the current environments where similar organisms are found.
		iv.	That some fossils represent organisms that lived long ago and have no modern counterparts.
		v.	The relationships between fossils of organisms that lived long ago and their modern counterparts.
		vi.	The relationships between existing animals and the environments in which they currently live.
3	Interpreting data		
	a	Students describe* that:	
		i.	Fossils provide evidence of organisms that lived long ago but have become extinct (e.g., dinosaurs, mammoths, other organisms that have no clear modern counterpart).
		ii.	Features of fossils provide evidence of organisms that lived long ago and of what types of environments those organisms must have lived in (e.g., fossilized seashells indicate shelled organisms that lived in aquatic environments).

		iii.	By comparing data about where fossils are found and what those environments are like, fossilized plants and animals can be used to provide evidence that some environments look very different now than they did a long time ago (e.g., fossilized seashells found on land that is now dry suggest that the area in which those fossils were found used to be aquatic; tropical plant fossils found in Antarctica, where tropical plants cannot live today, suggests that the area used to be tropical).

3-LS4-4 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-4. **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [*Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.*]

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

Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.*(secondary)*

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions.

- - - - - - - - - - - - - -

Connections to Engineering, Technology, and Applications of Science

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

- Knowledge of relevant scientific concepts and research findings is important in engineering.

Observable features of the student performance by the end of the grade:				
1	Supported claims			
	a	Students make a claim about the merit of a given solution to a problem that is caused when the environment changes, which results in changes in the types of plants and animals that live there.		
2	Identifying scientific evidence			
	a	Students describe* the given evidence about how the solution meets the given criteria and constraints. This evidence includes:		
		i.	A system of plants, animals, and a given environment within which they live before the given environmental change occurs.	
		ii.	A given change in the environment.	
		iii.	How the change in the given environment causes a problem for the existing plants and animals living within that area.	
		iv.	The effect of the solution on the plants and animals within the environment.	
		v.	The resulting changes to plants and animals living within that changed environment, after the solution has been implemented.	
3	Evaluating and critiquing evidence			
	a	Students evaluate the solution to the problem to determine the merit of the solution. Students describe* how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:		
		i.	How well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:	
			1.	How the solution makes changes to one part (e.g., a feature of the environment) of the system, affecting the other parts of the system (e.g., plants and animals).
			2.	How the solution affects plants and animals.

	b	Students evaluate the evidence to determine whether it is relevant to and supports the claim.
	c	Students describe* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed.

3-ESS2-1 Earth's Systems

Students who demonstrate understanding can:

3-ESS2-1. **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [*Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.*]

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 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. • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.	**ESS2.D: Weather and Climate** • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	**Patterns** • Patterns of change can be used to make predictions.

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	Students use graphical displays (e.g., table, chart, graph) to organize the given data by season using tables, pictographs, and/or bar charts, including:	
		i.	Weather condition data from the same area across multiple seasons (e.g., average temperature, precipitation, wind direction).
		ii.	Weather condition data from different areas (e.g., hometown and nonlocal areas, such as a town in another state).
2	Identifying relationships		
	a	Students identify and describe* patterns of weather conditions across:	
		i.	Different seasons (e.g., cold and dry in the winter, hot and wet in the summer; more or less wind in a particular season).
		ii.	Different areas (e.g., certain areas (defined by location, such as a town in the Pacific Northwest), have high precipitation, while a different area (based on location or type, such as a town in the Southwest) have very little precipitation).
3	Interpreting data		
	a	Students use patterns of weather conditions in different seasons and different areas to predict:	
		i.	The typical weather conditions expected during a particular season (e.g., “In our town in the summer it is typically hot, as indicated on a bar graph over time, while in the winter it is typically cold; therefore, the prediction is that next summer it will be hot and next winter it will be cold.”).
		ii.	The typical weather conditions expected during a particular season in different areas.

3-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

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
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Obtain and combine information from books and other reliable media to explain phenomena.	**ESS2.D: Weather and Climate** • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.	**Patterns** • Patterns of change can be used to make predictions.

Observable features of the student performance by the end of the grade:			
1	Obtaining information		
	a	Students use books and other reliable media to gather information about:	
		i.	Climates in different regions of the world (e.g., equatorial, polar, coastal, mid-continental).
		ii.	Variations in climates within different regions of the world (e.g., variations could include an area's average temperatures and precipitation during various months over several years or an area's average rainfall and temperatures during the rainy season over several years).
2	Evaluating information		
	a	Students combine obtained information to provide evidence about the climate pattern in a region that can be used to make predictions about typical weather conditions in that region.	
3	Communicating information		
	a	Students use the information they obtained and combined to describe*:	
		i.	Climates in different regions of the world.
		ii.	Examples of how patterns in climate could be used to predict typical weather conditions.
		iii.	That climate can vary over years in different regions of the world.

3-5-ETS1-1 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-1. **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**

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
Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	**ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.	**Influence of Science, Engineering, and Technology on Society and the Natural World** • People's needs and wants change over time, as do their demands for new and improved technologies.

Observable features of the student performance by the end of the grade:			
1	Identifying the problem to be solved		
	a	Students use given scientific information and information about a situation or phenomenon to define a simple design problem that includes responding to a need or want.	
	b	The problem students define is one that can be solved with the development of a new or improved object, tool, process, or system.	
	c	Students describe* that people's needs and wants change over time.	
2	Defining the boundaries of the system		
	a	Students define the limits within which the problem will be addressed, which includes addressing something people want and need at the current time.	
3	Defining the criteria and constraints		
	a	Based on the situation people want to change, students specify criteria (required features) of a successful solution.	
	b	Students describe* the constraints or limitations on their design, which may include:	
		i.	Cost.
		ii.	Materials.
		iii.	Time.