Mini-Map for SCI.EE.12.LS.Ecosys-1

Subject: Science
Life Science (LS)
Grade band: 9–12

Grade-Level Expectation

DLM Essential Element	DLM Disciplinary Core Idea Family[1]	Framework Disciplinary Core Ideas
SCI.EE.12.LS.Ecosys-1 Develop a model that describes how matter (plant or animal matter) and energy (i.e., sunlight and food energy) are cycled within an ecosystem.	Life Science – Ecosystem: Cycling of Matter and Flow of Energy	LS1.C: Organization for Matter and Energy Flow in Organisms LS2.A: Interdependent Relationships in Ecosystems LS2.B: Cycles of Matter and Energy Transfer in Ecosystems PS3.D: Energy in Chemical Processes and Everyday Life

[1] DLM Science Essential Elements organize Disciplinary Core Ideas (defined in the *Framework for K-12 Science Education*) into DCI families. By combining similar concepts within a domain, science content from the general education standards is reduced in depth, breadth, and complexity to provide access for students that qualify for the DLM alternate assessment.

Linkage Level Descriptions

Initial Precursor	Distal Precursor	Proximal Precursor	Target[2]
Recognize the patterned arrangement of a sequence or process in the natural world.	Use a food chain to demonstrate that matter and energy from food allows animals to do things to keep them alive.	Use a food chain/web to demonstrate that matter and energy that animals get from eating other animals and/or plants originally comes from the Sun, air, and water in their environment.	Use a model to describe how matter is cycled and energy flows between components of an ecosystem (i.e., environment, producers, consumers, and decomposers).

[2] The target linkage level description is a measurement target that describes the expectations (content and performance) of the Essential Element for assessment purposes.

Essential Element Three Dimensions

Each Essential Element is defined in the three dimensions described in the *Framework for K-12 Science Education*: disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). The table below lists the details of each dimension from the individual DLM Essential Element descriptions, with color-coding of dimensions corresponding to the Next Generation Science Standards (NGSS). The first row (in blue) lists the SEP(s) used to construct the Essential Element and describes ways each SEP could be incorporated. The second row (in orange) describes the science concepts within the DCI family related to this Essential Element. The third row (in green) lists the CCC(s) associated with the Essential Element and explains how each might be incorporated in the grade band (quoted from NSTA, 2013, matrix of CCCs). Note that the SEP is presented first here (rather than second, as it is in the full list of Essential Elements) to reflect the emphasis on practices in instruction and across the linkage levels. The final row (in white) includes examples of how the three dimensions could work together to support instruction for the Essential Element. These examples provide ideas for integrating the dimensions and are not exhaustive, nor are they intended to limit instruction.

Science and Engineering Practices	**Developing and Using Models:** Modeling in grades 9–12 builds on K–8 experiences and progresses to developing, using, and evaluating models (e.g., maps, diagram, drawing, physical replica, diorama, graphs, dramatization, storyboard) that represent relationships, events, and systems in the natural world. • Develop, use, and evaluate models to describe relationships between variables and components of a system. • Use models to construct and evaluate explanations in the natural world.
Disciplinary Core Ideas	**Ecosystem: Cycling of Matter and Flow of Energy** • Matter and energy flow through living systems. • Matter and energy are cycled and transferred from one system to another. • Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. • The energy released from food was once energy from the Sun that was captured by plants in the process that forms plant matter (from air and water) (see SCI.EE.12.LS.Plant-1). • As food matter is transferred among organisms in a living system, the matter is broken down and rearranged into new groupings of atoms (see SCI.EE.12.PS.Matter-2). This process provides organisms with matter and energy for life.

Crosscutting Concepts	**Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Systems can be designed to do specific tasks. • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Energy and Matter: Flows, Cycles, and Conservation:** Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior. • The total amount of energy and matter in closed systems is conserved. • Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. • Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems. • Energy drives the cycling of matter within and between systems. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
How three dimensions support instruction for this Essential Element	Students can use system models to develop a model of an ecosystem that describes the cycling of matter and energy through that system. Students can make connections between energy and matter flowing through living systems, being transferred from one system to another, and eventually recycled. These system interactions can be described in student-created models, such as a food web, that students can use to note where energy and matter flow into, out of, and within the model. For example, students note that energy transfer occurs when plant and animal matter is broken down when eaten and energy is released.

Instructional Resources

Resources
Learning modules and additional science instructional resources can be found at https://www.dlmpd.com/science/
A glossary defining key science terms found in the Essential Elements can be found at DLM Glossary for Science Learning Maps.

Link to Text-Only Map

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