HS-LS2: Ecosystems: Interactions, Energy, and Dynamics.

Performance Expectations

Students who demonstrate understanding can:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

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.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural	**LS2.A: Interdependent Relationships in Ecosystems** Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are	**Scale, Proportion, and Quantity** The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1) **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.(HS-LS2-4) 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. (HS-LS1-5),

and designed worlds. Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)	conserved. (HS-LS2-4) Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5)	

Common Core State Standards Connections:

ELA/Literacy –

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (HS-LS2-1, HS-LS2-4)

MP.4 Model with mathematics. (HS-LS2-1, HS-LS2-4)

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1, HS-LS2-4)

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1, HS-LS2-4)

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1, HS-LS2-4)