Ecology

IB/AP Biology

Reading and Objectives

I. Energy Flow and Productivity in Ecosystems

*Ch 50 pgs 1026-1030 and *Ch 54 pgs 1131-1138

4.1.1 Define ecology, ecosystem, population, community, species and habitat. 1
4.1.2 Explain how the biosphere consists of interdependent and interrelated ecosystems. 3
4.1.3 Define autotroph (producer), heterotroph (consumer), detritivore and saprotroph (decomposer). 1
4.1.4 Describe what is meant by a food chain giving three examples, each with at least three linkages (four organisms). 2
4.1.5 Describe what is meant by a food web. 2
4.1.6 Define trophic level. 1
4.1.7 Deduce the trophic level of organisms in a food chain and a food web.3
4.1.8 Construct a food web containing up to 10 organisms, given appropriate information. 3
4.1.9 State that light is the initial energy source for almost all communities.1
4.1.10 Explain the energy flow in a food chain. 3
4.1.11 State that when energy transformations take place, including those in living organisms, the process is never 90% efficient, commonly being 10–20%.1
4.1.12 Explain what is meant by a pyramid of energy and the reasons for its shape.3
4.1.13 Explain that energy can enter and leave an ecosystem, but that nutrients must be recycled. 3
G.2.2 Define gross production, net production and biomass. 1
G.2.3 Calculate values for gross production, net production and biomass from given data. 2
Gross production - respiration = net production
G.2.4 Discuss the difficulties of classifying organisms into trophic levels.3
G.2.5 Explain the small biomass and low numbers of organisms in higher trophic levels. 3
G.2.6 Construct a pyramid of energy given appropriate information. 3

➔ **Productivity (gross, net, primary); biomass (standing crop); ecological efficiency**
➔ How is energy flow through an ecosystem related to trophic structure?

II. Biogeochemical Cycles

*1138-1143

4.1.14 Draw the carbon cycle to show the processes involved 1
4.1.15 Explain the role of saprotrophic bacteria and fungi (decomposers) in recycling nutrients. 3
G.4.1 State that all chemical elements occurring in organisms are part of biogeochemical cycles and that these cycles involve water, land and the atmosphere. 1
G.4.2 Explain that all biogeochemical cycles summarize the movement of elements through the biological components of ecosystems (food chains) to form complex organic molecules, and subsequently simpler inorganic forms which can be used again. 3
G.4.3 Explain that chemoautotrophs can oxidize inorganic substances as a direct energy source to synthesize ATP. 3
G.4.4 State that chemoautotrophy is found only among bacteria.1
G.4.5 Draw a diagram of a nitrogen cycle. 1
Include the process of nitrogen fixation (free-living, symbiotic and industrial), denitrification, nitrification, feeding, excretion, root absorption, and putrefaction (ammonification).
G.4.6 Outline the roles of *Rhizobium*, *Azotobacter*, *Nitrosomonas*, *Nitrobacter* and *Pseudomonas denitrificans* in the nitrogen cycle. 2
G.4.7 Describe the conditions that favour denitrification and nitrification.2
G.4.8 Discuss the actions taken by farmers/gardeners to increase the nitrogen fertility

of the soil including fertilizers, plowing/digging and crop rotation (use of legumes). 3

➔ How do elements (C,N,P,S,O) cycle through ecosystems?

III. Habitat *1028-1033

G.1.1 Outline the factors that affect the distribution of plant species including temperature, water, light, soil pH, salinity and mineral nutrients. 2

G.1.2 Explain the factors that affect the distribution of animal species including temperature, water, breeding sites, food supply and territory. 3

➔ How do biotic and abiotic factors affect community structure and ecosystem function?

IV. Community Ecology *Ch 53 1028-1033

G.1.4 Explain what is meant by the niche concept, including an organism's spatial habitat, its feeding activities and its interactions with other organisms. 3

G.1.5 Explain the principle of competitive exclusion. 3

G.2.1 Explain the following interactions between species, giving two examples of each: competition, herbivory, predation, parasitism and mutualism. 3

G.2.7 Describe ecological succession using one example.2

G.2.8 Explain the effects of living organisms on the abiotic environment with reference to the changes occurring during ecological succession to climax communities. 3
Include soil development, accumulation of minerals and reduced erosion.

