

# Edexcel (B) Biology A-level

## Topic 10 - Ecosystems

### Definitions and Concepts

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## 10.1 - The nature of ecosystems

**ACFOR scales** - A category based method of determining and comparing the rough amounts of species in a given area by labelling certain species as **A**bundant, **C**ommon, **F**requent, **O**ccasional, **R**are, **N**one (no members of that species present in the area).

**Biomass** - The dry mass of all of the living organisms in an area.

**Ecosystem** - The interactions between living organisms and the environment in a given area.

**Genetic biodiversity** - A measure of the variety of genes that make up a species.

**Habitat biodiversity** - A measure of the number of different habitats found within an area.

**Individual counts** - A sampling method used to determine the number of organisms in a given area by counting each of the organisms individually. This is typically only done for small areas or large/sparse species.

**Negative correlation** - A relationship between values where both values change in opposite directions to each other. For example as one value increases, the other value decreases.

**Null hypothesis** - A hypothesis which states that there is no significant difference between two variables and that any difference that is observed is purely due to chance or error.

**Paired t-test** - A statistical technique used when two sets of data are related and can be grouped into pairs. The mean of the differences between pairs is analysed to determine whether there is a significant difference between the values in the pairs. In this case, the null hypothesis is that the mean of the difference is 0 (i.e. there is no difference between the values in the pairs). It is calculated using the following formula:

$$t = \frac{|\bar{d}|\sqrt{n}}{s_d}$$

$|\bar{d}|$  = *The absolute mean of the difference*

$\sqrt{n}$  = *The square root of the number of pairs*

$s_d$  = *The standard deviation of the differences between the pair values*

**Percentage cover** - A sampling method used to determine the proportion of a sample area which a given species occupies by allocating it to a percentage range.

**Positive correlation** - A relationship between values where both values change in the same direction as each other. For example as one value increases, so does the other.

**Pyramid of numbers** - A graphical representation of the number of organisms at each trophic level.



**Quadrat** - A sampling tool used to measure the distribution, abundance and types of organisms in an area. It is typically a square frame grid of a specific size containing smaller square divisions used for counting.

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

**Spearman's rank correlation coefficient** - A statistical measure used to determine if there is a significant correlation between two values. It is calculated using the following formula:

$$r = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

**Species biodiversity** - A measure of species richness and species evenness.

**Species evenness** - The number of individuals of each species living together in a community.

**Species richness** - The number of different species found within an area.

**Stratified sampling** - A type of non-random sampling in which populations are divided into strata and a random sample is taken from each, proportional to its size.

**Transects** - Lines used to measure the change in distribution and abundance of organisms in an area. These are usually used in conjunction with other sampling techniques like quadrats.

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

**Unpaired t-test** - A statistical technique used to compare the means of two independent sets of data to determine whether there is a significant difference between the two. This is often used to compare the mean of a set of data to the theoretical mean for the data set. It is calculated using the following formula:

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$|x|$  = Absolute value

$\bar{x}_1, \bar{x}_2$  = Means of the data sets

$s_1, s_2$  = Standard deviations of the data sets

$n_1, n_2$  = Number of repeats of the two sets



## 10.2 - Energy transfer through ecosystems

**Biomass transfer efficiency** - The proportion of energy transferred between biomass levels - calculated using the following equation:

$$\text{Biomass transfer efficiency} = \frac{\text{Biomass at higher level}}{\text{Biomass at lower level}} \times 100$$

**Gross primary productivity** - The total amount of energy fixed as chemical energy during photosynthesis carried out by producers.

**Net primary productivity** - The amount of chemical energy that is available for transfer once the energy loss from respiration is deducted from the total amount of energy - calculated by the following equation:

$$\text{Net primary productivity} = \text{Gross primary productivity} - \text{Energy loss due to respiration}$$

**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** - Microorganisms found in the soil responsible for the oxidation of ammonium ions to nitrate ions.

**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 nitrogen-containing compounds 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.

## 10.3 - Changes in ecosystems

**Abiotic factors** - Non-living factors present in the environment which affect ecosystems.

**Biotic factors** - Living factors present in the environment which affect ecosystems.

**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** - A community that remains stable and shows little change over time.

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

**Community** - The interactions of different species in the same area.



**Habitat** - The place where an organism lives.

**Niche** - The position occupied by an organism in its ecosystem.

**Pioneer species** - The first species to occupy a new area.

**Primary succession** - The colonisation of previously uninhabited land by a pioneer species.

**Secondary succession** - The re-colonisation of a habitat after a disturbance.

**Succession** - A directional change in a community over time.

#### **10.4 - Human effects on ecosystems**

**Anthropogenic climate change** - Changes in the climate that are caused by human activity.

**Conservation** - The maintenance of ecosystems and biodiversity by humans in order to preserve the Earth's resources.

**Convention on International Trade in Endangered Species (CITES)** - A treaty which ensures that any international trade of endangered species does not pose a threat to the survival of that species.

**Overfishing** - Unsustainable and excessive fishing which will deplete an area of fish over time if the amount of fishing exceeds the reproduction rate of the fish population.

**Sustainable** - The ability to maintain a process or supply over time.

**Sustainable fishing** - A responsible method of continuing to catch fish whilst preventing the decline of fish populations and protecting the habitats of marine animals.

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

**The peer review process** - A process used to evaluate and assess the validity, reliability and originality of scientific articles before their publication.

