3rd Grade – Topic Model – Bundle 2
Advantages in Survival

This is the second 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 2 Question: This bundle is assembled to address the question "How does the environment affect organisms?"

Summary
The bundle organizes performance expectations with a focus on helping students build understanding of the relationships between the organism traits and survival in a habitat. 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 being part of a group helps animals obtain food, defend themselves, and cope with changes (LS2.D as in 3-LS2-1) connects to the idea that for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all (LS4.C as in 3-LS4-3) in that both ideas are about the survival of kinds of organisms. These ideas can also connect to survival of individuals within a group and that sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing (LS4.B as in 3-LS4-2).

In order to identify the differences in characteristics between individuals that may provide an advantage, it is helpful to look at the patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals). And through the concept of patterns, this bundle also gives an opportunity to continue the study of the idea that 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 idea of weather patterns can also connect to the idea that a variety of natural hazards result from natural processes (ESS3.B as in 3-ESS3-1) as some natural hazards are weather related such as hurricanes or flash flooding.

The engineering design idea that research on a problem should be carried out before beginning to design a solution (ETS1.B as in 3-5-ETS1-2) could connect to multiple science concepts, such as that humans cannot eliminate natural hazards but can take steps to reduce their impacts (ESS3.B as in 3-ESS3-1) and that for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all (LS4.C as in 3-LS4-3). For example, the first connection could be made by having students research a given natural hazard before designing a solution to reduce the impact of that natural hazard. The second connection could be made by having students research the needs of a particular organism before designing an environment where that organism will survive well.

Bundle Science and Engineering Practices
Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of analyzing and interpreting data (3-ESS2-1), constructing explanations and designing solutions (3-LS4-2 and 3-5-ETS1-2), and engaging in argument from evidence (3-LS2-1, 3-LS4-3, and 3-ESS3-1). 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 (3-ESS2-1) and Cause and Effect (3-LS2-1, 3-LS4-2, 3-LS4-3, and 3-ESS3-1). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

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Performance Expectations 3-ESS2-1 is partially assessable.	3-LS2-1. **Construct an argument that some animals form groups that help members survive.** 3-LS4-2. **Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.** [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.] 3-LS4-3. **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.] 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-ESS3-1. **Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.] 3-5-ETS1-2. **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
Example Phenomena	There are many more animals living in a rainforest than in a desert. Flowers with a stronger scent attract more insects.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** ● 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. Students could *define a simple design problem* [caused by the fact that] ***some kinds of organisms cannot survive at all*** [in a] ***particular environment.*** 3-LS4-3 **Developing and Using Models** ● Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. Students could *use a model to test interactions in and function of a designed system* [that] ***can reduce the impacts of natural hazards***. 3-ESS3-1 **Planning and Carrying Out Investigations** ● Evaluate appropriate methods and/or tools for collecting data. Students could *evaluate appropriate methods for collecting data* [on how] ***groups of animals vary dramatically in size***. 3-LS2-1 **Analyzing and Interpreting Data** ● Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. Students could *compare and contrast data collected by different groups* [about] ***the differences in characteristics between individuals of the same species*** *in order to discuss similarities and differences in their findings*. 3-LS4-2

