THE INSTITUTE OF EDUCATION

Biology

Wesley Hammond

Higher Level

Ecology

What do you need to know about UNIT 1?

- Unit 1 is worth at least 25% of the Biology paper (can be worth up to 32.5%).
- Two short questions (10%) in Section A will be asked from scientific method, food and ecology.
- One long question (15%) in Section C will be asked from scientific method, food and ecology.
- An experiment question (7.5%) can also be sometimes asked in Section B of paper.

Ecology

This topic has been asked **every year since 2004**. It is worth between **15% to 27.5%** in your Leaving Certificate.

History of topic	
2004	80 marks
2005	60 marks
2006	110 marks
2007	80 marks
2008	95 marks
2009	80 marks
2010	80marks
2011	80 marks
2012	80 marks
2013	110 marks
2014	80 marks
2015	80 marks
2016	86 marks
2017	110 marks
2018	80 marks
2019	60 marks

Ecology

Ecology is the study of **interactions** between living things and their environment.

Biosphere:

- Part of the planet containing living organisms

  Example: Deep in the oceans and high in the mountains.

Ecosystem:

- Group of organisms that **interact** with their environment.

  Example: Woodlands, **grasslands**, bogs, lakes, hedgerows, desert.

(You will need to know one ecosystem in detail)

Habitat:

- A place where a plant or animal lives.

Population:

- All the members of the same species living in an area

  Example: population of rabbits in a field.

Community:

- All the different populations living in an area

  Example: population of bacteria, fungi, plants and animals in a field.

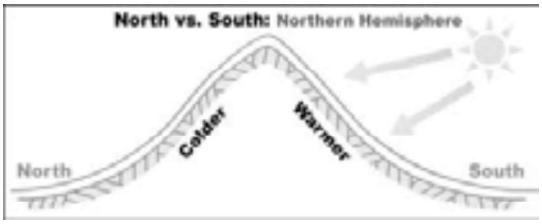
Environmental factors affecting organisms:

- **Abiotic factors** relate to **non living** factors
- **Biotic factors** relate to **living** factors
- **Climatic factors** refer to weather over a long period of time (rainfall, temperature)
- **Edaphic factors** relate to the soil (soil pH, soil type, soil temperature and soil moisture).

Effects of abiotic factors (non- living factors)

- **Altitude** = High altitudes are cooler and plants and animals cannot survive.

- **Aspect** = South facing slopes are warmer and receive more light which allows more plants to grow.



- **Steepness** = Steep slopes cannot hold water which makes it harder for plants and animals to exist.
- **Light intensity** = the more light available the more plants will grow.
- **Air temperature** = in warmer climates with higher temperatures, more plants will be present.
- **Wind speed** = plants exposed to high winds will not grow well and may eventually die.
- **Soil pH**: plants will grow better at certain pH values. If the soil is too acidic or basic the plant may die.

Effects of biotic factors (living factors)

Competition: Competition occurs when **organisms struggle and fight for a resource** that is in **short supply**.

Predation: Predation is the **catching, killing and eating** of another organism.

Food: the more food that is available to a plant or animal, the larger the number of organisms that will survive.

Parasitism: parasites cause harm to an organism and can kill the host.

Humans: humans can cause a lot of damage to natural environments.

Energy flow

NOTE: The sun is the primary source of energy flow.

- Feeding allows energy to flow from one organism to another in a habitat.

Producers:

Producers are organisms that carry out photosynthesis to make their own food.

Examples: sycamore trees, ivy

Primary producer → Primary consumer → Secondary consumer → Tertiary consumer

Consumers:

Consumers are organisms that **take in food from other organisms**.

