

Science Standard 8 Ecology

Organisms are linked to one another in an ecosystem by the flow of energy and the cycling of materials. Humans are an integral part of the natural system and human activities can alter the stability of ecosystems.

Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><u>Interactions within the Environment</u></p> <p>Enduring Understanding: Organisms and their environments are interconnected. Changes in one part of the system will affect other parts of the system.</p> <p>Essential Question: How can change in one part of an ecosystem affect change in other parts of the ecosystem?</p>	<p>A. An interconnectedness exists among the living and nonliving parts of an environment. This interconnectedness can be observed by the changes made by plants and animals in their environment. Level: Important</p> <p>B. Plants and animals need enough space and resources to survive. Overcrowding leads to an increased need for resources. Level: Important</p>	<p>A. People depend on living and nonliving resources to satisfy their need for food, shelter, and fuel. Level: Compact</p> <p>B. All living organisms interact with the living and nonliving parts of their surroundings to meet their needs for survival. These interactions lead to a constant exchange of matter. Level: Essential</p> <p>C. Adaptations in organisms enable them to live and reproduce in certain environments. Those organisms that are best suited for a particular environment have adaptations that allow them to compete for available resources and cope with the physical conditions of their immediate surroundings. Level: Essential</p> <p>D. Changes in an organism's environment may be either beneficial or harmful. Organisms may be affected by other organisms, by various physical factors (e.g., rainfall, temperature), by physical forces (e.g., storms, earthquakes), and by daily, seasonal, and annual cycles. Level: Essential</p>	<p>A. All populations living together (biotic factors) and the physical factors with which they interact (abiotic factors) compose an ecosystem. Level: Essential</p> <p>B. Ecosystems do not have precise boundaries. All ecosystems ultimately exchange materials with one another and all influence one another. Level: Compact</p> <p>C. The Delaware Estuary is a semi-enclosed tidal body of water with a free connection to the ocean. This richly productive system, including the associated marshes, provides a variety of habitats for diverse species. This system is biologically and economically important. Level: Compact</p> <p>D. A population consists of all individuals of a species that occur together at a given place and time. A species is a distinct biological grouping of organisms whose members interbreed in nature and produce fertile offspring. Level: Compact</p>	<p>A. Earth's ecosystems are interconnected by biological, chemical, and physical processes. Changes in one ecosystem may have local and/or global consequences. Level: Essential</p> <p>B. Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate complex ecosystems that are stable over long periods of time and tend to have cyclic fluctuations around an equilibrium. Level: Essential</p> <p>C. Ecosystems undergo major changes as a result of such factors as climate change, introduction of new species, and habitat destruction. These can be the result of natural processes and/ or human impact. Level: Essential</p> <p>D. Changes in the physical, chemical, or biological conditions of an ecosystem can alter the diversity of species in the system. Over time, ecosystems change and populations of organisms adapt, move, or become extinct. Level: Important</p>

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<p><u>Interactions within the Environment</u> <i>(Continued from previous page)</i></p>		<p>E. In order to survive, populations within an ecosystem require a balance of resources. Level: Important</p>	<p>E. The size of populations may change as a result of the interrelationships among organisms. These may include predator/prey ratios, availability of resources, and habitat changes. Level: Essential</p> <p>F. In all environments organisms with similar needs may compete with one another for resources including food, water, air, space and shelter. This competition results in natural population fluctuations. Level: Important</p> <p>G. Overpopulation can lead to depletion of resources and potential extinction of species. Level: Essential</p> <p>H. Organisms within an ecosystem may interact symbiotically through mutualism, parasitism, and commensalism. Level: Important</p>	<p>E. The carrying capacity for a specific population in an ecosystem depends on the resources available. Given adequate biotic and abiotic resources and no disease or predators, populations increase at rapid rates. Resources, (limiting factors), predation and climate, limit the growth of populations in specific niches in an ecosystem. Level: Important</p> <p>F. Populations can increase through exponential growth. Higher populations result in competition for limited resources and increases in environmental pollution. Level: Essential</p>

