

AP Environmental Science



UNIT 1: The Living World - Ecosystems

ESSENTIAL QUESTIONS

How do matter and energy move and change forms through ecosystems?

BIG IDEAS

- Students will examine the distribution of resources in ecosystems and its influences on species interactions.
- Students will understand there is a global distribution of terrestrial and aquatic biomes.
- Students will understand that ecosystems rely on biogeochemical cycles for survival.

GUIDING QUESTIONS

Content

- How does the availability of resources influence species interactions?
- What is the global distribution and principal environmental aspects of terrestrial and aquatic biomes?
- What are abiotic and biotic factors that determine the nature of ecosystems?
- How do living organisms acquire and transfer solar energy?
- How does energy flow and matter cycle through trophic levels?
- What are food webs and food chains?
- First Law of Thermodynamics

Process

- What are the steps and reservoir interactions in the carbon cycle?
- What are the steps and reservoir interactions in the nitrogen cycle?
- What are the steps and reservoir interactions in the phosphorus cycle?
- What are the steps and reservoir interactions in the hydrologic (water) cycle?
- What is the process by which matter and energy is transferred through a food chain or food web?

Reflective

- How does energy get converted from one form to another?
- How does energy decrease as it flows through ecosystems?
- How do positive and negative feedback loops play a role in food webs?

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UNIT 2: The Living World: Biodiversity

ESSENTIAL QUESTIONS

How do organisms within ecosystems adapt to the changes created by disruptions?

BIG IDEAS

- Students will understand how biodiversity, which includes genetic, species, and habitat diversity, is critically important to ecosystems
- Students will explore how organisms within ecosystems must adapt to the changes created by both natural and human disruptions.

GUIDING QUESTIONS

Content

- What are the different levels of biodiversity and their importance in ecosystems?
- What are ecosystem services and how do humans disrupt the distribution of those services?
- What is island biogeography and its role in evolution?
- What is ecological tolerance?
- How do long and short term natural disruptions impact an ecosystem?
- How do pioneer species impact the successional species of ecosystems after disruptions?

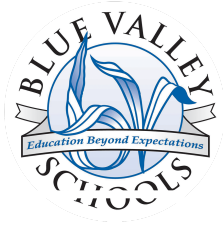
Process

- What is the process by which organisms adapt to their environment?
- What is the process of primary and secondary succession in ecosystems?

Reflective

- How does the structure and diversity of ecosystems change over time?
- What are the environmental consequences of natural disruptions versus human-made disruptions?
- How do environmental changes threaten a species' chances of survival?

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UNIT 3: Populations

ESSENTIAL QUESTIONS

How do populations within ecosystems change over time?

BIG IDEAS

- Students will examine the relationship between the type of species and the changes in a habitat over time.
- Students will understand how population growth is limited by environmental factors.
- Students will understand various interspecific and intraspecific interactions.

GUIDING QUESTIONS

Content

- What are the differences between generalists and specialists species? What type of environment fits a generalist species? What type of environment fits a specialist species?
- What are the differences between K- and r- selected species when it comes to reproduction, longevity of life and care of offspring?
- What are the three types of survivorship curves?
- What is carrying capacity and its impact on an ecosystem?
- How does the availability of resources affect population growth?
- What factors go into determining the growth or decline of a human population?
- What are the limiting factors as set forth by the Malthusian Theory that impact Earth's carrying capacity?
- What is demographic transition and what are the four different stages?

Process

- What factors impact total fertility rates in humans?
- What does a stable population entail?
- How does the rule of 70 help determine a population's doubling rate?
- How does a population transition through the different levels of demographic transition?

Reflective

- How do the three types of survivorship curves relate to K- or r-selected species?
- What occurs when populations overshoot their carrying capacity?
- Can you determine the population dynamics of a city/country by using age structure diagrams?

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UNIT 4: Earth Systems and Resources

ESSENTIAL QUESTIONS

How do earth systems and resources support life?

- Students will understand geological changes resulting from plate tectonics.
- Students will understand weathering, erosion, and characteristics of soil.
- Students will describe atmospheric composition and explain global air and water currents.

BIG IDEAS

GUIDING QUESTIONS

Content

- What are the similarities and differences between the properties of different soil types?
- What is the structure and composition of the Earth's atmosphere?
- What are the characteristics of watersheds?

Process

- How do the events and changes that occur at convergent, divergent, and transform plate boundaries affect the geology of the earth?
- How is soil formed?
- How does the sun's energy affect the Earth's surface?
- How does the Earth's geography affect weather and climate?

Reflective

- What environmental factors influence atmospheric circulation?
- What are the environmental changes and effects that result from El Niño or La Niña events (El Niño–Southern Oscillation)?

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UNIT 5: Land and Water Use

ESSENTIAL QUESTIONS

How does the use of natural resources impact the world?

BIG IDEAS

- Students will explore human activities that disrupt ecosystems and methods employed to reduce impact.
- Students will examine human use of natural resources.

GUIDING QUESTIONS

Content

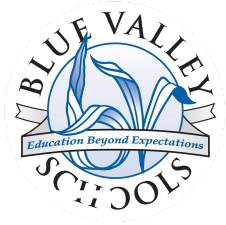
- What is the tragedy of the commons?
- What agricultural practices cause environmental damage?
- What are the different methods of irrigation?
- What are the different methods of meat production?
- What variables are measured in an ecological footprint?
- What is sustainability?

Process

- How have agricultural practices changed over time?
- How is mining used for natural resource extraction?
- What methods are used for mitigating problems related to urban runoff?
- What methods are used for mitigating human impacts on forests?

Reflective

- What are the effects of clearcutting forests?
- What are the benefits and drawbacks of different methods of irrigation?
- What are the benefits and drawbacks of different methods of pest control?
- What are the benefits and drawbacks of different methods of meat production?
- What are the causes of and problems related to overfishing?
- What are the ecological and economic impacts of natural resource extraction through mining?
- What are the effects of urbanization on the environment?
- What are the benefits and drawbacks of integrated pest management?
- What are sustainable agricultural food production practices?
- What are the benefits and drawbacks of aquaculture?



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UNIT 6: Energy Resources and Consumption

ESSENTIAL QUESTIONS

How does human use of renewable and nonrenewable energy resources impact the environment?

BIG IDEAS

- Students will explain concepts related to renewable and nonrenewable energy resources.
- Students will describe regional differences in energy resource availability and use.

GUIDING QUESTIONS

Content

- What are the differences between nonrenewable and renewable energy sources?
- What are the different types of fuels and how are they used?
- Where are the various types of natural energy resources located?

Process

- What trends exist in energy consumption?
- What methods are used in power generation using fossil fuels?
- How is nuclear energy used in power generation?
- How is solar energy used in power generation?
- How is hydroelectricity used in power generation?
- How are hydrogen fuel cells used in power generation?
- How is wind energy used in power generation?
- What methods are used for conserving energy?

Reflective

- Why are fossil fuels the most widely used energy resource if they are nonrenewable?
- What are the effects of fossil fuels on the environment?
- What are the effects from the use of nuclear energy on the environment?
- What are the effects from the use of biomass in power generation on the environment?
- What are the effects from the use of solar energy in power generation on the environment?
- What are the effects from the use of hydroelectricity in power generation on the environment?
- What are the effects from the use of hydrogen fuel cells in power generation on the environment?
- What are the effects from the use of wind energy in power generation on the environment?



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UNIT 7: Atmospheric Pollution

ESSENTIAL QUESTIONS

How do human activities affect air quality?

BIG IDEAS

- Students will examine the sources and effects of both indoor and outdoor air pollution.
- Students will learn about the natural and human sources of air pollution.
- Students will explore different methods to reduce air pollution.

GUIDING QUESTIONS

Content

- What are the sources of air pollution?
- What are the effects of air pollution?
- What are primary and secondary air pollutants?
- What is thermal inversion?
- What are the natural sources of Carbon Dioxides and particulates?
- What are indoor air pollutants?
- What are the impacts of being exposed to indoor air pollutants?
- What is acid deposition and how does it impact an environment?

Process

- What are the causes and effects of photochemical smog?
- What are the methods to reduce photochemical smog?
- What can be done to reduce air pollutants, specifically at the source?

Reflective

- How did the introduction of the Clean Air Act help regulate the use of different chemicals in manufacturing and fossil fuel usage, specifically lead?
- How does thermal inversion impact air pollution and smog episodes?
- How does human activity have a physical, chemical and biological consequence for the atmosphere?
- How do human activities result in noise pollution?

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UNIT 8: Aquatic and Terrestrial Pollution

ESSENTIAL QUESTIONS

How does pollution created by human activities directly impact ecosystems on land and in water?

BIG IDEAS

- Students will learn about the human activities that have a direct impact in the air, on land and in water.
- Students will explore how to identify sources of air pollution.
- Students will discover the human health issues that can be linked to pollution

GUIDING QUESTIONS

Content

- What are the differences between point and nonpoint sources of pollution?
- How do human activities impact aquatic ecosystems?
- What are oceanic dead zones and how are they caused?
- How the introduction of heavy metals, litter and increased sediment negatively impact aquatic ecosystems?
- What are endocrine disruptors and what is their impact on ecosystems?
- What are impacts of human activity on wetlands and mangroves?
- How does thermal pollution affect aquatic ecosystems?
- What are POPs and how do they impact ecosystems?
- What is the impact of bioaccumulation and biomagnification?
- What are the impacts of solid waste disposal?
- What are the best methods of sewage treatment?
- What is "lethal dose 50%" (LD_{50})?
- What are different sources of pollution that can lead to different human health issues?

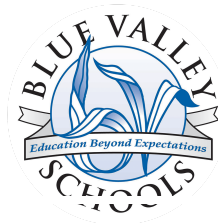
Process

- What is the process of biomagnification and bioaccumulation?
- What are the processes used to dispose of solid waste?
- Can you evaluate the dose response curves for different toxins or drugs?
- How do human pathogens cycle through environments and cause harm?

Reflective

- How does human activity have a physical, chemical and biological consequence for ecosystems?
- How does the mismanagement of oil spills and oil wash us impact aquatic and aquatic adjacent ecosystems?
- How does the excessive use of fertilizers and detergents impact aquatic ecosystems?
- What are the benefits and drawbacks of the current practices that could reduce the amount of generated waste?
- What are the direct and indirect impact of pollutants on the health of organisms, including humans?

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UNIT 9: Global Change

ESSENTIAL QUESTIONS

What is the global impact of local and regional human activities?

BIG IDEAS

- Students will learn about the human activities that contribute to global impacts in the areas of climate change, ocean warming and endangered species.
- Students will explore ways to mitigate their impact through sustainable use of resources

GUIDING QUESTIONS

Content

- What is the stratospheric ozone layer and its importance on Earth?
- What are chlorofluorocarbons (CFCs) and their impact on the ozone layer?
- What are alternative chemicals for CFCs?
- What is the greenhouse effect? What are the different greenhouse gases, their sources and potency in the atmosphere?
- What are the causes and effects of ocean warming?
- What are the causes and effects of ocean acidification?
- What are the environmental problems associated with invasive species and what are strategies used to control them?
- What are strategies used to combat endangered species from going extinct?
- What are strategies to combat the problem of habitat loss, changes in sea temperature, sea level rise and precipitation?

Process

- How do rising temperatures impact sea levels, sea ice, melting permafrost and displacement of coastal populations?
- How does warming oceans impact ocean currents and ocean conveyor belts?
- How does a warming Earth impact solar energy?
- How do species become endangered?

Reflective

- How do local and regional human activities have a global impact?
- How does the excess of greenhouse gases threaten the health of humans?
- How do short and long term changes in a climate impact ecosystems?
- What are the consequences of loss of snow and ice?
- How does the health of species closely tied to ecosystems have a large impact if removed or changes occur?
- How do human activities affect biodiversity?