



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*

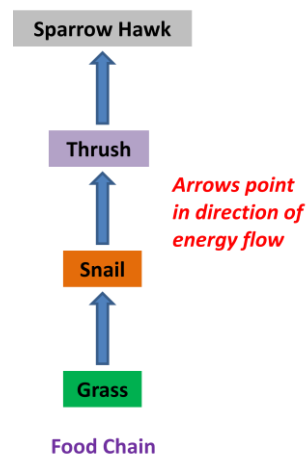
Environmental Factors

- **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 CO₂ and, H₂O 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

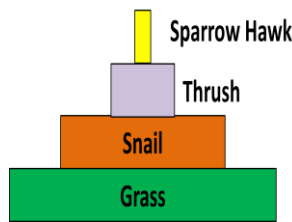
As a result food chains are **short** usually less than 5 levels

After 5 levels there is only 1/10 000th of the energy available to the top carnivore

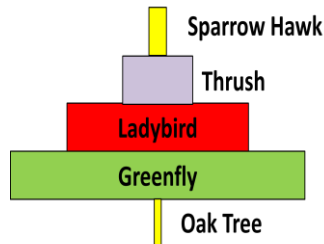
Grazing food chains begin with **plants** while **detritus food chains** begin with **detritus**

Trophic Level is a feeding level or stage in a food chain

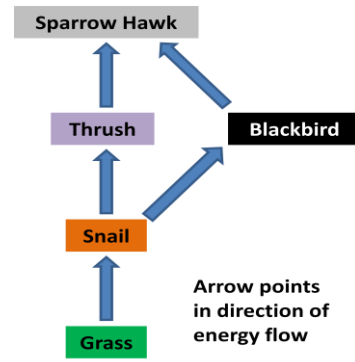
Food Web is two or more interconnected food chains



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

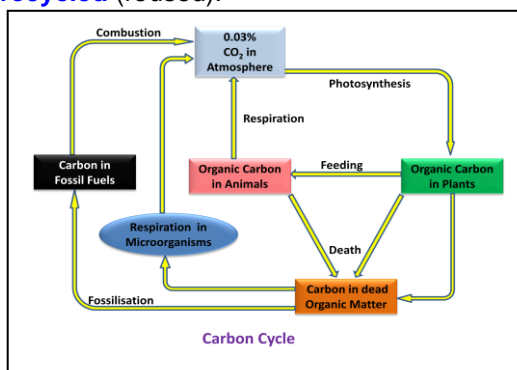
Pyramid of Numbers is a diagram showing the **numbers of organisms at each trophic level**

Limitations of the Pyramid of Numbers

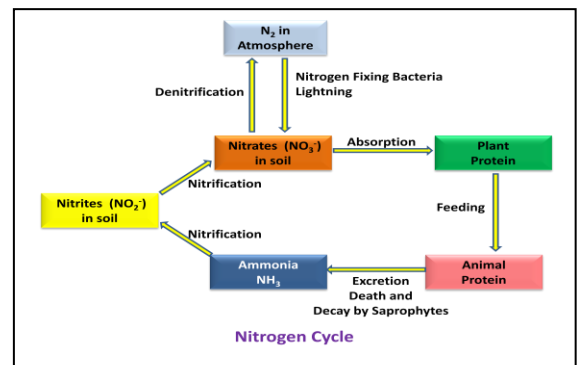
It **does not take into account the size of organisms** involved. E.g. on oak tree is massive while the thousands of greenfly that feed on it are tiny. This situation produces an **inverted pyramid**

Nutrient Recycling

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



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



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

nitrites 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 SO₂** from gases by **scrubbing**

The Ecological Impact of one Human Activity

Activity Burning Fossil Fuels

- **CO₂** contributes to **global warming**
- **SO₂** 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

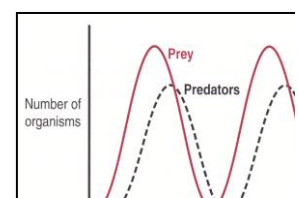
Role of Micro-organisms in Waste Management and Pollution Control

- **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**

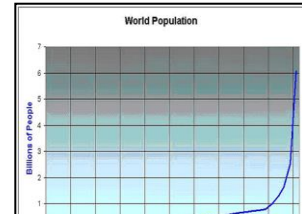


Population Dynamics

- **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

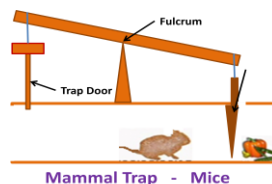
- **Monera** e.g. **bacteria**
- **Fungi** e.g. **lawyers wig**
- **Protista** e.g. **amoeba**
- **Plants** [flora] e.g. **daisy**, buttercup, thistle, primrose, nettle and grass
- **Animals** [fauna] e.g. **earthworm**, greenfly, ladybird, thrush, blackbird and Sparrow Hawk

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

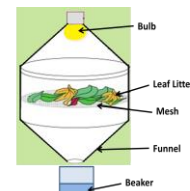
Collection Apparatus for an Ecological Study



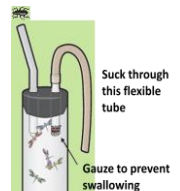
Mammal Trap - Mice



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 m²]
- State the **area of the quadrat** being used [50 cm × 50 cm = 0.25 m²]
- 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 [$245 \div 20 = 122.5$]
[total number of daisies / number of quadrats]
- **Population** = average number of daisies per quadrat \times number of quadrats that would fit in the area
= [$122.5 \times 2800 = 343\ 000$]

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** = $\frac{\text{Number caught 1}^{\text{st}} \text{ day} \times \text{Number caught 2}^{\text{nd}} \text{ day}}{\text{Number of animals Recaptured}} = \frac{75 \times 62}{31} = 150$

Number of animals Recaptured

31

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.