2nd Grade – Thematic Model – Bundle 2
Habitats

This is the second 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 2 Question: This bundle is assembled to address the question "What kinds of solutions can help plants meet their needs?"

Summary
The bundle organizes performance expectations with a focus on engineering design and the study of habitats as a system. 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 concept that plants depend on animals for pollination or to move their seeds around (LS2.A as in 2-LS2-2) connects to the concept that plants depend on water and light to grow (LS2.A as in 2-LS2-1) as both ideas are about plant needs. This relationship between organisms and water can also connect to the concept that there are many different kinds of living things in any area, and they exist in different places on land and in water (LS4.D as in 2-LS4-1).

Through the topic of water, these concepts connect to the idea that water exists as solid ice and in liquid form (ESS2.C as in 2-ESS2-3), and that heating or cooling a substance (such as water) may cause changes that can be observed (PS1.B as in 2-PS1-4).

The engineering design idea that designs can be conveyed through sketches, drawings, or physical models (ETS1.B as in K-2-ETS1-2 and 2-LS2-2) can be connected to multiple science concepts, such as that plants depend on animals for pollination or to move their seeds around (LS2.A as in 2-LS2-2) and there are many different kinds of living things in any area, and they exist in different places on land and in water (LS4.D as in 2-LS4-1). The first connection could be made through challenging students to design and then sketch a way to increase pollination of flowers after a decrease in the bee population. The second connection could be made by having students design two different plant habitats that each meets the needs of the many different kinds of plants that will be in each habitat. In either case, student sketches should be detailed enough to communicate their design fully.

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-LS2-2 and K-2-ETS1-2); planning and carrying out investigations (2-LS2-1 and 2-LS4-1); engaging in argument from evidence (2-PS1-4); and obtaining, evaluating, and communicating information (2-ESS2-3). 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-ESS2-3); Cause and Effect (2-PS1-4 and 2-LS2-1); and Structure and Function (2-LS2-2 and K-2-ETS1-2). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations	2-PS1-4. **Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** **[Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]**

Performance Expectations (Continued)	2-LS2-1. **Plan and conduct an investigation to determine if plants need sunlight and water to grow.** **[Assessment Boundary: Assessment is limited to testing one variable at a time.]** 2-LS2-2. **Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*** 2-LS4-1. **Make observations of plants and animals to compare the diversity of life in different habitats.** **[Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.]** **[Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]** 2-ESS2-3. **Obtain information to identify where water is found on Earth and that it can be a solid or liquid.** K-2-ETS1-2. **Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
Example Phenomena	Plants need liquid water in order to survive; they cannot live with only solid water (ice). Different plants can live in very different places (e.g., a cactus that lives in the desert, a cattail that lives in a pond).
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* [to determine which] ***changes caused by heating or cooling a substance are reversible***. 2-PS4-1 **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 a model to represent relationships* [between] ***different places*** [and the] ***kinds of living things in*** [that] ***area***. 2-LS4-1 **Planning and Carrying Out Investigations** ● Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. Students could *make observations of different pictures to make comparisons* [between] ***water found in different areas*** [and whether that water] ***exists as solid ice or in liquid form***. 2-ESS2-3 **Analyzing and Interpreting Data** ● Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems. Students could *use observations to describe patterns and relationships* [between] ***plants*** [and] ***water*** *in order to solve problems*. 2-LS2-1 **Using Mathematical and Computational Thinking** ● Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. Students could *measure and compare* [the temperature at which] ***heating or cooling a substance causes changes***, *and display the data using simple graphs.* 2-PS1-4