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<p><u>Energy Flow and Material Cycles in the Environment</u></p> <p>Enduring Understandings: Matter needed to sustain life is continually recycled among and between organisms and the environment. Energy from the Sun flows irreversibly through ecosystems and is conserved as organisms use and transform it.</p> <p>Essential Questions: How do matter and energy link organisms to each other and their environments? Why is sunlight essential to life on Earth?</p>	<p>A. All animals depend on plants. Some animals eat plants for food. Other animals eat animals that have eaten plants. Level: Important</p>	<p>A. Plants need energy from the Sun, water and nutrients for growth and survival. Level: Essential</p> <p>B. Animals eat plants or other animals that have eaten plants. Animals obtain energy and materials for body repair and growth from food. Level: Essential</p> <p>C. Dead plants and animals are broken down by decomposers. Level: Essential</p>	<p>A. In most ecosystems, energy enters as sunlight and is transformed by producers into a biologically usable form of matter through photosynthesis. That matter and energy then passes from organism to organism through food webs. Some energy is released from the system as heat. Level: Essential</p> <p>B. Over time, matter is transferred repeatedly from one organism to another and between organisms and their physical environment. As in all material systems, the total amount of matter remains constant, even though its form and location change. Level: Essential</p> <p>C. All organisms, including humans, are part of and depend on food webs. Food webs recycle matter continuously as organisms are decomposed after death to return food materials to the environment where it re-enters a food web. Level: Important</p>	<p>A. The Law of Conservation of Matter applies to ecosystems. Matter needed to sustain life in ecosystems is continually recycled (e.g., carbon cycle, water cycle, nitrogen cycle, mineral cycles) among organisms and between organisms and the environment. Level: Essential</p> <p>B. The Law of Conservation of Energy applies to ecosystems. All energy is conserved as it passes from the Sun through an ecosystem. During energy transformations, some energy is converted to unusable heat. A continual input of energy from the Sun keeps the process going. Level: Essential</p> <p>C. At each level of a food pyramid some energy is stored, but much is dissipated as heat. Consequently the number of trophic levels is finite, and the number of individuals in a population that feed at higher levels is limited. Level: Important</p>

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<p><u>Energy Flow and Material Cycles in the Environment</u> <i>(Continued from previous page)</i></p>				<p>D. Biomagnification is an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Biomagnification increases as trophic levels increase. Level: Important</p> <p>E. Understanding the process of biomagnification is very important in protecting human beings and other organisms from the adverse effects of chemical exposure, and has become a critical consideration in the regulation of chemical use. Level: Compact</p>

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<p><u>Human Impact</u></p> <p>Enduring Understanding: Humans can alter the living and non-living factors within an ecosystem, thereby creating changes to the overall system.</p> <p>Essential Question: How do humans have an impact on the diversity and stability of ecosystems?</p>	<p>A. Many natural resources are limited. The amount available can be made to last longer by decreasing the use of some resources or by reusing or recycling certain materials. Level: Essential</p>	<p>A. Human activities may cause pollution of air, water and soil. Level: Important</p> <p>B. Different technologies are used to access resources to meet human wants and needs. In many cases the environment is affected and resources become limited. Some activities may include burning of fossil fuels, logging, building of highways, shopping centers, and dams, introduction of one species to control another species, spraying of insects, as well as some aspects of farming. Level: Important</p>	<p>A. Humans can alter the biotic and abiotic factors within an ecosystem thereby creating changes to the overall system. Level: Essential</p> <p>B. The introduction of competing species, removal of natural habitat, alteration of native landscapes due to urban, industrial and agricultural activities, over-harvesting of species, alteration of waterways and removal of natural predators, etc., are actions that have a lasting impact on ecosystems. Level: Essential</p> <p>C. Individuals and policymakers make decisions regarding the use of resources based on estimated personal and societal benefits and risks. Impacts on environmental systems result from these decisions. Level: Compact</p>	<p>A. Exponential growth of the global human population and the resulting increase in consumption places severe stress on finite resources. Level: Essential</p> <p>B. Human decisions concerning the use of resources can affect the stability and biodiversity of the ecosystems and the natural recycling processes which maintain the quality of air, water, and land. Level: Essential</p> <p>C. Human activities have a major effect on other species. For example, increased land use reduces habitat available to other species, pollution changes the chemical composition of air, soil, and water, and introduction of non-native species disrupts the ecological balance. Level: Essential</p> <p>D. Advances in technology can help mitigate human impact on the environment and increase the carrying capacity of the ecosystem. Level: Important</p>

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<u>Human Impact</u> <i>(Continued from previous page)</i>				E. The complexity and interaction of these ecosystems requires individual and collaborative efforts on a local, regional, national, and international scale. Level: Compact