

Next Generation Science Connections to Harvard Forest LTER Schoolyard Ecology Project Themes*

Grade 4:

Life Science; 4LS1-1. *Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior and reproduction. (Leaves, roots, stem, bark, branches, flowers)*

Grade 5:

Earth and Space Sciences; 5-ESS1-2: *Use a model to communicate Earth's relationship to the sun, ...that explain: why people on earth experience day and night; b. patterns in daily changes in length...over a day; and c. changes in the position of the sun...at different times during a day, over a month, and over a year.*

Earth and Space Sciences; 5-ESS3-1: *Obtain and combine information about ways communities reduce the impact on the Earth's resources and environment by changing an agricultural, industrial, or community practice or process.*

Life Science; 5-LS1-1. *Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment; a. show that plants produce sugars ...b. show that some animals eat plants....*

Grade 7:

MS-LS1-4. *Explain, based on evidence, how characteristics animal behaviors as well as specialized plant structures increase the probability of successful reproduction of and plants respectively. (flowers attracting butterflies..., hard shells on nuts that squirrels bury.*

MS-LS2-1. *Analyze and interpret data to provide evidence for the effects of periods of abundant and scarce resources on the growth of organisms and the number of organisms (size of populations)in an ecosystem.*

MS-LS2-2. *Describe how relationships among and between organisms in an ecosystem can be competitive, predatory, parasitic, and mutually beneficial and that these interactions are found across multiple ecosystems.*

MS-LS2-4. *Analyze data to provide evidence that disruptions (natural and human-made) to any physical or biological component of an ecosystem can lead to shifts in all its populations. (focus should be on ecosystems characteristics varying over time)*

MS-LS2-7(MA) *Construct a model of a food web to explain that energy is transferred among producers, primary, secondary, and tertiary consumers, and decomposers as they interact within an ecosystem. (Students should be able to predict changes in relative sizes of populations based on food webs)*

Grade 8:

Earth and Space Sciences MS-ESS1-1b. *Develop and use a model of the Earth-sun system to explain the cyclical pattern of seasons, which includes the Earth's tilt and differential intensity of sunlight on different areas of Earth and across the year.*

Life Science MS-LS1-5. *Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (could include availability of food, light, space, and water)*

Life Science MS-LS4-4. *Explain the mechanism of natural selection, in which genetic variations of some traits in population increases some individuals' likelihood of surviving and reproducing in a changing environment. Provide evidence that natural selection occurs over many generations.*

Grades 9-10:

Earth and Space Systems:

HS-ESS2-4. *Use a model to describe how variations in the flow of energy into and out of the earth's systems result in changes to climate. (causes of climate change differ by timescale...changes in human activity...surface temps...precip. patterns, biosphere distribution)*

HS-ESS3-3. *Illustrate relationships among management of natural resources, the sustainability of human populations, and biodiversity. (habitat use and fragmentation, land and resource conservation)*

HSESS3-5. *Analyze results from global climate models to describe how forecasts are made of the current rate of global or regional climate change and associated future impacts to Earth systems.*

More Grades 9-10:

Biology:

HS-LS1-5. *Use a model to illustrate how photosynthesis uses light energy to transform carbon dioxide and water into oxygen and chemical bonds of glucose and other carbohydrates.*

HS-LS2-1. *Analyze data sets to support explanations that biotic and abiotic factors affect ecosystem carrying capacity. (biotic-feeding relationships, symbioses, competition, disease. Abiotic- climate, weather events)*

HS-LS2-6. *Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere and geosphere. (carbon dioxide, biomass)*

HS-LS2-6. *Evaluate the claims, evidence, and reasoning that in stable conditions the dynamic interactions within an ecosystem tend to maintain relatively consistent numbers and types of organisms even when small changes in conditions occur but that extreme fluctuations in conditions may result in a new ecosystem. Analyze data to provide evidence that ecosystems with greater biodiversity tend to have greater resistance and resilience to change.*

HS-LS2-7. *Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.*

HS-LS4-5. *Evaluate evidence that demonstrates how changes in environmental conditions may result in the emergence of new species over generations and/or the extinction of other species, and that these processes may occur at different rates depending on the conditions.*

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**The standards listed above come from Review of the Mass. Science and Technology/Engineering Framework, 2009-2016*