## MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

**Science and Engineering Practices**

**Developing and Using Models**
- Modeling in 6–8 builds on K–5 experiences and progressions to develop using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop a model to describe phenomena. (MS-LS2-3)
- Analyzing and Interpreting Data
  - A analyzing a data in 6–8 builds on K–5 experiences and progressions to include extending quantitative analysis to inv estigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - A analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)
- Constructing Explanations and Designing Solutions
  - Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions 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. (MS-LS2-2)
- Engaging in Argument from Evidence
  - Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a claim supported by evidence that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
  - Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)
  - Ev aluate conflicting design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

### Disciplinary Core Ideas

#### LS2.A: Interdependent Relationships in Ecosystems
- Organisms, and populations of organisms, are dependent on their environment interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environment, both living and nonliving, are shared. (MS-LS2-2)

#### LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of energy and matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

#### LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptors to physical or biological components of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
- Biodiversity describes the variety of species found on Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. (MS-LS2-5)

#### LS4.D: Biodiversity and Humans
- Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)

### Crosscutting Concepts

#### Patterns
- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

#### Cause and Effect
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

#### Energy and Matter
- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

#### Stability and Change
- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4)

## Connections to Nature of Science

### Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

### Science Addresses Questions About the Natural and Material World
- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

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* The performance expectations marked with an asterisk integrate traditional scientific content with engineering through a Practice or Disciplinary Core Idea.

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### MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

#### Common Core State Standards Connections

- **ELA/Literacy**
  - RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1), (MS-LS2-2), (MS-LS2-4)
  - RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flow chart, diagram, model, graph, or table). (MS-LS2-1)
  - RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5)
  - RI.8.8: Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4), (MS-LS2-5)
  - WHST.6-8.1: Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4)
  - WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2)
  - WHST.6-8.9: Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2), (MS-LS2-4)
  - SL.8.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS2-2)
  - SL.8.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS2-2)
  - SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS2-3)

- **Mathematics**
  - MP.4: Model with mathematics. (MS-LS2-5)
  - 6.RP.A.3: Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5)
  - 6.EE.C.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS2-3)
  - 6.SP.B.5: Summarize numerical data sets in relation to their context. (MS-LS2-2)

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