Unit 03: Populations

Content Area: **Science**
Course(s): **Environmental Science**
Time Period: **Marking Period 1**
Length: **4 weeks**
Status: **Published**

Standards

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)
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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)

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-ESS3-3	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
SCI.9-12.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
SCI.9-12.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
SCI.9-12.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.9-12.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.9-12.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
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-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
SCI.9-12.HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
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-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
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-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
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-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Essential Questions

Describe how and why a population can change over time.

Describe how human population growth can impact the environement.

Content / Skills

Students will investigate the role of biodiversity in ecosystems and the role of animal behavior on survival of individuals and species. Students have increased understanding of interactions among organisms and how those interactions influence the dynamics of ecosystems. Students can generate mathematical comparisons, conduct investigations, use models, and apply scientific reasoning to link evidence to explanations about interactions and changes within ecosystems