This seventh grade curriculum begins with a unit that connects two of the three disciplines—life science and earth science. In this unit, students use their knowledge of ecosystems to think more deeply about how natural processes and human activities have shaped Earth’s ecosystems. In this culminating project, students are asked to design an arena that mimics a natural environment, keeping these concepts in mind.

The integrated model requires students to access and use a wide range of ideas from prior grades. This content knowledge spans four different Disciplinary Core Ideas: LS2.A. Interdependent Relationships in Ecosystems, LS2.B. Cycles of Matter and Energy Transfer in Ecosystems, ESS2.B. Plate Tectonics and Large Scale System Interactions, and ESS3.A. Natural Resources.

As students explore these core ideas, they build on their skills in the following science and engineering practices: Developing and Using Models, Analyzing and Interpreting Data, and Constructing Explanations. In addition to science and engineering practices, students also continue to build on their knowledge of the following crosscutting concepts: Patterns, Cause and Effect, Systems and System Models, and Energy and Matter.

\*This summary is based on information found in the NGSS Framework.

**K-8 Progression of Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts for Unit 1**

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| **Disciplinary Core Ideas** | **K-2** | **3-5** | **6-8** |
| **LS2.A**  **Interdependent Relationships in Ecosystems** | Plants depend on water and light to grow and also depend on animals for pollination or to move their seeds around. | The food of almost any animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants, while decomposers restore some materials back to the soil. | Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems but the patterns are shared. |
| **LS2.B**  **Cycles of Matter and Energy Transfer in Ecosystems** | N/A | Matter cycles between the air and soil and among organisms as they live and die. | The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. |
| **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. | Earth’s physical features occur in patterns, as do earthquakes and volcanoes. Maps can be used to locate features and determine patterns in those events. | Plate tectonics is the unifying theory that explains movements of rocks at Earth’s surface and geological history. Maps are used to display evidence of plate movement. |
| **ESS3.A**  **Natural Resources** | Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. | Energy and fuels humans use are derived from natural sources and their use affects the environment. Some resources are renewable over time, others are not. | Humans depend on Earth’s land, ocean, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes. |

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| **Science and Engineering Practices** | **K-2** | **3-5** | **6-8** |
| **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 and/or use a model to represent amounts, relationships, relative scales (bigger/smaller), and/or patterns in the natural and designed world(s). | Modeling in 3-5 builds on prior experiences and progresses to building and revising simple models and using models to represent events and design solutions.   * Develop and/or use models to describe and/or predict phenomena. | Modeling in 6-8 builds on prior experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.   * Develop a model to predict and/or describe phenomena. |
| **Analyzing and Interpreting Data\*** | Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.   * Record information (observations, thoughts, and ideas). * 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.   . | Analyzing data in 3-5 builds on prior 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/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. * Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. | Analyzing data in 6-8 builds on prior experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.   * Analyze and interpret data to provide evidence of a phenomenon. |
| **Constructing Explanations\*** | Constructing Explanations in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena.   * Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena. | Constructing Explanations in 3-5 builds on prior experiences and progresses to the use of evidence and ideas in constructing explanations that specify variables that describe and predict phenomena.   * Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard). * Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. | Constructing Explanations in 6-8 builds on prior experiences and progresses to include constructing explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.   * Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. * Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. |

\*These SEPs are summatively assessed using the Culminating Project.

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| **Crosscutting Concepts** | **K-2** | **3-5** | **6-8** |
| **Patterns\*** | Students recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.   * Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. | Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.   * Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. * Patterns of change can be used to make predictions. * Patterns can be used as evidence to support an explanation. | Students recognize that macroscopic patterns are related to the nature of microscopic and atomic-level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human designed systems. They use patterns to identify cause and effect relationships, and use graphs and charts to identify patterns in data.   * Patterns in rates of change and other numerical relationships can provide information about natural systems. * Patterns can be used to identify cause-and-effect relationships. |
| **Cause and Effect\*** | Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.   * Events have causes that generate observable patterns. | Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity might or might not signify a cause and effect relationship.   * Cause and effect relationships are routinely identified, tested, and used to explain change. | Students classify relationships as causal or correlational, and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.   * Cause and effect relationships may be used to predict phenomena in natural or designed systems. |
| **Systems and System Models\*** | Students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.   * Objects and organisms can be described in terms of their parts. * Systems in the natural and designed world have parts that work together. | Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.   * A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. * A system can be described in terms of its components and their interactions. | Students can understand that systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. They can use models to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. They can also learn that models are limited in that they only represent certain aspects of the system under study.   * Systems may interact with other systems; they may have sub-systems and be a part of a larger complex system. * Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. |
| **Energy and Matter\*** | Students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.   * Objects may break into smaller pieces, be put together into larger pieces, or change shapes. | Students learn matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.   * Matter is made of particles. * Matter is transported into, out of, and within systems. * Energy can be transferred in various ways and between objects. | Students learn matter is conserved because atoms are conserved in physical and chemical processes. They also learn that within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.   * The transfer of energy can be tracked as energy flows through a natural system |

\*These CCCs are summatively assessed using the Culminating Project.

