

# 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.

