

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.

