Mini-Map for SCI.EE.12.LS.EcoHlth-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.EcoHlth-1 Use data to make an argument about the effects of unstable environments on the health of ecosystems.	Life Science – Ecosystem Health	LS2.A: Interdependent Relationships in Ecosystems LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.D: Biodiversity and Humans ESS2.A: Earth Materials and Systems ESS2.D: Weather and Climate ESS2.E: Biogeology ESS3.A: Natural Resources

[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]
Predict the likely result of a common action of or on a novel object, based on the characteristics the object shares with a category of familiar objects.	Use information to identify associations between a healthy ecosystem, where many different living things make their habitat, and their ability to find the things they need to live (i.e., space to grow, shelter, water, and food).	Use evidence to make and support claims about the relationships between living and nonliving elements of a habitat, resource availability, growth of organisms, and the size of populations of organisms within an ecosystem.	Use data as evidence to make arguments about the relationships between disturbances within Earth's spheres, resource availability, population growth, biodiversity, and the health and stability of an ecosystem.

[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	**Analyzing and Interpreting Data:** Analyzing data in grades 9–12 builds on K–8 experiences and progresses to analyzing and evaluating to support explanations about relationships and solutions to problems in the natural world. • Represent and analyze data to determine and describe relationships between variables. • Use data to construct and evaluate arguments. • Analyze data to design and evaluate solutions to problems. **Engaging in Argument from Evidence:** Engaging in argument from evidence in grades 9–12 builds on K–8 experiences and progresses to evaluating information to construct arguments about the natural world. • Use observations, information, data, models, and mathematical reasoning to develop and evaluate claims. • Use information to construct an argument.

Disciplinary Core Ideas	**Ecosystem Health**
	• A healthy ecosystem can support the needs of diverse populations. Therefore, a healthy ecosystem supports biodiversity.
	• Resource availability determines where animals and humans live.
	• Ecosystems have limits on organisms and populations.
	  o Limits on ecosystems are based on resource availability (both living and nonliving resources).
	  o Limiting factors slow or stop population growth. Examples may include predation, competition, disease, immigration of species, weather, food, and water availability.

	• Unstable environments impact populations of animals and plants. o An unstable ecosystem is unable to resist disturbances and quickly returns to its average state after a disturbance. o Disturbances or disruptions to living and nonliving factors in ecosystems affect the populations living there. o Unstable environments may be caused by a variety of factors such as drought, flood, migration of species, immigration of species, invasive species, disease, or an unhealthy predator-to-prey ratio. o Unstable environments can decrease biodiversity. o Changes in biodiversity affect populations' access to living and nonliving resources. This includes humans. o Human activity can disrupt or disturb ecosystems. o Changes in weather and climate impact ecosystems. • Earth's spheres interact, impacting ecosystems. o The biosphere and geosphere dynamically interact: Living organisms (biosphere) have impacted Earth's spheres (hydrosphere, geosphere, and atmosphere) and vice versa.

Crosscutting Concepts	**Cause and Effect: Mechanism and Explanation:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. • Systems can be designed to cause a desired effect. • Changes in systems may have various causes that may not have equal effects. **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. **Stability and Change**: For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. • Much of science deals with constructing explanations of how things change and how they remain stable. • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. • Feedback (negative or positive) can stabilize or destabilize a system. • Systems can be designed for greater or lesser stability.

How three dimensions support instruction for this Essential Element	Students can learn about cause-and-effect relationships within systems by analyzing data related to resource availability and population size and diversity within an ecosystem. For example, students can describe how a change in weather affects the availability of plants in an ecosystem, which then affects the animals that eat those plants. Students can understand concepts of stability and change through data related to biodiversity. For example, a decrease in biodiversity is caused by limiting factors such as competition for space, food, and water. The effects of this decrease are a less stable ecosystem with reduced population size. Students can use data to support claims about the effects of limiting factors on population growth or to discover that it may take time for an ecosystem to recover after a disturbance. To learn about systems and system models, students can observe that the system of Earth's spheres interact and impact ecosystems or that human interactions also have an impact on ecosystems. For example, students can analyze data to understand how changes in the Earth's hydrosphere can impact water availability in an ecosystem or use data to support the argument that overfishing can disrupt food chains and affect an entire ecosystem.

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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