HS. Interdependent Relationships in Ecosystems

A Performance Expectations HS.LS2.IRE

1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales. HS.LS2.1
2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. HS.LS2.2
3. 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. HS.LS2.6
4. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS.LS2.7
5. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. HS.LS2.8

B Science and Engineering Practices HS.IRE.SEP

1 Using Mathematics and Computational Thinking HS.IRE.SEP.1

- a Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) HS.IRE.SEP.1A
- b Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) HS.IRE.SEP.1B
- c Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS2-7) HS.IRE.SEP.1C

2 Constructing Explanations and Designing Solutions HS.IRE.SEP.2

- a Design, evaluate, and refine a solution to a complex realworld problem, based on scientific knowledge, studentgenerated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7) HS.IRE.SEP.2A

3 Engaging in Argument from Evidence HS.IRE.SEP.3

- a Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6) HS.IRE.SEP.3A
- b Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8) HS.IRE.SEP.3B

4 Scientific Knowledge is Open to Revision in Light of New Evidence HS.IRE.SEP.4

- a Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2) HS.IRE.SEP.4A
- b Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HS-LS2-6),(HS-LS2-8) HS.IRE.SEP.4B

C Disciplinary Core Ideas HS.IRE.DCI

1. LS2.A: Interdependent Relationships in Ecosystems HS.IRE.DCI.LS2.A
   a. Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. 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. (HSLS2-1),(HS-LS2-2) HS.IRE.DCI.LS2.A.1
   b. (NYSED) Carrying capacity results from the availability of biotic and abiotic factors and from challenges such as predation, competition, and disease. (HS-LS2-1),(HSLS2-2) HS.IRE.DCI.LS2.A.2
2. LS2.C: Ecosystem Dynamics, Functioning, and Resilience HS.IRE.DCI.LS2.C
   a. 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) HS.IRE.DCI.LS2.C.1
   b. 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) HS.IRE.DCI.LS2.C.2
3. LS2.D: Social Interactions and Group Behavior HS.IRE.DCI.LS2.D
   a. Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8) HS.IRE.DCI.LS2.D.1
4. LS4.D: Biodiversity and Humans HS.IRE.DCI.LS4.D
   a. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).(secondarytoHS-LS2-7) HS.IRE.DCI.LS4.D.1
   b. 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.IRE.DCI.LS4.D.2
5. ETS1.B: Developing Possible Solutions HS.IRE.DCI.ETS1.B
   a. 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 HSLS2-7) HS.IRE.DCI.ETS1.B.1

D Crosscutting Concepts HS.IRE.CC

1. Cause and Effect HS.IRE.CC.1
   a. Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2- 7),(HS-LS2-8)
2. Scale, Proportion, and Quantity HS.IRE.CC.2
   a. The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HSLS2-1) HS.IRE.CC.2A
   b. Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2) HS.IRE.CC.2B
3. Stability and Change HS.IRE.CC.3
   a. Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),(HS-LS2-7) HS.IRE.CC.3A