- **Primary consumer**: feed on producers

Example: Herbivores feed nly on plants (deer)
Decomposers – feed on dead matter (bacteria and fungi)
Detritus feeders (mussels, earthworms)

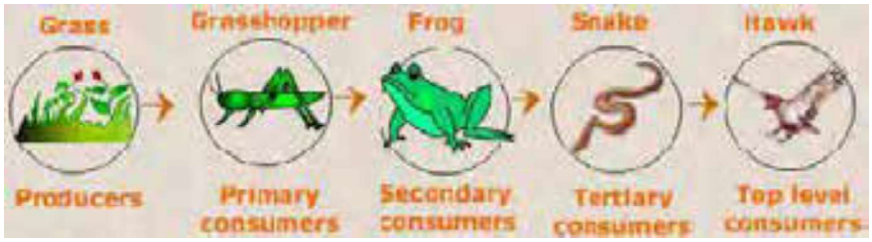
- **Secondary consumer**: animals that feed on primary consumers

Example: Carnivores (only eat meat)

Scavengers (feed on animals killed by other)

- **Tertiary consumers:** feed on secondary consumers

NOTE: These are normally the top consumers.



What are omnivores?

- Organisms that feed on **both** plants and animals.

Example: Badgers, humans, bear.

Food chain

A food chain is a **sequence of organisms** in which each **one is eaten by the next** organism in the food chain.

A trophic level is a feeding stage in the food chain.

Examples of a grazing food chain:

Grass → Rabbit → Fox

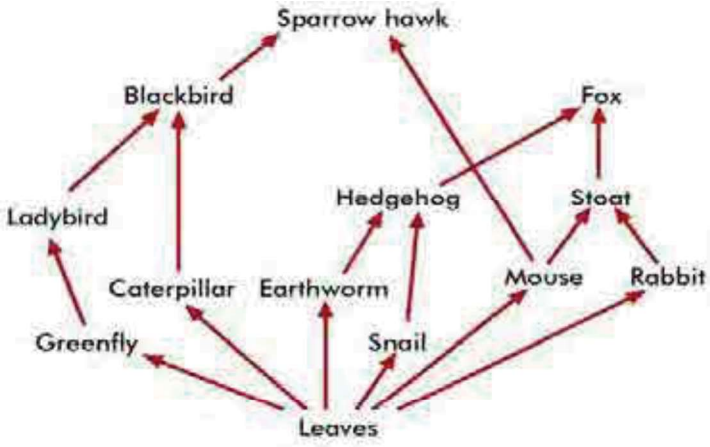
Dandelion → Butterfly → Thrush → Hawk

What affects the length of a food chain?

- The amount of energy passing from one trophic level to the next trophic level decreases which **limits the length of a food chain**.
- Only 10 % of energy from each stage is passed onto next trophic level.
- Other 90% is used by organisms for energy or lost by heat.

Food web:

Food web consists of **two or more food chains** that are interlinked.



Examples:

Producer: Leaves

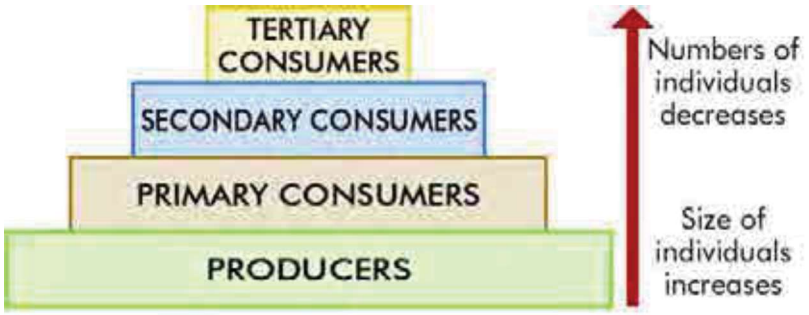
Primary consumer: Snail, earthworm, greenfly, rabbit, mouse, caterpillar

Secondary consumer: Stoat, ladybird, hedgehog

Tertiary consumer: fox.

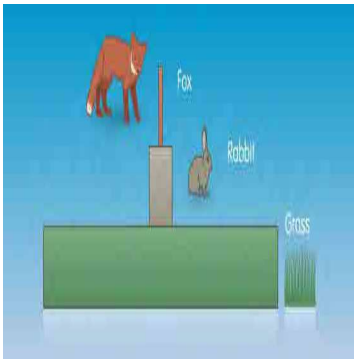
Pyramid of numbers

- A pyramid of numbers represents the **organism number** at each **trophic level** in a food chain.
- **Number** of organisms at each trophic level **decreases** as you move up the food chain, and the **size** of the individual **increases**.

