science biology

GCSE B7 – Ecology

- **Species** – group of similar organisms reproducing to make fertile offspring
- **Habitat** – where an organism lives
  Population – all organisms of a species in a habitat
  Community – all the populations of different species in a habitat
  Ecosystem – the interaction of a community (biotic) with the non-living (abiotic) parts of their environment.
- **Interdependence** - species depend on other species within a community for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community.
- **A stable community** – all the species and environmental factors are in balance, so population sizes remain fairly constant e.g. tropical rainforests.

Abiotic factors - Non-living factors that affect the ecosystem	**Biotic factors** - Living factors that affect the ecosystem
light, CO_2, temperature, O_2, moisture, soil pH, wind	Competition, food, parasites, predators, disease

Distribution of organisms: where organisms are found in a habitat at a particular time. It is affected by abiotic (eg. temperature) and biotic (eg. food availability) factors.

Adaptations: Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live.

Structural adaptations - the features of an organism's body structure e.g. shape, size or colour.

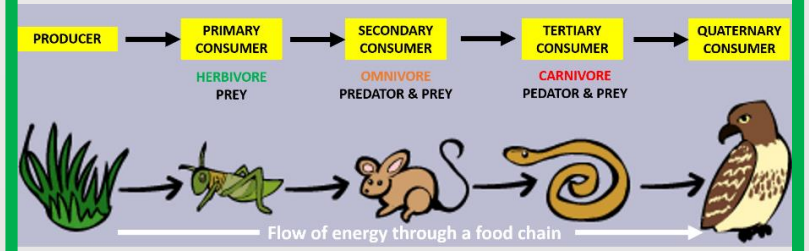
Behavioural adaptations - how an organism behaves e.g. some species migrate to warmer climates during winter months.

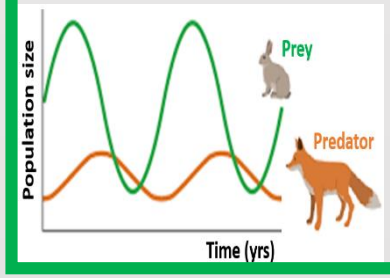
Functional adaptations - internal processes of an organism e.g. desert animals produce little sweat and small amounts of urine to conserve water.

Some organisms live in environments that are very extreme, such as at **high temperature**, **pressure**, or **salt concentration**. They are called **extremophiles** (eg. bacteria living in deep sea vents)

Biodiversity: variety of all the different species of organisms on Earth or within an ecosystem. **High biodiversity** increases the stability of ecosystems. The future of the human species on Earth relies on us maintaining a high level of biodiversity. Many human activities are reducing biodiversity ☹

Food chains: plants are the producers of **biomass** (living tissue) on Earth. All food chains begin with a **producer** which synthesise glucose. Primary **consumers** eat producers, which in turn are eaten by secondary consumers and then tertiary consumers. Consumers that kill and eat other animals are **predators**, and those eaten are **prey**.



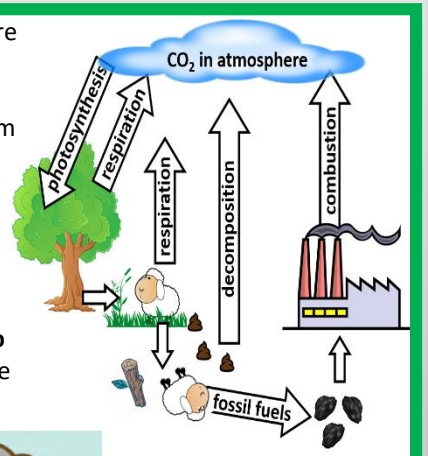


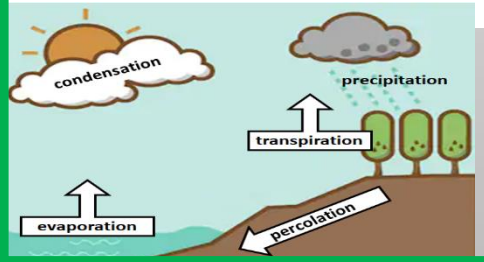
In a stable community the numbers of predators and prey rise and fall in cycles. The amount of food limits the population of a species. If the prey population increases then so will the predator population. As the number of predators increase, the number of prey decrease.

All materials in the living world are recycled to provide the building blocks for future organisms.

Carbon cycle: returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis.

Microorganisms are responsible for cycling materials through an ecosystem by returning **carbon to the atmosphere** as carbon dioxide and **mineral ions to the soil**.





Water cycle: provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated.

