AP Environmental Science Exam Prep Session: The Living World

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AP Environmental Science Topic Outline

II. The Living World (10–15%)
- A. Ecosystem Structure
  (Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)
- B. Energy Flow
  (Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)
- C. Ecosystem Diversity
  (Biodiversity; natural selection; evolution; ecosystem services)
- D. Natural Ecosystem Change
  (Climate shifts; species movement; ecological succession)
- E. Natural Biogeochemical Cycles
  (Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)

Important Legislation

Endangered Species Act (ESA): identifies threatened and endangered species in the US, and puts their protection ahead of economic considerations.
Convention on International Trade in Endangered Species (CITES): lists species that cannot be commercially traded as live specimens or wildlife products.
Lacey Act: prohibits interstate transport of wild animals dead or alive without federal permit.
U.S. Marine Mammal Protection Act: prohibits taking marine mammals in U.S. waters and by U.S. citizens, and the importing marine mammals and marine mammal products into the U.S.

Important Terms

Biotic: the living components of an ecosystem.
Abiotic: the nonliving components of an ecosystem.
Producer/Autotroph: organisms that make their own food—photosynthetic life (plants).
Trophic Levels: producers → primary consumer → secondary consumer → tertiary consumer.
Energy Flow through Food Webs: 10% of the usable energy is transferred to the next trophic level. Reason: usable energy lost as heat
(2nd law of Thermodynamics), not all biomass is digested & absorbed, predators expend energy to catch prey.
Primary succession: development of communities in a lifeless area not recently inhabited by life (ex. lava flow, retreating glacier).
Secondary succession: life progresses where soil remains (ex. clear-cut/burned forest, old farm, vacant lot).
Mutualism: symbiotic relationship where both organisms benefit.
Commensalism: symbiotic relationship where one organism benefits & the other is unaffected.
Parasitism: relationship in which one organism (the parasite) obtains nutrients at the expense of the host.
Photosynthesis: plants convert CO_2 (atmospheric carbon) into complex carbohydrates (glucose $C_6H_{12}O_6$).
Aerobic Respiration: oxygen consuming producers, consumers & decomposers break down complex organic compounds & convert C back into CO_2.
Nitrogen Fixation: because atmospheric N cannot be used directly by plants, it must first be converted into ammonia by bacteria. **Ammonification:** decomposers covert organic waste into ammonia.
Nitrification: ammonia is converted to nitrate ions (NO_3^-).
Assimilation: inorganic N is converted into organic molecules such as DNA/amino acids & proteins.
Denitrification: bacteria convert ammonia back into N.
Phosphorus: does not exist as a gas; released by weathering of phosphate rocks, it is a major limiting factor for plant growth. Phosphorus cycle is slow, and not atmospheric.
Hydrologic Cycle Components: evaporation, transpiration, runoff, condensation, precipitation, and infiltration.
Keystone Species: species whose role in an ecosystem is more important than others.
Indicator Species: species that serve as early warnings that an ecosystem is being damaged.
In Natural Ecosystems: 50-90% of pest species are kept under control by: predators, diseases, parasites.

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Endangered Species

Most Endangered Species: have a small range, require large territory, have long generations, have a very specialized niche, or live on an island.

Atlantic Salmon: interbreeding with and competition from escaped farm-raised salmon from the aquaculture industry threaten the wild salmon population.
California Condor: reasons for decline include shootings, poisoning, lead poisoning, collisions with power lines, egg collecting, pesticides, habitat loss, and the decline of large and medium-size native mammals due to encroachments of agriculture and urbanization.
Delhi Sands Flower-Loving Fly: a 1-inch long insect currently restricted to only 12 known populations in San Bernardino and Riverside counties. An estimated 98% of its habitat has been converted to residential, agricultural, and commercial use.
Florida Panther: hunting and development that resulted in habitat loss and fragmentation.
Gray Wolf: subject of predator eradication programs sponsored by the Federal government. Prior to Endangered Species Act (1973), exterminated from the lower 48 states except for a few hundred inhabiting extreme northeastern Minnesota and a small number on Isle Royale, Michigan
Grizzly Bear: conflict with humans and development that resulted in habitat loss and fragmentation
Piping Plover: predation and human disturbance are thought to be the main causes of the plover's decline. It is listed as endangered in the Great Lakes region and as threatened in the Great Plains and on the Atlantic coast
Manatee: initial population decreases resulted from overharvesting for meat, oil, and leather. Today, heavy mortality occurs from accidental collisions with boats and barges, and from canal lock operations.
Whooping Crane: drainage of wetlands, conversion of grasslands to agriculture, and hunting for feathers.