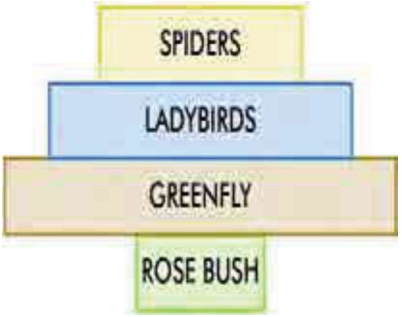


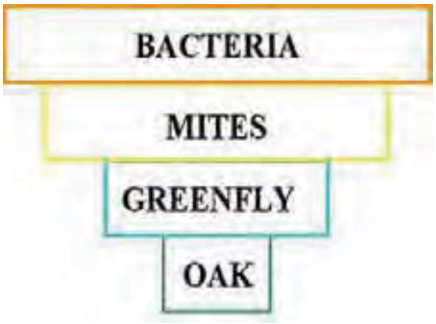
Note: Body size of organisms tend to increase as you move up pyramid because larger animals tend to eat smaller ones.

Example of normal pyramid:

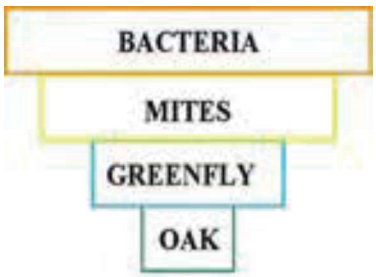


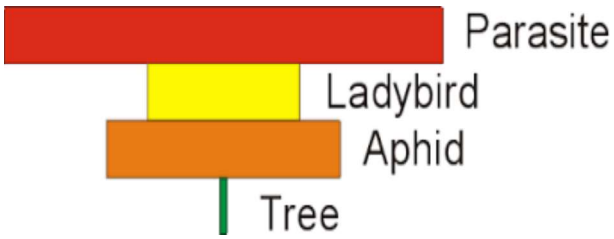
Example of inverted pyramid:





Example of parasitic pyramids:





Limitations of pyramid of numbers:

- They do not take into account the size of the organisms.

- Sometimes the pyramid cannot be drawn to scale due to the numbers being so big (millions of bacteria may live on one ash tree).

What is a niche?

- The niche is the **role an organism plays** in its community.

Example: what it eats and how it interacts with different organisms in the surrounding environment.

If more than one species has the same niche they cannot survive for long due to competition (for space, food, mates).

NOTE: swallows and thrushes prevent competition by having different niches.

Swallow: feeds on aerial insects

Thrushes: feeds on ground insects

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Note:

If an organism is introduced into a vacant niche it has a better chance of survival as there is less competition.

Why might an organism still not survive when introduced into a vacant niche?

- It may not be able to adapt to new habitat.

Pollution/Conservation/ Waste management

Impacts of humans on ecosystems:

Humans affect ecosystems in three ways:

- Pollution
- Conservation
- Waste management

Pollution:
Pollution is **a harmful addition** to the environment.

Sources of pollution:

- Electricity generation
- Transport
- Farm wastes

What are pollutants?

- Pollutants are **substances** that cause pollution.

Three types of pollution: (only need to know one type)

- **Agricultural/ domestic/ industrial pollution.**
- **Agricultural pollution** (**slurry**, fertilisers, pesticides, silage run-off).

Effects of agricultural pollution:

- Slurry (animals waste material) enters rivers or lakes during heavy rainfall which causes algal to grow.
- When algae die and breakdown, oxygen is absorbed and therefore the level in oxygen in water falls.
- Water plants and animals die due to lack of oxygen.

NOTE: The addition of nutrients to fresh water is called **eutrophication.**

Solving these problems:

- Storing slurry in **leak proof tanks**.
- **Spread the slurry in the dry summer** time as there is less chance of it being washed into streams.

Conservation:

Conservation is the **management of our environment**, which will **prevent the death and extinction** of organisms.

NOTE: The present rate of extinction is faster now than ever before.

Benefits of conservation:

- Prevents organisms becoming extinct
- Maintains a wide range of living things.
- Organisms may be useful in nature.
- Maintains a balance in nature.

NOTE: **Nature reserves and Zoos** are used to prevent extinctions and protect organisms.

