Alabama Science

Environmental Science

Ecosystems: Interactions, Energy, and Dynamics

Matter and Energy Flow

Energy and Matter

1 Use mathematical representations to illustrate how the first two laws of thermodynamics demonstrate energy transfers throughout ecosystems, including food chains, food webs, and trophic levels, at various levels of biological organization. ES.1

2 Obtain, evaluate, and communicate information to model the cycling of matter through the biosphere, atmosphere, hydrosphere, and geosphere, including the flow of carbon, water, nitrogen, phosphorus, and sulfur. ES.2

Unity and Diversity

Biodiversity

Cause and Effect

3 Construct an explanation of how biotic and abiotic factors affect biodiversity and populations in ecosystems. ES.3

Biodiversity

Scale, Proportion, and Quantity

Support a claim that biodiversity is a natural resource which fosters ecosystem resilience, including the role of keystone, invasive, native, endemic, and indicator species. ES.3.A

a **Support a claim that biodiversity is a natural resource which fosters ecosystem resilience, including the role of keystone, invasive, native, endemic, and indicator species.** ES.3.A

Analyze and interpret data collected through geographic research and field investigations to describe Alabama's biodiversity by region. ES.3.B

b **Analyze and interpret data collected through geographic research and field investigations to describe Alabama's biodiversity by region.** ES.3.B

Earth's Systems

System Interactions

Stability and Change

4 Engage in an evidence-based argument to explain how Earth's systems affect the biosphere and the biosphere affects Earth's systems over various amounts of time. ES.4

5 Obtain, evaluate, and communicate information regarding how short-term and long-term natural cyclic fluctuations cause ecosystem change. ES.5

Earth and Human Activity

Natural Resources

Cause and Effect

6 Obtain, evaluate, and communicate information to describe the use of renewable and nonrenewable energy sources. ES.6

Natural Resources

Structure and Function

Natural Resources

Scale, Proportion, and Quantity

7 Obtain, evaluate, and communicate information to describe the development, management, and recycling of mineral resources. ES.7

Human Impact

Cause and Effect

8 Construct or revise a claim based on evidence of the effects of human activities on Earth's systems, natural resources, and ecosystem services. ES.8

- a Evaluate published information from computational models which illustrate the effects of an increase in atmospheric carbon dioxide on photosynthesis and the effect of ocean acidification on marine populations. ES.8.A
- b Use engineering practices to evaluate and refine a current solution designed to protect natural resources from anthropogenic sources of atmospheric, terrestrial, or aquatic pollution. ES.8.B

9 Obtain, evaluate, and communicate information based on evidence to explain how key natural resources, natural hazards, and climate variability influence human activity and welfare. ES.9

- a Communicate scientific information about how environmental change may disproportionately impact people in certain socioeconomic groups or geographic locations. ES.9.A

10 Use mathematics and graphic models to communicate how human activity may affect genetic variation in organism populations, including threatened and endangered species. ES.10

Human Population and Global Change

Patterns

11 Construct an explanation of how human populations undergo growth and decline. ES.11

a Analyze and interpret data on human population trends in developing and developed countries and in the global population as a whole. ES.11.A

Human Population and Global Change

Scale, Proportion, and Quantity

Human Population and Global Change

Cause and Effect

12 Obtain, evaluate, and communicate information to describe the effects of human population growth on global ecosystems. ES.12

a Evaluate and communicate information describing the impact of measures used to increase the food supply for the growing human population, including the use of GMOs, monocultures, integrated pest management (IPM), and precision agriculture. ES.12.A

b Evaluate and communicate information describing the effects of urbanization on the environment. ES.12.B

Human Population and Global Change

Scale, Proportion, and Quantity

13 Design and defend a sustainability plan to reduce an individual's ecological footprint, taking into account how market forces and societal demands influence personal choices. ES.13

Analyze and interpret data on the origins and availability of renewable and nonrenewable forms of energy to predict consumption trends. ES.6.A

a **Analyze and interpret data on the origins and availability of renewable and nonrenewable forms of energy to predict consumption trends.** ES.6.A

Construct an argument based on data about the risks and benefits of using renewable and nonrenewable energy sources in Alabama. ES.6.B

b **Construct an argument based on data about the risks and benefits of using renewable and nonrenewable energy sources in Alabama.** ES.6.B

Construct explanations of the types of environmental impacts produced by human populations in each stage of the demographic transition model. ES.11.B

b **Construct explanations of the types of environmental impacts produced by human populations in each stage of the demographic transition model.** ES.11.B