➔ **Climate, biomes, edaphic, competitive exclusion principle, exotic species, fundamental versus realized nich**

End of Unit 1. Expect Test on All of Unit 1.

V. Statistics and Field Techniques *1083-1085

4.2.6 Define random sample. 1

4.2.7 Describe one technique used to estimate the population size of an animal species based on a capture-mark-release-recapture method. (Lincoln Index) 2

4.2.8 Describe one method of random sampling used to compare the population numbers of two plant species, based on quadrat methods. 2

4.2.9 Calculate the mean of a set of values. 2

4.2.10 State that the term standard deviation is used to summarize the spread of values around the mean and that 68% of the values fall within ±1 standard deviation of the mean. 1
For normally distributed data about 68% of all values lie within ±1 standard deviation of the mean. This rises to about 95% for ±2 standard deviations.

4.2.11 Explain how the standard deviation is useful for comparing the means and the spread of ecological data between two or more populations. 3

G.1.3 Deduce the significance of the difference between two sets of data using calculated values for t and the appropriate tables. (Student T Test) 3

G.3.3 Outline the use of the Simpson diversity index. 2
D= diversity index
N = total number of organisms of all species found
n = number of individuals of a particular species

VI. Population Ecology
(Ch 52)

A. Demography *1084-1104

4.2.1 Outline how population size can be affected by natality, immigration, mortality and emigration.2
4.2.2 Draw a graph showing the sigmoid (S-shaped) population growth curve. 1
4.2.3 Explain reasons for the exponential growth phase, the plateau phase and the transitional phase between these two phases.3
4.2.4 Define carrying capacity. 1

B. Limiting Factors *1097-1104

4.2.5 List three factors which set limits to population increase. 1

Focus on R and K Strategies

➔ What models are useful in describing the growth of a population?
➔ How is population size regulated by abiotic and biotic factors?

VII. Conservation *1145-1151; *1156- 1165

G.3.1 Discuss reasons for the conservation of biodiversity using rainforests as an example. Reasons should include ethical, ecological, economic and aesthetic arguments. 3
G.3.2 Outline the factors that caused the extinction of one named animal and one named plant species. 2
G.3.4 Explain the use of biotic indices and indicator species in monitoring environmental change. 3
G.3.5 Outline the damage caused to marine ecosystems by the overexploitation of fish. 2
G.3.6 Discuss international measures that would promote the conservation of fish. 3
G.3.7 Discuss the advantages of in situ conservation of endangered species (terrestrial and aquatic nature reserves). 3
G.3.8 Outline the management of nature reserves. 2
Include control of alien species, restoration of degraded areas, promotion of the recovery of threatened species and control of human exploitation.
G.3.9 Outline the use of ex situ conservation measures including captive breeding of animals, botanic gardens and seed banks. 2
G.3.10 Discuss the role of international agencies and conservation measures including CITES and WWF. 3
CITES—Convention on International Trade in Endangered Species
WWF—World Wildlife Fund
4.5.1 Outline two local or global examples of human impact causing damage to an ecosystem or the biosphere. One example must be the increased greenhouse effect. 2
4.5.2 Explain the causes and effects of the two examples in 4.5.1, supported by data. 3
4.5.3 Discuss measures which could be taken to contain or reduce the impact of the two examples, with reference to the functioning of the ecosystem. 3
G.5.1 Describe the role of atmospheric ozone in absorbing ultra violet (UV) radiation. 2
G.5.2 Outline the effects of UV radiation on living tissues and biological productivity.2
G.5.3 Outline the chemical effect of chlorine on the ozone layer. 2
G.5.4 Discuss methods of reducing the manufacture and release of ozone-depleting substances including recycling refrigerants, reducing production of gas-blown plastics and using CFC-free propellants. 3
G.5.5 Outline the consequences of releasing raw sewage and nitrate fertilizer into rivers. 2
G.5.6 Outline the origin, formation and biological consequences of acid precipitation on plants and animals. 2
G.5.7 State that biomass can be used as a source of fuels such as methane and ethanol. 1
G.5.8 Explain the principles involved in the generation of methane from biomass, including the conditions needed, organisms involved and the basic chemical reactions that occur.

➔ **Biological magnification, greenhouse effect**
➔ In what ways are humans affecting biogeochemical cycles?