Example of conservation in Fisheries

Problems with the fishing industry:

- **Overfishing** has reduced the number in fish stocks.
- The use of **small fish mesh in nets** results in small fish being caught and killed.

Solutions to these problems:

- **Size of mesh in the nets should be made larger** so small fish can escape. This allows small fish to escape and maintain the numbers of the population.
- Use fish **quotas** to ensure only certain amount of fish are caught.

Waste Management

Agriculture:

- Slurry (animals waste material) enters rivers or lakes during heavy rainfall which causes algal to grow.
- When algae die and breakdown, oxygen is absorbed and therefore the level in oxygen in water falls.
- Water plants and animals die due to lack of oxygen.

Solving these problems:

- Storing slurry in **leak proof tanks**.
- **Spread the slurry in the dry summer** time as there is less chance of it being washed into streams.

Waste management in fish:

- Waste materials such as fish heads, tails, and intestines are diluted by water.
- These substances are highly alkaline and are **neutralised** by adding acid. Used to create fertiliser.

Waste management in forestry:

- Waste materials from tops of trees, small branches, roots and saw dust

  are processed to form wood products (MDF)

Problems with waste disposal

- Wastes may contain micro organisms that cause **diseases.**
- Nutrients from agricultural waste released into water can cause plants and animals to die.
- Waste in landfill sites can be **unslightly** and **smell** (attract rats)
- Incinerators can cause **poisonous gases** to be released.

NOTE: Heat from incinerators can be used to produce electricity.

Control of waste production:

- Reduce
- Reuse
- Recycle

Role of micro-organisms in waste management:

- **Landfill sites** should be covered in soil as bacteria and fungi are present which will **break down some of the material.**
- In secondary stage of **sewage treatment** bacteria and fungi are used to break down organic matter.

Factors affecting Populations

A **population** is all the **organisms of same species** living in an area.

How are Populations controlled?

- Predation
- Competition
- Parasitism
- Symbiosis

Competition

Competition occurs when **organisms struggle and fight for a resource** that is in **short supply**.

Examples: Two male blackbirds competing for a female.

What resources might animals compete for?

- Food
- Shelter
- Mates
- Space

What resources might plants compete for?

- Food
- Space
- Water
- Light

Intra-specific competition

Takes place between the **same** species

Example: two robins fighting for territory

Inter-specific competition

Takes place between **different** species

Example: blackbird and thrush competing for food.

Types of competition

Contest competition

- This is where there is a **physical contest** between two individual organisms and only one benefits (**only one gets the resource**).

  Examples: Two male deer fighting for territory and female mates.

Scramble competition

- All of the competing individuals get some of the resource but none of the organisms get enough resource to survive.

Examples: plant seedlings competing for light and space. If some are not removed they will not get enough light, water and space and may die.

NOTE:

How to avoid competition?

- The butterfly and caterpillar which are the same species avoid competition as they have different mouth parts. Butterfly feed on nectar while caterpillars feed on leaves.

Predation

Predation is the **catching, killing and eating** of another organism.

A predator is an organism is an organism that catches, kills and eats another organism (foxes)

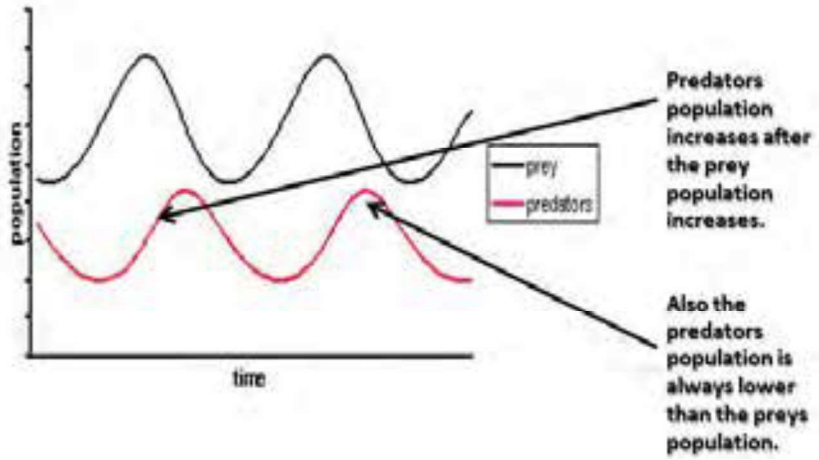
The **prey** is the organism that is eaten by the predator **(rabbits).**

Predator – Prey relationships:

Example: **Predator**: Fox **Prey:** rabbit

- As the population of prey increases, the number of predators will rise (more food available).

