Standard

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

Performance Expectations

- The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities.
- The activities outlined in this article are just one step toward reaching the performance expectations listed below.

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HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Dimensions	Classroom Connections
Science and Engineering Practices	
Constructing Explanations and Designing Solutions Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review).	Students construct explanations for how matter cycles and energy flows through ecosystems based on evidence obtained from their jars, simulations, and interactives conducted throughout the unit.
Developing and Using Models Develop, revise, and use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students develop a model for their local ecosystem by carefully selecting and assembling biotic and abiotic factors. The jar ecosystems serve as models of matter and energy flow and biotic interactions. The added disturbances serve as models for how large-scale ecosystems might respond to disturbances.
Engaging in Argument from Evidence Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	After introducing disturbances, students develop arguments regarding the impact of changing conditions in ecosystems using evidence they have collected from their jars.

Disciplinary Core Ideas

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Only a fraction of matter consumed at the lower level of a food web is transferred up, resulting in fewer organisms at higher levels. At each link in an ecosystem elements are combined in different ways and matter and energy are conserved. Photosynthesis and cellular respiration are key components of the global carbon cycle.	Students observe that their jars may support, for example, several ants but only one spider due to approximately 10% of energy making it up to the next trophic level. They observe energy flow between tropic levels as consumers feed. Students also use their jars to model the carbon cycle, focusing on the roles of photosynthesis and cellular respiration.
LS2.C: Ecosystem Dynamics, Functioning, and Resilience If a biological or physical disturbance to an ecosystem occurs, including one induced by human activity, the ecosystem may return to its more or less original state or become a very different ecosystem, depending on the complex set of interactions within the ecosystem.	Students introduce disturbances into their jar ecosystems and observe the resulting changes. The ecosystem may change very little or a lot, often with surprising results. The jar disturbances lead to a discussion about human impacts on large-scale ecosystems.

Crosscutting Concepts

Energy and Matter Energy cannot be created or destroyed. It 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.	Students observe how incoming solar energy drives the water cycle in heir jars, as well as powering photosynthesis. This provides the base of the trophic pyramid which supports life in the ecosystem. Students also trace energy flow in their ecosystems as they develop food webs.
Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.	Ecosystems may remain stable over time, but changes like movement, consumption, and death are always occurring. Students' introduced disturbances may result in the ecosystem returning to its initial state, or the ecosystem may settle into a new, changed state.