PRACTICAL – USING SAMPLING TECHNIQUES TO DETERMINE THE DISTRIBUTION AND ABUNDANCE OF ORGANISMS.

Quadrats: to estimate population sizes - good for field sampling

1. Grid out the area
2. Use random number generator to place quadrat
3. Use an field ID guide to identify species of plant
4. Count number of organisms /% coverage
5. Repeat & calculate mean number of each species per quadrat
6. Calculate area of habitat and how many quadrats would fit in it
7. Multiply each mean by the total quadrat area

Transect: to see changes in distribution - good for shorelines/woods

1. Lay tape along the length of the area
2. Place quadrat at regular intervals eg. Every 1m
3. Use an field ID guide to identify species of plant
4. Count number of organisms /% coverage
5. Move the transect along and make repeats to calculate a mean

Rapid growth in the human population and an increase in the standard of living mean that more resources are used and more waste and pollution is produced:

- **Water pollution** from sewage/fertiliser eg. **eutrophication** (algae blooms on top of lake →blocks sunlight → lake plants die & decay → O_2 is taken from the water by microbes → fish die)
- **Air pollution** from smoke/SO_2 eg. acid rain (alters pH of soil and water, kills roots and leaves)
- **Land pollution** from landfill/toxic chemicals eg. leaching (chemicals move through soil affecting plant growth)

All pollution reduces biodiversity. Humans reduce the amount of land available for other animals and plants by building, quarrying, farming and dumping waste.

Peat Bogs: destruction of peat bogs to make garden compost reduces the area of this habitat and its variety of different species (biodiversity) Decaying or burning peat releases **carbon dioxide** into the atmosphere

Global Warming: Levels of carbon dioxide and methane in the atmosphere are increasing, trapping more heat energy = melting polar ice caps, sea level rises, extreme weather, migration, extinctions.

Improving biodiversity and protecting environments:

- breeding programmes for endangered species
- protection and regeneration of rare habitats
- reintroduction of field margins and hedgerows in agricultural areas
- reduction of deforestation and carbon dioxide emissions
- recycling resources rather than dumping in landfill

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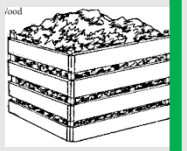
GCSE B7 – Ecology (+triple)

science biology

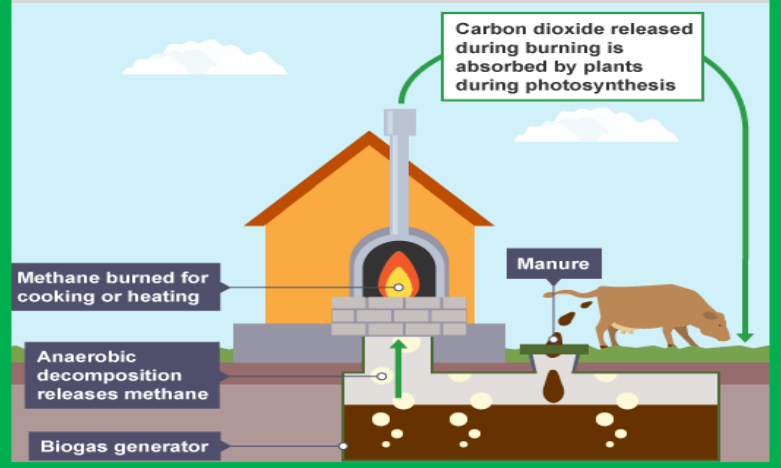
Decomposition: puts nitrates back into the soil and carbon dioxide back into the atmosphere.
Conditions for decay:
Temperature: Decay is controlled by enzymes so too cold = too slow, too hot = denatured.
Moisture: Makes it easier for microorganisms to digest food and prevents drying out.
Oxygen: For aerobic respiration – growth, reproduce etc. Aerobic respiration results in an increase in temperature in a compost heap

- **Compost Heaps** - decay releases nutrients from dead plants and animals to make fertile soil.
- **Air holes** - let oxygen in, regulate temperature.
- **Warmth** - generated by respiring microorganisms.
- Finely shredded waste increases surface area.



Decomposers (fungi and bacteria) break down dead matter by secreting enzymes into the environment. Small soluble food molecules then diffuse into the microorganism.

Biogas: anaerobic respiration in bacteria can produce methane – flammable gas (fuel) Biogas can be produced on a small scale in a **biogas generator**. The carbohydrate-containing materials are fed in, and a range of bacteria anaerobically ferment the carbohydrate into biogas. The remaining solids settle to the base of the digester and can be run off to be used as **fertiliser** for the land. The **optimum** temperature for biogas production is between 32°C and 35°C.
Cooler Countries – slow respiration rate – bury generator with thick walls. **Warmer Countries** – denatures enzymes – bury generator so ground keeps it cool during the day.



