Ecology

Biology – Leaving Cert

Quick Notes

Ecology

Definitions

Ecology: ***the study of the interrelationships between plants, animals and their environment***.
Ecosystem: ***Organisms [plants + animals NOT singular] and their interactions with the environment***
E.g. grassland, deciduous woodland, coniferous woodland, bog, seashore etc.
Biosphere: ***the parts of earth that support life*** [**NOT** the global ecosystem**]**
Habitat: ***Place where a species lives*** **[NOT** where plants or animals by themselves**]**
Niche: ***the role of an organism in the ecosystem***.
Population: ***members of one species living in an ecosystem***
Community: ***different species sharing the resources in an ecosystem***

Environmental Factors

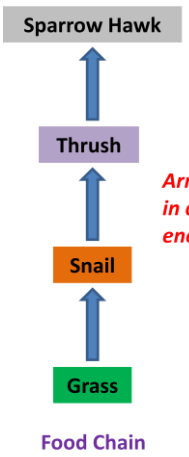
- **Abiotic factors** ***are non-living factors***
  - **Climatic factors**.
    - **Light intensity, wind, exposure, temperature, day length**
  - **Edaphic Factors** ***are factors relating to soil.***
    - **pH, porosity, water content, humus content, mineral content**

- **Biotic factors** ***are influences of living organisms on each other***
  - **Competition, predation, feeding, disease, nitrogen-fixing bacteria, decomposers**

Energy Flow

The **sun is the primary source of energy** for our planet.

- **Autotrophs** organisms that **make their own food** – called **producers**
  - **Photosynthetic** Use **sunlight to make carbohydrates** from CO_2 and, H_2O using **chlorophyll**.
    They change **solar energy** into **chemical energy**
  - **Chemosynthetic** bacteria which make **food using chemical reactions** other than photosynthesis
- **Heterotrophs** cannot make their own food – also called consumers
  - **Herbivores** – **primary consumers** – **only eat plants** e.g. rabbits
  - **Carnivores** – **secondary consumers** – **only eat animals** e.g. cats
  - **Omnivores** – **secondary consumers** – **eat both plants and animals** e.g. humans
  - **Detritus feeders** – **eat dead and decaying vegetation** e.g. Dugesia
  - **Decomposers** – **break down dead organic matter** usually by **extracellular digestion** e.g. fungi

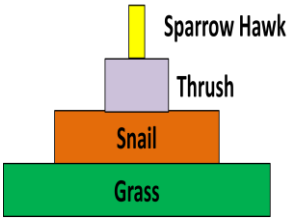


Feeding as a Pathway of Energy Flow.

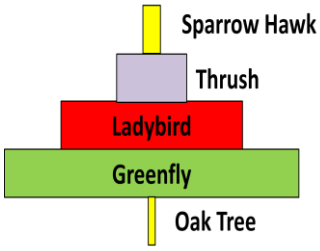
Food Chain ***pathway along which energy is passed from one species to another***
On average only **10%** of the energy in one level is **assimilated** by the next
As a result food chains are **short** usually less than 5 levels
After 5 levels there is only 1/10 000th of the energy available to the top carnivore
Grazing food chains begin with **plants** while **detritus food chains** begin with **detritus**

Tropic Level ***is a feeding level*** or stage in a food chain

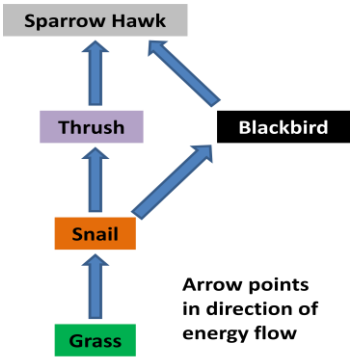
Food Web ***is two or more interconnected food chains***



Pyramid of Numbers



Inverted Pyramid of Numbers



Food Web

In all these examples make sure you give the names of species e.g. ladybird NOT beetle

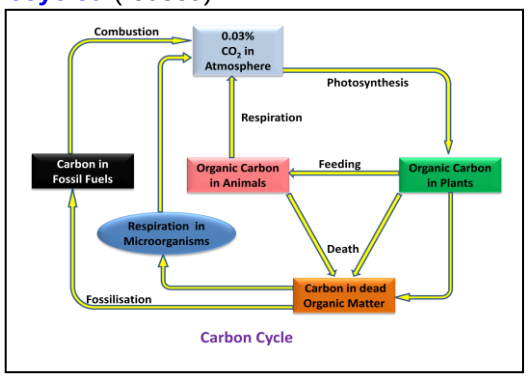
Pyramid of Numbers is a diagram showing the **numbers of organisms at each trophic level**

Limitations of the Pyramid of Numbers

It **does not take into account the size of organisms** involved. E.g. on oak tree is massive while the thousands of greenfly that feed on it are tiny. This situation produces an **inverted pyramid**

