

# Unit 04A: Interdependent Relationships in Ecosystems - Ecology and Cycles

Content Area: **Science**  
Course(s): **Generic Course**  
Time Period: **Semester 2**  
Length: **1.5 weeks**  
Status: **Published**

## Standards

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### **LS2.A: Interdependent Relationships in Ecosystems** (pp. 150-152, NRC, 2012)

- 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),(HS-LS2-2)

### **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** (pp. 154-156, NRC, 2012)

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)
- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

### **LS2.D: Social Interactions and Group Behavior** (pp. 156-157, NRC, 2012)

- Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8)

### **LS4.C: Adaptation** (pp. 164-166, NRC, 2012)

- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. (HS-LS4-6)

### **LS4.D: Biodiversity and Humans** (pp. 166-167, NRC, 2012)

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HS-LS2-7)
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change.

Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7),(HS-LS4-6.)

### **ETS1.B: Developing Possible Solutions** (pp. 206-208, NRC, 2012)

- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (secondary to HS-LS2-7),(secondary to HS-LS4-6)

Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary to HS-LS4-6)

SCI.9-12.HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
SCI.9-12.HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
SCI.9-12.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.
SCI.9-12.HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
SCI.9-12.HS-LS2-6	Evaluate 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.
SCI.9-12.HS-LS2-8	Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.
SCI.9-12.HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
SCI.9-12.HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
SCI.9-12.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

### **Essential Questions**

- How are organisms and their environment interconnected?
- Which factors influence the ability of living organisms to obtain and use energy to sustain life?

### **Content / Skills**

## Content

- How changes in one part of the ecosystem affect another part.
- How nutrients cycle through an ecosystem.

## Skills

- Create and interpret Food Webs and Food Chains.
- Define and apply ecological terms.
- Distinguish between the different types of feeding relationships.
- Identify Trophic Levels and how energy is transferred from one level to another.
- Use mathematical formulas to justify the concept of an efficient diet.