CAIE Biology A-level

Topic 18: Biodiversity and classification

Notes

Biodiversity is the **variety of living organisms**, over time the variety of life on Earth has become more extensive but now it is being **threatened by human activity** such as deforestation. Biodiversity can be measured in terms of:

- **Species richness** is the **number of different species in a community** and can be measured by simply counting the number of species present via methods such as **random sampling.**

- **Genetic diversity** is a measure of the **genetic variation** found in a particular species, in other words it is the **number of alleles in a gene pool**. It can be determined by calculating **the heterozygosity index (H),** the higher the heterozygosity index (H), the more genetically diverse the species.
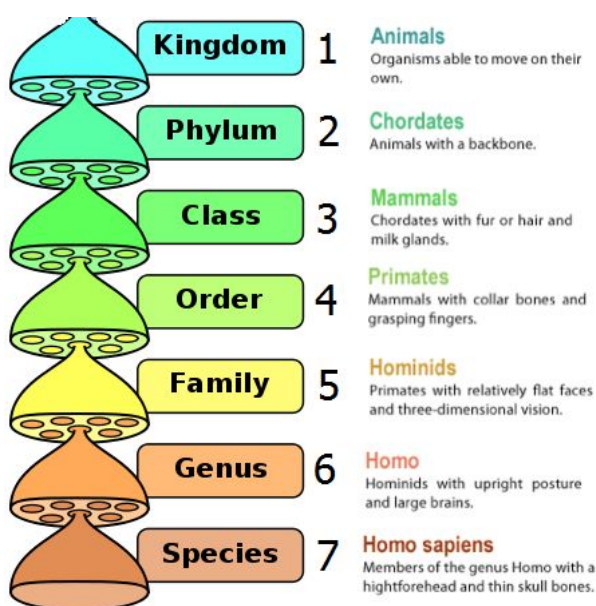 **H= number of heterozygotes / number of individuals in the population**

Biodiversity can also be measured using the **index of diversity (D)** which can be calculated as following:

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

D = Diversity index
N = total number of organisms
n = total number of organisms of each species
Σ = the sum of

Endemism is the state of a species being **unique to a particular geographic location** such as an island and are not found anywhere else.

Species and taxonomy

Rank	Example	Description
Kingdom 1	Animals	Organisms able to move on their own.
Phylum 2	Chordates	Animals with a backbone.
Class 3	Mammals	Chordates with fur or hair and milk glands.
Order 4	Primates	Mammals with collar bones and grasping fingers.
Family 5	Hominids	Primates with relatively flat faces and three-dimensional vision.
Genus 6	Homo	Hominids with upright posture and large brains.
Species 7	Homo sapiens	Members of the genus Homo with a hightforehead and thin skull bones.

Classification is the process of **naming and organising organisms into groups based on their characteristics.** Organisms can be grouped into one of the five kingdoms: **animals, plants, fungi, prokaryotes and protoctista.** They can then be grouped further into **phylum, class, order, family, genus and species.** Each species is named according to the **binomial system,** the first part of the name is the genus and the second part of the name is the species.

Figure SEQ Figure * ARABIC 1 Wikipedia

The analysis of molecular differences in different organisms to determine the extent of their revolutionary relatedness is known as **molecular phylogeny**. The data obtained by molecular phylogeny has been accepted by scientists and this gave rise to new taxonomic groupings – all organisms can be separated into one of the **three domains: Bacteria, Archaea and Eukarya.** Archaea are prokaryotic cells; they often live in extreme conditions as they have strong membranes that are able to stand high temperatures and low pHs. Eukarya includes the plant, animal, fungi and protista kingdoms.

Viruses are not included in the three domains as they are **non-living** and are not classed as cells. In taxonomy, they are instead classified by the disease which the virus causes and the type and structure of their nucleic acid.

The scientific community evaluates the data in the following ways:
- The findings are published in **scientific journals** and presented **scientific conferences**.
- Scientists then study the evidence in a process called **peer review**
- Scientists start **collecting evidence** to either **support or reject the suggestion**

Conservation

- There are many threats to biodiversity in **aquatic** and **terrestrial** ecosystems. The threats include **loss of habitat** and **environment degradation**, **climate change**, excessive use of **fertilisers** which leads to **pollution**, **overexploitation** and **unsustainable use of resources** as well as invasion of **alien species.** **Alien species** might outcompete the native organisms or introduce diseases therefore they need to be controlled.

- There are many **ecological, aesthetic, social and commercial** reasons to maintain biodiversity. For instance, microorganisms are a source of useful products such as antibiotics.

- **Zoos** use various methods to **conserve endangered species and their genetic diversity,** some of the methods used include: **captive breeding programmes** in which endangered species are carefully bred to increase genetic diversity and population size and **reintroduction programmes** which aim to release animals bred in captivity into their natural habitat as well as to restore lost habitats.

- **Seed banks** store a large number of seeds in order to **conserve genetic diversity** and prevent plant species from going **extinct**. Storing seeds instead of plants means that a **large variety of species can be conserved,** it's also cheaper than storing whole plants as it takes up **less space.** The seeds are stored in **cool, dry conditions** as this maximises the amount of time they can be stored for and they are **periodically tested for viability.**

- Other means of conserving endangered mammals include **assisted reproduction** in the form of **IVF, embryo transfer and surrogacy.**

- **Culling and contraceptive methods** are used to prevent overpopulation of protected and non-protected species.

- Non-governmental organisations such as **World Wide Fund for Nature (WWF)** and **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** play an important role in local and global conservation. For instance, WWF funds conservation projects and publicises environmental issues whereas CITES controls the trade of endangered species and their products.

- **Degraded habitats** can be restored on a small scale by **planting new trees** on land that is no longer needed for food production and on a large scale by **replanting forests.**