- As predators population begins to increase, the population of prey decrease.



Factors that affect predator - prey populations:

- **Availability of food**: if prey numbers are large, this can cause an increase in the numbers of predators.

- **Disease**: can cause population numbers decrease dramatically.

- **Migration of predators:** predators may have to move area if the preys population is really small which makes it easier for the prey populations to increase.

What is an adaption?

- Is a feature that **helps an organism to survive** and reproduce.

Adaptations of predators and prey

Predators:

- **Foxes** can run fast and have good sense of smell to catch prey.
- Owls have great eyesight to catch their prey at night **(nocturnal)** which allows them to avoid other competition.
- Hawks have excellent eye sight to locate prey.
- Ladybirds have a strong jaw to kill and eat aphids.

Prey

- Mice can run fast and hide to avoid being eaten.
- Frogs are camouflaged to avoid attack by its predators.
- Ladybirds have a bright red colour, indicating that they taste very bad.

Adaptions of plants:

- Nettles have a sting to protect them from predators.
- Bright colour flowers is used to attract insects for pollination.

Factors that affect human populations:

- **War –** increase the death rate
- **Famine –** increase the death rate
- **Contraception -** reduces the birth rate
- **Disease –** increases the death rate.

Parasitism:

- Occurs when one organism obtains its food from a live host **causing it harm**.

Types of parasites:

1) **Endoparasites**: live on the **inside** of the host's body causing harm (liver fluke in sheep, tapeworm in the human small intestines).

2) **Exoparasites**: live on the **outside** of the host's body (fleas on a dog, green fly on a rosebush).

What is the role of parasites in nature?

- They control populations of the organism that they feed on.

How do parasites differ from other predators?

- They are smaller than normal predators.
- They can attack the host inside the body.

Symbiosis:

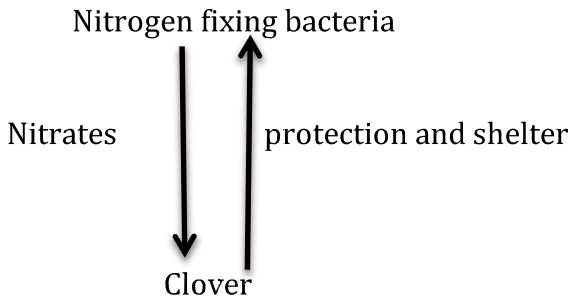
- When two different organisms live in close association with each other and at least one benefits.

- **Mutualism** is another form of symbiosis where both benefits.

Examples of symbiosis:

- Symbiotic bacteria in the human large intestines. They **produce vitamin B and K** for the human (host) and they get food and shelter from the host.

- **Nitrogen fixing bacteria** convert nitrogen gas into nitrates for the plant in the soil. The bacteria get food and shelter living in roots.



Aquatic environments

Factors that affect aquatic environments:

- Light: Plants are only found towards surface of water.
- Currents: Plants can be carried away unless attached to rocks.
- Salt content: salt concentration affects what organisms live in water.
- Wave action: Can cause damage to plants or animals.

