

WJEC (Wales) Biology A-level

Topic 3.5 - Population Size and Ecosystems

Definitions and Concepts

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Abiotic factors - The non-living aspects of an ecosystem e.g. light, temperature, water availability, oxygen availability and soil pH.

Abundance - The number of individuals per species in a specific area at any given time.

Ammonification - The production of ammonium compounds when decomposers feed on organic nitrogen-containing molecules.

Azotobacter - A type of nitrogen-fixing bacteria that lives freely in the soil.

Belt transect - A line along a sampled area upon which quadrats are placed at intervals to determine the abundance and distribution of organisms in an ecosystem.

Biomass - The total mass of organic material, measured in a specific area over a set time period.

Biotic factors - The living components of an ecosystem e.g. food availability, pathogens, predators and other species.

Birth rate - The number of offspring born per thousand of population per year.

Carbon cycle - The cycle through which carbon (in the form of carbon dioxide) moves between living organisms and the environment, involving respiration, photosynthesis and combustion.

Carrying capacity - The average size of a population that can be supported by an ecosystem over extended periods of time. This varies depending on biotic and abiotic factors.

Climax community - The stable community of organisms that exists at the final stage of ecological succession.

Colonisation - The occupation of a new area by a species.

Community - All of the populations of different species living together in a habitat.

Competition - When different organisms compete for the same resources (e.g. light, water, mates, territory) in an ecosystem. This limits population sizes.

Death rate - The number of deaths per thousand of population per year.

Deforestation - The removal of trees from land which is subsequently used to grow crops or provide space for cattle.

Denitrification - The conversion of nitrate ions to nitrogen gas by denitrifying bacteria.

Denitrifying bacteria - Anaerobic microorganisms, found in waterlogged soils, responsible for the reduction of nitrate ions to nitrogen gas.

Density-dependent factors - Factors whose effects on population size differ with population density e.g. competition, predation, disease.



Density-independent factors - Factors whose effects on population size remain the same regardless of population density e.g. climate.

Detritivores - Organisms that feed on dead organic matter.

Distribution - The spread of living organisms in an ecosystem.

Ecology - The study of the relationships among organisms and their environment.

Ecosystem - The community of organisms (biotic) and non-living (abiotic) components of an area and their interactions.

Efficiency of energy transfer - The efficiency of energy transfer between trophic levels is calculated using:

$$\text{efficiency} = \frac{\text{energy available after transfer}}{\text{energy available before transfer}} \times 100$$

Emigration - The number of individuals leaving a region per thousand of population per year.

Eutrophication - The process by which pollution by nitrogen-containing fertilisers results in algal blooms and subsequent oxygen level reduction in bodies of water.

Extinction - The death of all living members of a species.

Fertilisers - Natural or artificial materials that are added to soils to provide essential nutrients and improve plant growth.

Global warming - The gradual rise in the average temperature of the Earth due to increasing atmospheric levels of carbon dioxide and methane gas.

Greenhouse effect - The increase of global temperatures caused by the trapping of solar heat by gases in the atmosphere.

Gross primary productivity (GPP) - The rate of chemical energy fixture during photosynthesis by all producers in an ecosystem, measured in $\text{kJ m}^{-2} \text{ year}^{-1}$.

Habitat - The region where an organism normally lives.

Immigration - The number of individuals entering a region per thousand of population per year.

Lag phase - A period of slow population growth.

Line transect - A line along a sampled area. The species touching the transect at regular intervals are recorded to determine the abundance and distribution of organisms in an ecosystem.



Log phase - A period of rapid population growth in which birth rate exceeds death rate. Also known as the exponential phase.

Net primary production (NPP) - The amount of chemical energy that is available to heterotrophs in an ecosystem. It is calculated by subtracting chemical energy generated in respiration (R) from gross primary production:

$$\text{net primary production (NPP)} = \text{gross primary production (GPP)} - \text{respiratory losses (R)}$$

Niche - Describes how an organism 'fits' into an ecosystem and its role in that environment.

Nitrification - The conversion of ammonium ions to nitrate ions by nitrifying bacteria. This takes place in two stages: ammonium ions are oxidised to nitrite ions; nitrite ions are oxidised to nitrate ions.

Nitrifying bacteria - Aerobic microorganisms found in the soil responsible for the oxidation of ammonium ions to nitrate ions.

Nitrobacter - A genus of nitrifying bacteria that oxidises nitrites into nitrates.

Nitrogen cycle - The cycle through which nitrogen moves between living organisms and the environment, involving ammonification, nitrification, nitrogen fixation and denitrification.

Nitrogen fixation - The conversion of atmospheric nitrogen gas into ammonia by nitrogen-fixing bacteria in the soil or root nodules of legumes.

Nitrogen-fixing bacteria - Microorganisms responsible for the conversion of atmospheric nitrogen gas into nitrogen-containing compounds. They can be free-living or mutualistic.

Nitrosomonas - A genus of nitrifying bacteria that oxidises ammonium compounds into nitrites.

Pioneer species - Species that can survive in hostile environments and colonise bare rock or sand e.g. lichens.

Population - All organisms of the same species living with one another in a habitat at the same time.

Primary succession - A type of succession in which pioneer species colonise a newly formed or exposed area of land.

Producers - Photosynthetic organisms at the start of the food chain that manufacture biomass for all living things.

Pyramid of biomass - A table of the dry mass of living material at each trophic level of a food chain. This forms the shape of a pyramid.

Quadrat - A square grid of known area used in sampling to determine the abundance of organisms in a habitat.



Random sampling - A sampling technique used to avoid bias e.g. creating a square grid and generating random coordinates.

Rhizobium - A type of nitrogen-fixing bacteria that lives inside the root nodules of leguminous plants.

Saprotrophs - Organisms that feed by extracellular digestion. They release enzymes which catalyse the breakdown of dead plant and animal material into simpler organic matter.

Secondary succession - A type of succession in which a habitat is re-colonised after a disturbance.

Seres - Various intermediate stages in succession in an ecosystem progressing towards a climax community.

Soil aeration - The exchange of oxygen between the soil and atmosphere to produce the aerobic conditions required for nitrification. Human activities such as drainage and ploughing are used to improve aeration.

Stationary phase - A period of stability in which population numbers generally remain constant.

Succession - Describes changes in the community of organisms occupying a certain area over time.

Systematic sampling - A sampling technique used to determine the abundance and distribution of organisms along an area at periodic intervals e.g. along a belt transect. This is commonly used in ecosystems where some form of gradual change occurs.

Trophic level - The position that an organism holds in a food chain, food web, pyramid of numbers or pyramid of biomass.