Additional Practices Building to the PEs (Continued)	**Using Mathematical and Computational Thinking** ● Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems. Students could *describe, estimate, and graph quantities to address scientific questions* [about the] ***differences in characteristics between individuals of the same species***. 3-LS4-2 **Constructing Explanations and Designing Solutions** ● Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard). Students could *construct an explanation of observed relationships* [between] ***particular environments*** [and] ***survival of organisms***. 3-LS4-3 **Engaging in Argument from Evidence** ● Construct and/or support an argument with evidence, data, and/or a model. Students could use *evidence to support an argument* [that] ***being part of a group helps animals cope with changes***. 3-LS2-1 **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena or solutions to a design problem. Students could *combine information from books and other reliable media to explain* [why some animals seem to have] ***advantages in finding mates***. 3-LS4-2
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* [compare] *physical quantities* [of] ***particular environments*** [in which] ***some organisms cannot survive***. 3-LS4-3 **Systems and System Models** ● A system can be described in terms of its components and their interactions. Students could describe ***animals that are part of a group*** *as components of a system*. 3-LS2-1 **Structure and Function** ● Substructures have shapes and parts that serve functions. Students could describe that ***differences in*** *substructures of* ***individuals of the same species provide advantages***. 3-LS4-2
Additional Connections to Nature of Science	**Scientific Investigations Use a Variety of Methods** ● Science investigations use a variety of methods, tools, and techniques. Students could identify that one *investigation* [to identify] ***patterns of the weather across different times and areas*** [may] *use* [different] *tools* [than a different type of investigation]. 3-ESS2-1 **Scientific Knowledge is Based on Empirical Evidence** ● Scientists use tools and technologies to make accurate measurements and observations. Students could describe that *scientists use tools and technologies to make accurate measurements and observations* [of] ***a variety of natural hazards*** [so that] ***humans can take steps to reduce their impacts***. 3-ESS3-1

3-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

3-LS2-1. **Construct an argument that some animals form groups that help members survive.**

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).

- Construct an argument with evidence, data, and/or a model.

Disciplinary Core Ideas

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size *(Note: Moved from K–2)*.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

Observable features of the student performance by the end of the grade:

1	Supported claims	
	a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some animals form groups and that being a member of that group helps each member survive.
2	Identifying scientific evidence	
	a	Students describe* the given evidence, data, and/or models necessary to support the claim, including:
		i. Identifying types of animals that form or live in groups of varying sizes.
		ii. Multiple examples of animals in groups of various sizes:
		1. Obtaining more food for each individual animal compared to the same type of animal looking for food individually.
		2. Displaying more success in defending themselves than those same animals acting alone.
		3. Making faster or better adjustments to harmful changes in their ecosystem than would those same animals acting alone.
3	Evaluating and critiquing evidence	
	a	Students evaluate the evidence to determine its relevance, and whether it supports the claim that being a member of a group has a survival advantage.
	b	Students describe* whether the given evidence is sufficient to support the claim and whether additional evidence is needed.
4	Reasoning and synthesis	
	a	Students use reasoning to construct an argument connecting the evidence, data and/or models to the claim. Students describe* the following reasoning in their argument:
		i. The causal evidence that being part of a group can have the effect of animals being more successful in obtaining food, defending themselves, and coping with change supports the claim that being a member of a group helps animals survive.
		ii. The causal evidence that an animal losing its group status can have the effect of the animal obtaining less food, not being able to defend itself, and not being able to cope with change supports the claim that being a member of a group helps animals survive.

3-LS4-2 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-2. **Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.** [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

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 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.

- Use evidence (e.g., observations, patterns) to construct an explanation.

Disciplinary Core Ideas

LS4.B: Natural Selection

- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

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 variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
	b	Students use evidence and reasoning to construct an explanation for the phenomenon.
2	Evidence	
	a	Students describe* the given evidence necessary for the explanation, including:
		i. A given characteristic of a species (e.g., thorns on a plant, camouflage of an animal, the coloration of moths).
		ii. The patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals).
		iii. Potential benefits of a given variation of the characteristic (e.g., the light coloration of some moths makes them difficult to see on the bark of a tree).
3	Reasoning	
	a	Students use reasoning to logically connect the evidence to support the explanation for the phenomenon. Students describe* a chain of reasoning that includes:
		i. That certain variations in characteristics make it harder or easier for an animal to survive, find mates, and reproduce (e.g., longer thorns prevent predators more effectively and increase the likelihood of survival; light coloration of some moths provides camouflage in certain environments, making it more likely that they will live long enough to be able to mate and reproduce).
		ii. That the characteristics that make it easier for some organisms to survive, find mates, and reproduce give those organisms an advantage over other organisms of the same species that don't have those traits.
		iii. That there can be a cause-and-effect relationship between a specific variation in a characteristic (e.g., longer thorns, coloration of moths) and its effect on the ability of the individual organism to survive and reproduce (e.g., plants with longer thorns are less likely to be eaten, darker moths are less likely to be seen and eaten on dark trees).