Environmental Change:

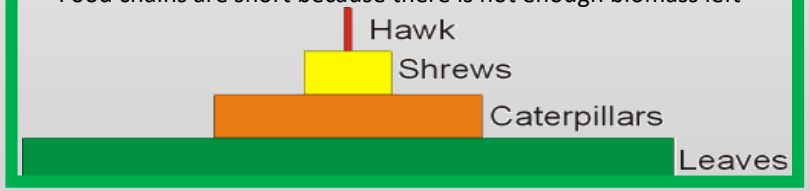
Seasonal Changes	Daylight, amount of rainfall, temperature all change with the seasons. Animals migrate.
Geographical Changes	Changes to soil (structure and pH), altitude, saltiness of water. Organisms have adaptations to survive.
Human Interaction	**Negative**: Global warming, acid rain, pollution **Positive**: Maintaining rainforests, reducing pollution, conservation of hedgerows and woodlands
Living Factors	New predator, diseases, new competitors

Biomass: mass of organism (no water)
Trophic Levels: stages in a food chain eg. producer, primary consumer
Pyramid of Biomass: shows the proportion of organisms at each trophic level. Rules for drawing a good one:

- Producer always at the bottom.
- They always have a pyramid shape

Biomass is lost from the food chain at each level because:

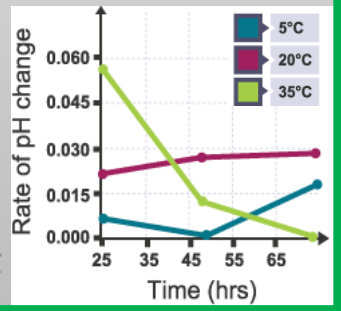
- Not all organisms or parts are eaten e.g. roots, bones.
- Faeces contain biomass (available to decomposers for decay)
- Most biomass consumed is used for respiration not growth
- Food chains are short because there is not enough biomass left



PRACTICAL – RATE OF DECAY
As milk decays its pH reduces because the milk bacteria respire converting lactose sugar to lactic acid.

- 3 beakers of milk
- Measure the pH
- Place at 3 different temperatures
- Measure the pH at 24, 48 & 72 hrs
- Calculate the rate of change of pH
- Faster drop in pH = faster decay

$$rate\ of\ change = \frac{change\ in\ value}{change\ in\ time}$$



Food Security: Having enough food for the population
Biological factors threatening food security:

- the increasing birth rate has threatened food security in some countries
- changing diets in developed countries means scarce food resources are transported around the world
- new pests and pathogens that affect farming
- environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail
- the cost of agricultural inputs
- conflicts that have arisen in some parts of the world which affect the availability of water or food.

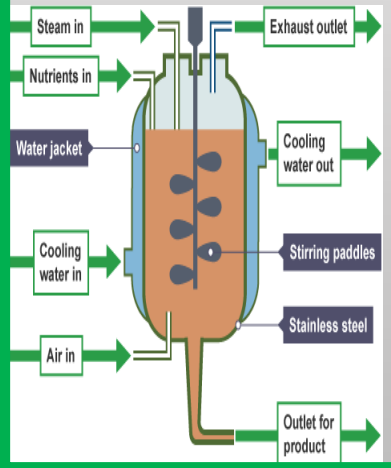
To make food production efficient:

- Shorter food chains so less biomass lost
- Limit movement of farm animals = less respiration = more growth
- Warmer temperature – less respiration more biomass
- Fish bred in cages on high protein diets

Downsides: Ethical concerns over animal cruelty and welfare, Cost for lighting and heating, disease spreads in intensive farms

Sustainable = producing foods in ways that supply the whole human population and can continue for years.
Maintaining fish stocks: breeding must continue or species may become extinct. To prevent overfishing:

- Larger-holed nets to only catch the bigger, older fish
- Ban fishing during breeding season
- Strict fishing quotas to make sure some fishermen only bring in a limited number of specific types of fish.



Modern biotechnology techniques enable large quantities of food to be produced.
The fungus **Fusarium** (grows fast on glucose syrup) in a **fermenter** under **aerobic** conditions. Fungal biomass is harvested, purified and processed to make **mycoprotein**. It can be shaped and flavoured to make a low fat, protein rich food.
GM crops could provide more food or food with improved nutritional value eg. golden rice.

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