NOT Endangered Species

American Alligator: overhunting and destruction of habitat caused original listing, removed from the list of endangered species by the Fish and Wildlife Service in 1987.
Bald Eagle: ingested DDT by eating contaminated fish. The pesticide caused the shells of the bird's eggs to thin and resulted in nesting failures. Loss of nesting habitat and hunting for feathers also contributed to the population decline. Reclassified from endangered to threatened (1995).
Peregrine Falcon: ingested DDT by eating smaller birds, which had eaten contaminated prey. The pesticide caused the shells of the bird's eggs to thin and resulted in nesting failures. Removed from the list of endangered species by the Fish and Wildlife Service in August 1999.
Gray Whale: the eastern North Pacific stock of gray whale has the distinction of being the first population of a marine mammal species to be removed from the List of Endangered and Threatened Species.

Biomes

Biome: large distinct terrestrial region having similar climate, soil, plants & animals.
Tropical Rain Forests: characterized by the greatest diversity of species, believed to include many undiscovered species. Occur near the equator. Soils tend to be low in nutrients. Distinct seasonality: winter is absent, and only two seasons are present (rainy and dry).
Temperate Forests: occur in eastern North America, Japan, northeastern Asia, and western and central Europe. Dominated by tall deciduous trees. Well-defined seasons include a distinct winter. Logged extensively, only scattered remnants of original temperate forests remain.
Boreal Forests or Taiga: represent the largest terrestrial biome. Dominated by needleleaf, coniferous trees. Found in the cold climates of Eurasia and North America: two-thirds in Siberia with the rest in Scandinavia, Alaska, and Canada. Seasons are divided into short, moist, and moderately warm summers and long, cold, and dry winters. Extensive logging may soon cause their disappearance.
Temperate Shrub Lands: occurs along the coast of Southern California and the Mediterranean region. Characterized by areas of Chaparral–miniature woodlands dominated by dense stands of shrubs.
Savannas: grassland with scattered individual trees. Cover almost half the surface of Africa and large areas of Australia, South America, and India. Warm or hot climates where the annual rainfall is 20-50 inches per year. The rainfall is concentrated in six or eight months of the year, followed by a long period of drought when fires can occur.
Temperate Grasslands: dominated by grasses, trees and large shrubs are absent. Temperatures vary more from summer to winter, and the amount of rainfall is less than in savannas. Temperate grasslands have hot summers and cold winters. Occur in South Africa, Hungary, Argentina, the steppes of the former Soviet Union, and the plains and prairies of central North America.
Deserts: covers about one fifth of the Earth's surface and occur where rainfall is less than 50 cm/year. Most deserts occur at low latitudes, have a considerable amount of specialized vegetation, as well as specialized animals. Soils have abundant nutrients, need only water to become productive, and have little or no organic matter. Common disturbances include occasional fires or cold weather, and sudden, infrequent, but intense rains that cause flooding.
Tundra: treeless plains that are the coldest of all the biomes. Occur in the arctic and Antarctica. Dominated by lichens, mosses, sedges, and dwarfed shrubs Characterized by extremely cold climate, permanently frozen ground (permafrost) low biotic diversity, simple vegetation structure, limitation of drainage, short season of growth and reproduction.
Wetlands: areas of standing water wet all or most of the year that support aquatic plants including marshes, swamps, and bogs. Species diversity is very high. Includes bogs, swamps, sloughs, marshes
Fresh Water: defined as having a low salt concentration (less than 1%). Plants and animals are adjusted to the low salt content and would not be able to survive in areas of high salt concentration (i.e., ocean). There are different types of freshwater regions: ponds and lakes, streams and rivers, and estuaries.
Oceans: the largest of all the ecosystems. The ocean regions are separated into separate zones: intertidal, pelagic, abyssal, and benthic. All four zones have a great diversity of species.