The Nutrient Cycles

Nutrient recycling

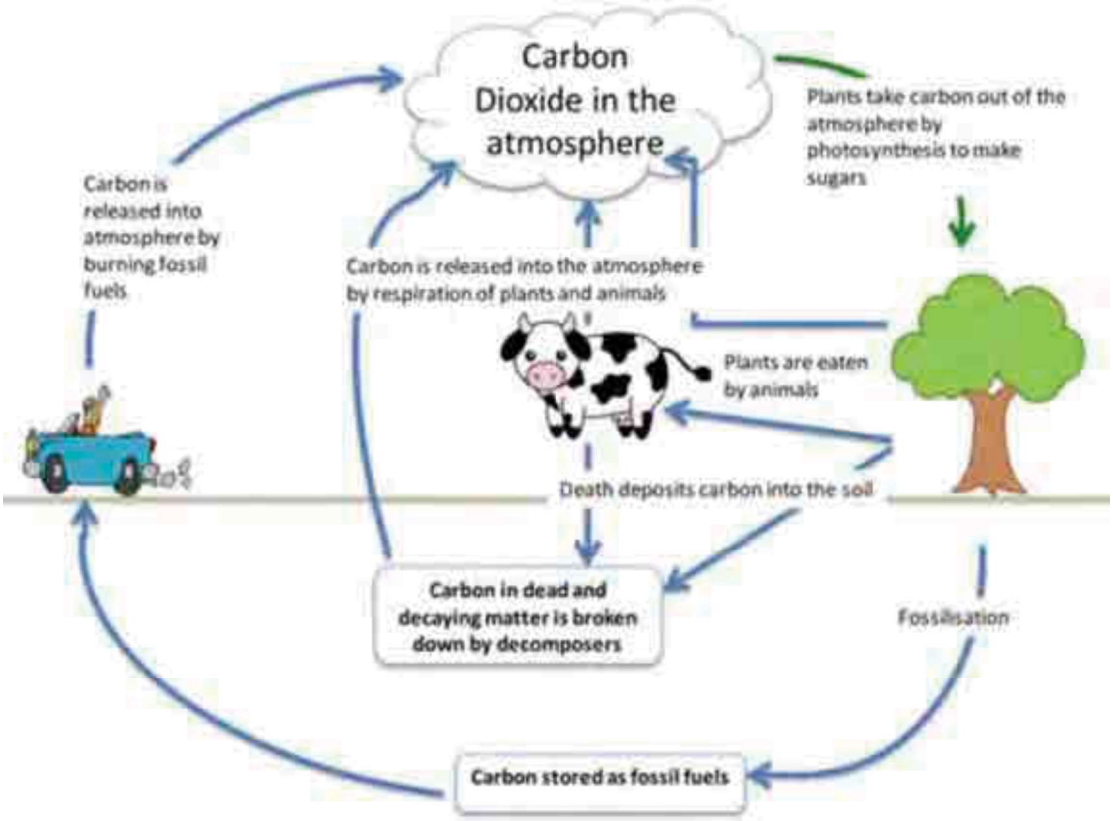
- Nutrient recycling allows elements like **carbon and nitrogen** to be **exchanged** between living and non-living parts of an ecosystem

- Also accepted in marking scheme (**allows nutrients to be reused**)

The Carbon Cycle

What is the function of the carbon cycle?

- So carbon can be converted to carbon in living things (carbohydrates)



Processes involved in the carbon cycle:

- Photosynthesis
- Respiration
- Decomposition
- Combustion

Function of living organisms in the carbon cycle:

Bacteria and fungi: their role as **decomposers** help return carbon back into the atmosphere.

Animals: return carbon back into the atmosphere by the process of **respiration**.

Plants: absorb carbon from the atmosphere by a process called **photosynthesis.**

The Nitrogen Cycle

What is the function of the nitrogen cycle?

- It converts nitrogen into forms that living things can use.
- Living things use nitrogen for the **formation of protein**, RNA, DNA .

Bacteria involved in the nitrogen cycle:

- Bacteria of decay
- Nitrogen fixing bacteria
- Nitrifying bacteria
- Denitrifying bacteria

What bacteria are involved in the nitrogen cycle?

Nitrogen fixation:

- Using **nitrogen fixing bacteria** (anaerobic bacteria who live on roots of legumes of clover), they **convert nitrogen gas into nitrates**.

Decomposition:

- **Bacteria of decay** break down dead organisms and release nitrogen in the form of ammonia into the soil.

Nitrification:

- Using **nitrifying bacteria** ammonia is converted into nitrites and nitrates (these bacteria are chemosynthetic in that they make their own food using chemical reactions)

Denitrification:

- Using **denitrifying bacteria** (anaerobic bacteria) the nitrates are converted back into nitrogen gas.

NOTE:
What is common to both Carbon and Nitrogen cycle?

- Bacteria involved/ excretion/ death and decay/ nutrition.