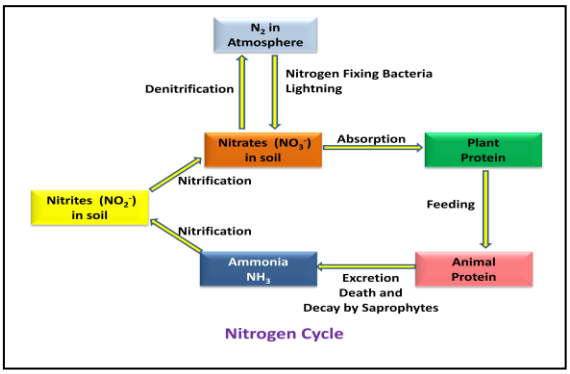
Nutrient Recycling

Elements that are used to produce nutrients are **in limited supply** so they have to be **recycled** (reused).



Carbon Cycle

This applies particularly to **carbon** and **nitrogen**.



Nitrogen Cycle

Nitrogen Fixation: ***converting atmospheric nitrogen in soluble nitrogenous compounds*** e.g. nitrates or ammonia

Nitrification: ***conversion of ammonia to nitrites*** or converting nitrites to nitrates by **nitrifying bacteria**

Denitrification: ***conversion of nitrates to atmospheric nitrogen*** by **denitrifying bacteria**

Human Impact on an Ecosystem

Pollution: ***any harmful addition to the environment***,
Pollutant: any **substance that causes damage to the environment**
Sulphur Dioxide as a Pollutant

- **Source burning fossil fuels**

- **Damage** causes **acid rain** which (a) **kills fish** in rivers & lakes (b) **kills trees** (c) **damages buildings**
- **Control** (a)**reduce amount** of fossil fuel being **burned**, (b) **remove SO_2** from gases by **scrubbing**

The Ecological Impact of one Human Activity

Activity **Burning Fossil Fuels**

- **CO_2** contributes to **global warming**
- **SO_2** causes **acid rain**
- **Soot** particles can cause **respiratory tract problems**

Conservation ***The management of the environment to maintain existing populations***.
Forestry – Example of **conservation practise** - **plant a tree for each tree that is cut down**
Benefits of Conservation Biodiversity **prevents outbreaks of disease**, is a possible **source of medicines**
You can also use any example from one of the following areas: agriculture or fisheries.

Waste Management

- Needed to **prevent pollution**
- **Waste Disposal Methods** include **landfill, incineration and recycling**

Problems Associated with Waste Disposal

- **Shortage of landfill sites**
- **Landfill sites** are **unsightly, smelly, attract vermin and may pollute local groundwater**.
- **Incineration** may produce **toxic gases**

Example of Waste Management

Forestry **large branches** are used to make **woodchip and MDF**
Smaller branches are left to **rot** so **nutrients are recycled**

Importance of Waste Minimisation

Limited non-renewable resources are being used up so reducing waste will make them last longer

Methods of Waste Minimisation **Reduce – Reuse - Recycle**

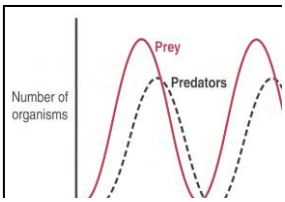
Role of Micro-organisms in Waste Management and Pollution Control

- **Waste Management:** Microorganisms are used in **sewage treatment** to break down organic matter and make it biologically safe. They are also used to break down **compost**
- **Pollution Control:** They are used to **treat oil spills** and break them down to less harmful substances

Ecological Relationships

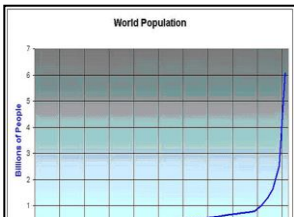
- **Competition** is the Struggle between organisms for resource in short supply.
  - **Contest** **One** organism **gets all** (or loses) the resource e.g. Stags for mates
  - **Scramble** **Each** organism **gets some** e.g. rabbits for grass
- **Predation**
  - **Predator** **animal that hunts and kills another animal for food** **e.g. fox**
  - **Prey** **an animal that is hunted and killed by another animal for food** **e.g. rabbit**
- **Symbiosis** is a **close relationship between two species where one benefits**
  1) **Parasitism** **one species lives in or on another species causing harm** e.g. liver fluke in sheep
  2) **Mutualism** **two species living in close association** where **both benefit** e.g. bacteria in large intestine get food and shelter and supply the host with vitamin K
  3) **Commensalism** **two species living in close association where one benefits**, and the other neither benefits nor harmed. E.g. birds nesting in a hawthorn bush

  The above factors are all important in **controlling population**



Population Dynamics

- **Food plentiful**, few predators so **prey numbers increase**
- **Predators** now have more food so they **increase**
- Eventually **predators kill off too many prey**, and then don't have enough food
- When **prey** population is **small** they find it **easier to find good hiding places**
- The **predators** then **die** or **emigrate**
- **Predator population** always **lower than prey** and their population change **lags behind** the prey.