**Progression of Knowledge from Kindergarten – 8th grade**

LS2.A. Interdependent Relationships in Ecosystems: In Kindergarten - second grade, students begin to think about the different living things in an environment, the matter that plants need to grow, and one example of how plants and animals interact. At this stage, the knowledge is context specific and does not connect these pieces within an ecosystem as a whole. In third – fifth grade, students begin to make these connections as they consider the interactions between four broad parts of the environment. Rather than apply these ideas within specific contexts, students begin to form concepts that can be generalized to most environments. This sets the foundation for this seventh grade unit, in which students will engage with generalizable phenomena within most ecosystems, explaining the different interactions between organisms, including how resources affect populations. From kindergarten – fifth grade, students are building their understanding of Cause and Effect and Systems and System Models to organize these concepts, as well as Developing and Using Models to help them demonstrate understanding of the core ideas. By this seventh grade unit, they are moving towards gathering evidence of these phenomena in order to construct explanations.

The following is the progression of the Performance Expectations for this DCI:

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| **2-LS2-1** | Plan and conduct an investigation to determine if plants need sunlight and water to grow. |

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| **2-LS2-2**  **5-LS2-1** | Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.  Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. |
| **MS-LS2-1** | Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. |
| **MS-LS2-2** | Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. |

LS2.B. Cycles of Matter and Energy Transfer in Ecosystems: In Kindergarten - second grade, students do not explicitly touch on this DCI, but do explore parts and interactions within environments, which lays the foundation for this DCI (see LS2.A above). In third – fifth grade, students begin to conceptualize the environment as whole, exploring interactions as movement of matter. This provides a clear and easy progression into this seventh grade unit, in which students engage with all the interactions within an ecosystem, modeling not only how matter cycles, but also how energy flows through an ecosystem. In both fifth grade and seventh grade, students use the skill of Developing and Using Models to help them demonstrate this understanding. As students progress from fifth to seventh grade, they move from using Systems and System Models to organize these concepts to also considering how Energy and Matter are at play within an ecosystem.

The following is the progression of the Performance Expectations for this DCI:

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| **5-LS2-1** | Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. |
| **MS-LS2-3** | Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. |
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ESS2.B. Plate Tectonics and Large Scale System Interactions: Kindergarten - second grade introduces students to map representations of geographic features in general, such as the kind of land and bodies of water in an area. At this stage, questions that students explore are generic, such as “How does land change and what are some things that cause it to change?” In third – fifth grade, students take this a step further by analyzing and interpreting actual data from maps in order to describe patterns in Earth’s features. These patterns will then be used in this seventh grade unit, as students look at one specific set of patterns in data—those that provide evidence of past plate motions. Thus, students gradually move from identifying features on Earth to explaining the processes that resulted in those features. While students begin to explore these concepts in Kindergarten – second grade by Developing Models, they later progress to Analyzing and Interpreting actual Data, a skill they will need in this 7th grade unit. At all grade levels, students are building their ability to see Patterns amongst Earth’s features in order to draw conclusions.

The following is the progression of the Performance Expectations for this DCI:

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| **2-ESS2-2** | Develop a model to represent the shapes and kinds of land and bodies of water in an area. |
| **4-ESS2-2** | Analyze and interpret data from maps to describe patterns of Earth’s features. |
| **MS-ESS2-3** | Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. |

ESS3.A. Earth’s Natural Resources: In Kindergarten - second grade, students begin to consider how the needs of plants and animals (including animals) affect the places in which they live. This lays the foundation for students to consider a particular context in third – fifth grade: how energy and fuels are derived from natural resources and their uses can affect the environment. Here, students move from a more general push-and-pull relationship between organism and environment to specifically thinking about humans are negatively impacting environments through use of fuels. This seventh grade unit takes that a step further by exploring the human *and* natural causes that lead to an uneven distribution of many types of resources, not just fuels. While science and engineering practices related to this DCI vary throughout grade levels, students consistently use the crosscutting concept of Cause and Effect to consider effects on environment.

The following is the progression of the Performance Expectations for this DCI:

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| **K-ESS3-1** | Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. |
| **4-ESS3-1** | Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses can affect the environment. |
| **MS-ESS3-1** | Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes. |