Additional Practices Building to the PEs (Continued)	**Constructing Explanations and Designing Solutions** ● Use information from observations (firsthand or from the media) to construct an evidence-based account of natural phenomena. Students could *use information from firsthand observations to construct an evidence-based account* [that] ***heating or cooling a substance may cause changes that can be observed*** [and] ***these changes are sometimes reversible***. 2-PS1-4 **Engaging in Argument from Evidence** ● Identify arguments that are supported by evidence. Students can *identify arguments that are supported by evidence* [for the claim that] ***there are many different kinds of living things in any area***. 2-LS4-1 **Obtaining, evaluating, and communicating information** ● Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea. Students could *describe how specific images support the idea* [that] ***plants depend on water and light to grow.*** 2-LS2-1
Additional Crosscutting Concepts Building to the PEs	**Patterns** ● Patterns in the natural and designed world(s) can be observed, used to describe phenomena, and used as evidence. Students could *use patterns of* ***changes caused by heating or cooling a substance*** *to describe phenomena*. 2-PS1-4 **Systems and System Models** ● Systems in the natural and designed world have parts that work together. Students could describe that ***plants depending on animals for pollination*** [is a] *system in the natural world* [that] *has parts that work together*. 2-LS2-2 **Stability and Change** ● Some things stay the same while other things change. Students could develop a model to describe that *some* ***water found in ponds*** *stays in* ***liquid form*** *while other* ***water changes*** [into] ***solid ice***. 2-PS1-4 and 2-ESS2-3
Additional Connections to Nature of Science	**Science is a Way of Knowing** ● Scientific knowledge helps us know about the world. Students could describe how their *scientific knowledge* [about] ***different kinds of living things*** [that] ***exist in different places on land and in water*** helps [them] know about the world. 2-LS4-1 **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ● Scientists search for cause and effect relationships to explain natural events. Students could construct an argument with evidence to support the claim that they, like *scientists, searched for cause and effect relationships* [*between*] ***plants*** [and] ***water and light***. 2-LS2-1

2-PS1-4 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-4. **Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]

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 K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Construct an argument with evidence to support a claim.

- -

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science searches for cause and effect relationships to explain natural events.

Disciplinary Core Ideas

PS1.B: Chemical Reactions

- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

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 changes caused by heating or cooling can be reversed and some cannot.
2	Identifying scientific evidence	
	a	Students describe* the given evidence, including:
		i. The characteristics of the material before heating or cooling.
		ii. The characteristics of the material after heating or cooling.
		iii. The characteristics of the material when the heating or cooling is reversed.
3	Evaluating and critiquing the evidence	
	a	Students evaluate the evidence to determine:
		i. The change in the material after heating (e.g., ice becomes water, an egg becomes solid, solid chocolate becomes liquid).
		ii. Whether the change in the material after heating is reversible (e.g., water becomes ice again, a cooked egg remains a solid, liquid chocolate becomes solid but can be a different shape).
		iii. The change in the material after cooling (e.g., when frozen, water becomes ice, a plant leaf dies).
		iv. Whether the change in the material after cooling is reversible (e.g., ice becomes water again, a plant leaf does not return to normal).
	b	Students describe* whether the given evidence supports the claim and whether additional evidence is needed.
4	Reasoning and synthesis	
	a	Students use reasoning to connect the evidence to the claim. Students describe* the following chain of reasoning:
		i. Some changes caused by heating or cooling can be reversed by cooling or heating (e.g., ice that is heated can melt into water, but the water can be cooled and can freeze back into ice [and vice versa]).

		ii.	Some changes caused by heating or cooling cannot be reversed by cooling or heating (e.g., a raw egg that is cooked by heating cannot be turned back into a raw egg by cooling the cooked egg, cookie dough that is baked does not return to its uncooked form when cooled, charcoal that is formed by heating wood does not return to its original form when cooled).

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

Students who demonstrate understanding can:

2-LS2-1. **Plan and conduct an investigation to determine if plants need sunlight and water to grow.** [*Assessment Boundary: Assessment is limited to testing one variable at a time.*]

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

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on water and light to grow.

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns.

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon and purpose of the investigation, which include answering a question about whether plants need sunlight and water to grow.
2	Identifying the evidence to address the purpose of the investigation	
	a	Students describe* the evidence to be collected, including:
		i. Plant growth with both light and water.
		ii. Plant growth without light but with water.
		iii. Plant growth without water but with light.
		iv. Plant growth without water and without light.
	b	Students describe* how the evidence will allow them to determine whether plants need light and water to grow.
3	Planning the investigation	
	a	Students collaboratively develop an investigation plan. In the investigation plan, students describe* the features to be part of the investigation, including:
		i. The plants to be used.
		ii. The source of light.
		iii. How plants will be kept with/without light in both the light/dark test and the water/no water test.
		iv. The amount of water plants will be given in both the light/dark test and the water/no water test.
		v. How plant growth will be determined (e.g., observations of plant height, number and size of leaves, thickness of the stem, number of branches).
	b	Students individually describe* how this plan allows them to answer the question.
4	Collecting the data	
	a	According to the investigation plan developed, students collaboratively collect and record data on the effects on plant growth by:
		i. Providing both light and water,
		ii. Withholding light but providing water,
		iii. Withholding water but providing light, or
		iv. Withholding both water and light.

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

2-LS2-2. **Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.***

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 simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on animals for pollination or to move their seeds around.

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.*(secondary)*

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	Students develop a simple model that mimics the function of an animal in seed dispersal or pollination of plants. Students identify the relevant components of their model, including those components that mimic the natural structure of an animal that helps it disperse seeds (e.g., hair that snares seeds, squirrel cheek pouches that transport seeds) or that mimic the natural structure of an animal that helps it pollinate plants (e.g., bees have fuzzy bodies to which pollen sticks, hummingbirds have bills that transport pollen). The relevant components of the model include:
		i. Relevant structures of the animal.
		ii. Relevant structures of the plant.
		iii. Pollen or seeds from plants.
2	Relationships	
	a	In the model, students describe* relationships between components, including evidence that the developed model mimics how plant and animal structures interact to move pollen or disperse seeds.
		i. Students describe* the relationships between components that allow for movement of pollen or seeds.
		ii. Students describe* the relationships between the parts of the model they are developing and the parts of the animal they are mimicking.
3	Connections	
	a	Students use the model to describe*:
		i. How the structure of the model gives rise to its function.
		ii. Structure-function relationships in the natural world that allow some animals to disperse seeds or pollinate plants.

2-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

2-LS4-1. **Make observations of plants and animals to compare the diversity of life in different habitats.** [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [*Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.*]

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

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data which can be used to make comparisons.

- -

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Disciplinary Core Ideas

LS4.D: Biodiversity and Humans

- There are many different kinds of living things in any area, and they exist in different places on land and in water.

Crosscutting Concepts

Observable features of the student performance by the end of the grade:		
1	Identifying the phenomenon under investigation	
	a	Students identify and describe* the phenomenon and purpose of the investigation, which includes comparisons of plant and animal diversity of life in different habitats.
2	Identifying the evidence to address the purpose of the investigation	
	a	Based on the given plan for the investigation, students describe* the following evidence to be collected:
		i. Descriptions* based on observations (firsthand or from media) of habitats, including land habitats (e.g., playground, garden, forest, parking lot) and water habitats (e.g., pond, stream, lake).
		ii. Descriptions* based on observations (firsthand or from media) of different types of living things in each habitat (e.g., trees, grasses, bushes, flowering plants, lizards, squirrels, ants, fish, clams).
		iii. Comparisons of the different types of living things that can be found in different habitats.
	b	Students describe* how these observations provide evidence for patterns of plant and animal diversity across habitats.
3	Planning the investigation	
	a	Based on the given investigation plan, students describe* how the different plants and animals in the habitats will be observed, recorded, and organized.
4	Collecting the data	
	a	Students collect, record, and organize data on different types of plants and animals in the habitats.

2-ESS2-3 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-3. **Obtain information to identify where water is found on Earth and that it can be solid or liquid.**

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

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new 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.

Disciplinary Core Ideas

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed.

Observable features of the student performance by the end of the grade:			
1	Obtaining information		
	a	Students use books and other reliable media as sources for scientific information to answer scientific questions about:	
		i.	Where water is found on Earth, including in oceans, rivers, lakes, and ponds.
		ii.	The idea that water can be found on Earth as liquid water or solid ice (e.g., a frozen pond, liquid pond, frozen lake).
		iii.	Patterns of where water is found, and what form it is in.
2	Evaluating Information		
	a	Students identify which sources of information are likely to provide scientific information (e.g., versus opinion).	

K-2-ETS1-2 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-2. **Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given 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

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 simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	Students develop a representation of an object and the problem it is intended to solve. In their representation, students include the following components:
		i. The object.
		ii. The relevant shape(s) of the object.
		iii. The function of the object.
	b	Students use sketches, drawings, or physical models to convey their representations.
2	Relationships	
	a	Students identify relationships between the components in their representation, including:
		i. The shape(s) of the object and the object's function.
		ii. The object and the problem is it designed to solve.
3	Connections	
	a	Students use their representation (simple sketch, drawing, or physical model) to communicate the connections between the shape(s) of an object, and how the object could solve the problem.