Factors Affecting Human Population

- **War decreases** population but birth rate usually jumps to compensate
- **Famine decreases** population
- **Contraception can decrease** populations if it is freely available
- **Disease decreases** populations if virulent and widespread e.g. malaria

Study of an Ecosystem - Grassland

Diversity of Life Forms

Members of **all five Kingdoms** are present

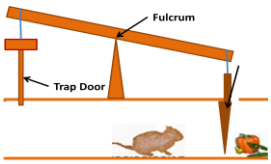
- **Monera** e.g. **bacteria**
- **Fungi** e.g. **lawyers wig**
- **Protista** e.g. **amoeba**
- **Plants** [flora] e.g. **daisy**, buttercup, thistle, primrose, nettle and grass
- **Animals** [fauna] e.g. **earthworm**, greenfly, ladybird, thrush, blackbird and Sparrow Hawk

You have to be able to identify any **five plants** and any **five animals** using a simple Key

Habitats

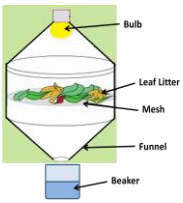
Habitats include copse, stream, hedgerow, soil

Collection Apparatus for an Ecological Study

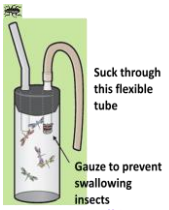


Mammal Trap - Mice

Pitfall Trap - Surface Dwelling Insects



Tullgren Funnel
Leaf Litter Insects



Pooter – Small Insects

Organism Distribution

- **Qualitative Study** ***Simply records which species are present***
- **Quantitative Study** calculates ***the number of individuals of a species present***.
- **Percentage frequency** the percentage of quadrats that a species is found in
- **Percentage cover** The percentage of the ground covered by the aerial parts of a plant in a quadrat

Estimate the Number of Daisies on a Well Grazed Area using a 50 cm × 50 cm Quadrat

- Measure the length and width of the location to be studied [20 m × 35 m = 700 m^2]
- State the **area of the quadrat** being used [**50 cm × 50 cm = 0.25 m^2**]
- Calculate the number of quadrats that would fit in the study area [700 ÷ 0.25 = 2800]
- Place the quadrat **randomly**
- **How** throw a bean **bag over your shoulder** and place a chosen corner of the quadrat touching the bag
- **Count** the number of daisies in the quadrat
- **Repeat** 20 times [pick 20 numbers of your choice and add them. Assume total is 245]

- **Calculate** the average number of daisies per quadrat [245 ÷ 20 = 122.5]
  [total number of daisies / number of quadrats]
- **Population** = average number of daisies per quadrat × number of quadrats that would fit in the area
  = [122.5 × 2800 = 343 000]

Estimate the Number of Snails in a Copse using the "Mark and Recapture" Technique

- Set a group of cryptozoic **traps**
- **Collect** any snails caught**, mark them inconspicuously** and **count them**. [75]
- **Release** them **in the same area**
- **Collect** them again **after a few days**
- Record the **total number caught** [62] and the **number recaptured** [31]
- **Calculate the population** = $\frac{\text{Number caught 1st day} \times \text{Number caught 2nd day}}{\text{Number of animals Recaptured}} = \frac{75 \times 62}{31}$
  = 150

Presentation of Results

Use **tables, diagrams, graphs**, histograms, or any other relevant method to display the results.

Possible Sources of Error

Miscalculation, limited sample size, incorrect identification of species

Measure any Three Abiotic Factors present in the Selected Ecosystem,

- **Light Intensity** - use a **Light Meter**
- **Temperature** - use a **Thermometer**
- **pH** - use a **pH Meter** or **Universal Indicator Paper**

Organism Adaptations

- **Structural, competitive or behavioural adaptations** are necessary to allow the organism **to survive** in its habitat

Organism	Adaptation
Ladybird	**Bright colours to warn predators** it has a nasty taste
Owl	**Good eyesight for seeing prey**
Greenfly	**Green for camouflage**
Blackbird	**Wings to fly**
Buttercup	**Bright flowers to attract insects** for pollination
Primrose	Prefers **damp shady areas**
Daisy	Thrives in **open areas** with little shade
Thistle	**Prickles to stop cows eating** them

In the exam you are often asked to read an extract from a book and answer questions using the information it contains. The answers can frequently be transcribed directly from the passage. Look at past papers and marking schemes to practice these.