3-LS4-3 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-3. **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

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).

- Construct an argument with evidence.

Disciplinary Core Ideas

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

Observable features of the student performance by the end of the grade:		
1	Supported claims	
	a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.
2	Identifying scientific evidence	
	a	Students describe* the given evidence necessary for supporting the claim, including:
		i. Characteristics of a given particular environment (e.g., soft earth, trees and shrubs, seasonal flowering plants).
		ii. Characteristics of a particular organism (e.g., plants with long, sharp leaves; rabbit coloration).
		iii. Needs of a particular organism (e.g., shelter from predators, food, water).
3	Evaluating and critiquing evidence	
	a	Students evaluate the evidence to determine:
		i. The characteristics of organisms that might affect survival.
		ii. The similarities and differences in needs among at least three types of organisms.
		iii. How and what features of the habitat meet the needs of each of the organisms (i.e., the degree to which a habitat meets the needs of an organism).
		iv. How and what features of the habitat do not meet the needs of each of the organisms (i.e., the degree to which a habitat does not meet the needs of an organism).
	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.
4	Reasoning and synthesis	
	a	Students use reasoning to construct an argument, connecting the relevant and appropriate evidence to the claim, including describing* that any particular environment meets different organisms' needs to different degrees due to the characteristics of that environment and the needs of the organisms. Students describe* a chain of reasoning in their argument, including the following cause-and-effect relationships:
		i. If an environment fully meets the needs of an organism, that organism can survive well within that environment.
		ii. If an environment partially meets the needs of an organism, that organism can survive less well (e.g., lower survival rate, increased sickliness, shorter lifespan) than organisms whose needs are met within that environment.

		iii.	If an environment does not meet the needs of the organism, that organism cannot survive within that environment.
		iv.	Together, the evidence suggests a causal relationship within the system between the characteristics of a habitat and the survival of organisms within it.

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

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.

Disciplinary Core Ideas

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.

Crosscutting Concepts

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-ESS3-1 Earth and Human Activity

Students who demonstrate understanding can:

3-ESS3-1. **Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lighting rods.]

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

ESS3.B: Natural Hazards

- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change.

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 (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones).

Connections to Nature of Science

Science is a Human Endeavor

- Science affects everyday life.

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 design solution that reduces the impact of a weather-related hazard.
2	Identifying scientific evidence	
	a	Students describe* the given evidence about the design solution, including evidence about:
		i. The given weather-related hazard (e.g., heavy rain or snow, strong winds, lightning, flooding along river banks).
		ii. Problems caused by the weather related hazard (e.g., heavy rains cause flooding, lightning causes fires).
		iii. How the proposed solution addresses the problem (e.g., dams and levees are designed to control flooding, lightning rods reduce the chance of fires) [note: mechanisms are limited to simple observable relationships that rely on logical reasoning].
3	Evaluating and critiquing evidence	
	a	Students evaluate the evidence using given criteria and constraints to determine:
		i. How the proposed solution addresses the problem, including the impact of the weather-related hazard after the design solution has been implemented.
		ii. The merits of a given solution in reducing the impact of a weather-related hazard (i.e., whether the design solution meets the given criteria and constraints].
		iii. The benefits and risks a given solution poses when responding to the societal demand to reduce the impact of a hazard.

3-5-ETS1-2 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-2. **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**

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 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.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Crosscutting Concepts

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

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information.
	b	Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem.
	c	Students specify how each design solution solves the problem.
	d	Students share ideas and findings with others about design solutions to generate a variety of possible solutions.
	e	Students describe* the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design [note: emphasis is on what is necessary for designing solutions, not on a step-wise process].
2	Describing* criteria and constraints, including quantification when appropriate	
	a	Students describe*:
		i. The given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate.
		ii. How the criteria and constraints will be used to generate and test the design solutions.
3	Evaluating potential solutions	
	a	Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem.
	b	Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem.