

AP Environmental Science

Chapter 3: Ecosystem Ecology

Objectives: Students should be able to...

3.1 - list the basic components of an ecosystem.

- 3.1.1 Identify the parts that make up an ecosystem
- 3.1.2 Explain the components that impact what type of ecosystems occur in different areas
- 3.1.3 Identify examples of different boundaries that set apart ecosystems
- 3.1.4 Describe processes that are not bound to ecosystem boundaries

3.2 - describe how energy flows through ecosystems.

- 3.2.1 Identify organisms that are autotrophs and be able to identify reactants and products of photosynthesis
- 3.2.2 Identify organisms that do cellular respiration and the reactants and products of respiration
- 3.2.3 Differentiate between primary, secondary, and tertiary consumers and be able to label on a food chain and food web
- 3.2.4 Define and identify consumers, producers, scavengers, detritivores, and decomposers in a food web
- 3.2.5 Explain the connection between Gross Primary Productivity (GPP) and Net Primary Productivity and be able to calculate given each given numerical values
- 3.2.6 Compare and contrast ecosystems based on their productivity and identify the factors that impact their ability to be productive
- 3.2.7 Define ecological efficiency and identify the value for efficiency that most ecosystems operate at in nature

3.3 - describe how carbon, nitrogen, and phosphorus cycle within ecosystems.

- 3.3.1 Define biogeochemical
- 3.3.2 Explain the roles of flows and pools in biogeochemical cycles
- 3.3.3 Identify the flows & pools within the hydrological cycle & explain how the processes work together
- 3.3.4 Identify the flows & pools within the carbon cycle & explain how the processes work together
- 3.3.5 Identify the flows & pools within the nitrogen cycle & explain how the processes work together
- 3.3.6 Identify the flows & pools within the phosphorus cycle & explain how the processes work together
- 3.3.7 Explain how humans are altering each of the cycles mentioned in the previous objectives

3.4 - explain how ecosystems respond to natural and anthropogenic disturbances.

- 3.4.1 Define disturbance as it pertains to an ecosystem
- 3.4.2 Define watershed and explain the role it can play in studying the environment
- 3.4.3 Compare and contrast resistance and resilience
- 3.4.4 Define restoration ecology, explain why it is important, and identify key examples
- 3.4.5 Explain the science behind the intermediate disturbance hypothesis

3.5 - discuss the values of ecosystems and how humans depend on them.

- 3.5.1 Differentiate between instrumental and intrinsic values of an ecosystems
- 3.5.2 Explain how the following instrumental services provide value to humans
 - 3.5.2.1 Provisions
 - 3.5.2.2 Regulating Services
 - 3.5.2.3 Support Systems
 - 3.5.2.4 Resilience
 - 3.5.2.5 Cultural Services
- 3.5.3 Explain the factors that impact the intrinsic value of an ecosystem

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Chapter 4a: Global Climate and Weather

Objectives: Students should be able to...

4.1 - explain the forces that drive global circulation patterns and how those patterns determine weather and climate.

- 4.1.1 Explain the difference between weather and climate
- 4.1.2 List the layers of the atmosphere starting at the Earth's surface and moving up
- 4.1.3 Identify the temperature differences between each layer and the science behind these differences
- 4.1.4 List the important traits of each layer as it pertains to the environment and humans
- 4.1.5 Explain how the tilt of the Earth relates to seasons and identify the Earth's position for each season in the Northern hemisphere
- 4.1.6 Define albedo and identify areas on the earth with low and high albedo
- 4.1.7 Define adiabatic heat and adiabatic cooling and connect each to convection currents
- 4.1.8 Identify the location of Hadley and polar cells on a globe
- 4.1.9 Explain the effect Hadley cells and polar cells have on global climate
- 4.1.10 Explain what the Intertropical Convergence Zone (ITCZ) is and its connection to weather
- 4.1.11 Describe the Coriolis Effect and use it to determine global wind patterns
- 4.1.12 Define gyres and identify their role in global climates
- 4.1.13 Connect upwellings to ocean productivity
- 4.1.14 Explain the science behind thermohaline circulation
- 4.1.15 Identify the differences in ocean temperatures and weather based on El Nino
- 4.1.16 Identify the properties on different sides of a mountain based on the rain shadow effect and know the science behind why the rain shadow effect occurs

4.2 - describe the major terrestrial biomes.

- 4.2.1 Correctly identify biomes on the Whittaker diagram based on their average temperature and annual precipitation
- 4.2.2 Label biomes on a map of the world
- 4.2.3 Identify the growing season on a climate diagram and explain why the growing season occurs during that time period
- 4.2.4 List the major characteristics and unique terms that apply to the following biomes and the reasons behind the characteristics
 - 4.2.4.1 Tundra
 - 4.2.4.2 Boreal Forest
 - 4.2.4.3 Temperate Rainforest
 - 4.2.4.4 Temperate Seasonal Forest
 - 4.2.4.5 Woodland/Shrubland
 - 4.2.4.6 Temperate Grassland/Cold Desert
 - 4.2.4.7 Tropical Rainforest
 - 4.2.4.8 Tropical Seasonal Forest/Savanna
 - 4.2.4.9 Subtropical Desert

4.3 - describe the major aquatic biomes.

- 4.3.1 Explain the properties of a lake and stream that make it different than a lake
- 4.3.2 Label the parts of a lake and the properties of each part
- 4.3.3 Identify the different types of wetlands and the vital roles wetlands play in the environment
- 4.3.4 Identify the unique properties of salt marshes and their importance to the greater environment
- 4.3.5 Explain the importance of mangroves to coastlines
- 4.3.6 Identify the types of organisms that live in an intertidal zone and explain why those organisms must have unique adaptations
- 4.3.7 Explain the importance of coral reefs to humans
- 4.3.8 Describe the organisms that makeup coral and also the diversity of other organisms in the reef
- 4.3.9 Explain what coral bleaching is, what causes it, and what its effects would be if it occurs
- 4.3.10 Label the zones of the open ocean and list the properties of each zone

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Chapter 5: Evolution of Biodiversity

Objectives: Students should be able to...

5.1 - explain the concept of biodiversity and how it is measured.

- 5.1.1 Differentiate between ecosystem, species and genetic diversity.
- 5.1.2 List the number of species named and number of species estimated on Earth.
- 5.1.3 Define species richness and species evenness. Give an example of an area with high richness and low evenness, high richness and high evenness, low richness and high evenness, etc.
- 5.1.4 Describe why scientists use phylogenies and interpret a phylogenetic tree.

5.2 - describe the ways in which evolution can occur.

- 5.2.1 Differentiate and give examples of micro and macro evolution.
- 5.2.2 Describe how mutations occur and how they can affect offspring.
- 5.2.3 Define genotype and phenotype and give one example of each. Are phenotypes only determined by an organism's genes?
- 5.2.4 Define and describe examples of evolution by artificial selection (examples to know: dog domestication, edible plants from mustard, herbicide/antibiotic resistant organisms).
- 5.2.5 Explain evolution by natural selection and include Darwin's 5 key ideas.
- 5.2.6 Define fitness and adaptations and explain how they both relate to each other.
- 5.2.7 Explain evolution by random processes including mutation, genetic drift, bottleneck effect and founder effect.

5.3 - explain how environmental change affects speciation and extinction.

- 5.3.1 Define geographic isolation and give examples.
- 5.3.2 Define reproductive isolation.
- 5.3.3 Describe how allopatric speciation occurs.
- 5.3.4 Define sympatric speciation and explain the role polyploidy plays.
- 5.3.5 Explain the relationship between the pace of evolution and rate of environmental change, genetic variation, population size, and generation time.
- 5.3.6 Describe the process of genetic engineering to create genetically modified organisms. Give several examples.

5.4 - explain the concept of an ecological niche.

- 5.4.1 Differentiate between fundamental and realized niche.
- 5.4.2 List key characteristics of generalists and specialists.
- 5.4.3 Describe how environmental changes altered tree species distribution over time.
- 5.4.4 Identify three reasons why a species might go extinct.
- 5.4.5 Define mass extinction and list how many Earth has experienced.
- 5.4.6 Describe what scientists believed caused the extinction of the dinosaurs.
- 5.4.7 Describe how the current mass extinction is different than previous mass extinctions.