# Biology Knowledge Organiser
Ecology

## Importance of communities

| Key Word | Explanation |
|---|---|
| Population | A group of **organisms** of the same **species** in the same place. |
| Community | All the living **organisms** in an **ecosystem**. |
| Habitat | The environment in which **organisms** live. |
| Ecosystem | The interaction between the community of living organisms (**biotic**) & the non-living (**abiotic**) parts of their environment. |
| Stable Community | A **community** where **species** and environmental factors are in balance & so **populations** remain fairly constant. |
| Interdependence | Within **communities**, species depend on other species for food, shelter, pollination, seed dispersal etc. If one **population** is affected, so is the rest of the **community** |

## Competition:

Organisms must compete to survive.

| Animals | Plants |
|---|---|
| Food | Light |
| Territory | Water |
| Mates | Mineral Ions |
| | Space |

## Biotic and Abiotic that can affect communities

Organisms do not live in isolation, there are various factors that can affect them. These factors can be **BIOTIC** (living) and **ABIOTIC** (non-living).

| Biotic (living) | Abiotic (non-living) |
|---|---|
| Food Availability | Light Intensity |
| New Predators | Temperature |
| New Pathogens | Moisture Levels |
| New Competitors | Soil pH and mineral content in the soil |
| | Wind Intensity/ Direction |
| | CO2 levels for plants |
| | O2 levels for aquatic animals |

## Adaptations

To survive and reproduce, organisms require a supply of materials (resources) from their environment and other organisms living there.

Adaptations are features of an organism that help it to survive and to compete successfully to acquire these resources.

Some organisms have adaptations that allow them to live in extreme environments (high temp, high pressure, high salt conc.). These organisms are called extremophiles. For example, bacteria living in deep sea thermal vents are extremophiles.




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## Types of adaptations

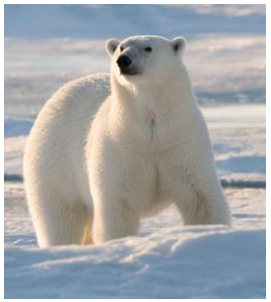
| Type | Description | Example |
|---|---|---|
| Structural | Shape/colour of animal or body part. | **Camouflage** – the sandy-brown coat of a lioness matches perfectly the dried grasses of the savannah. **Insulation** – seals have a thick layer of fat (blubber) to insulate. |
| Behavioural | Things the animal does (behaviour). | **Migration** – many bird species seasonally migrate, travelling large distances for food or mates. **Basking** – cold blooded reptiles bask in the sun to absorb heat. |
| Functional | Biological processes within the organism. | **Anti-freeze** – Some Antarctic fish produce a chemical that stops their cells from freezing below 0°C. |

Remember, plants also have structural, behavioural and functional adaptations to help them compete and survive

## Adaptations in cold climates

**Thick layer of fat & fur** – insulation, reduces heat loss & an energy store (structural/functional)

**Camouflaged fur** – allows bear to ambush prey (structural)



**Large & Stocky** – low SA:V ratio* reduces heat loss. (structural)

**Females dig dens** - to protect their offspring from the cold and winds (behavioural)

**Fat-heavy diet** – their digestive system is adapted to digest nutritious seal blubber (functional)

**Large, furry paws** – better grip on icy surfaces and insulation (structural)

## Adaptations in hot climates

| Animals | Plants |
|---|---|
| **Specialised kidneys** – produce concentrated urine, reduces water loss. | **Curled leaves** – reduces surface area. reducing evaporation |
| **Large**, **thin ears** – increases energy transfer from their skin, cooling them | **Small**, **fleshy leaves** – can store water |
| **Small bodies** – large SA:V ratios, increases loss of heat. | **Thick, waxy cuticle** – reduces evaporation |
| | **Sprawling roots or Deep roots** - Increases water absorption |

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## Abundance and Distribution

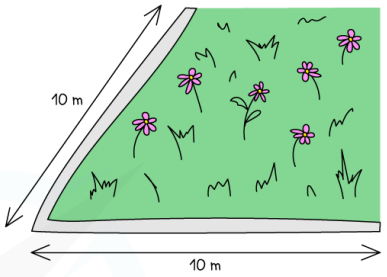
Ecologists study the make-up of ecosystems. Ecologists are often interested in two things:

- Abundance – how many organisms there are in a habitat.
- Distribution – in which areas those organisms are found within a habitat. You will learn how ecologists measure these in this topic's required practical.

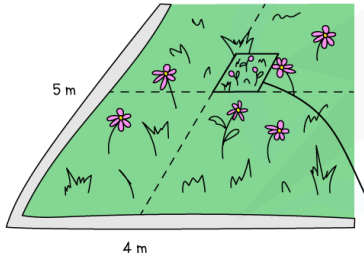
## REQUIRED PRACTICAL: Part 1 Estimating Abundance

ESTIMATING POPULATION SIZE METHOD

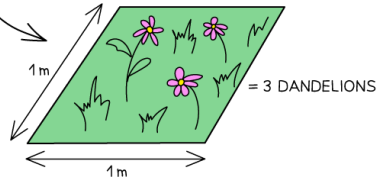
1 USE TWO TAPE MEASURES TO LAY OUT A SURVEY AREA (e.g. 10 m × 10 m) IN YOUR CHOSEN HABITAT, SUCH AS THE SCHOOL FIELD.




2 USE A RANDOM NUMBER GENERATOR TO CREATE A SET OF COORDINATES TO PLACE YOUR FIRST QUADRAT. e.g. IF YOU GET A 4 AND A 5, PLACE YOUR QUADRAT 4 m ALONG THE x–AXIS AND 5 m ALONG THE y–AXIS.




3 COUNT THE NUMBER OF YOUR CHOSEN PLANT SPECIES (e.g. DANDELIONS) THAT ARE FOUND WITHIN THIS QUADRAT.




| Quadrat | Number of dandelions |
|---|---|
| 1 | 3 |
| 2 | 4 |
| 3 | 2 |
| 4 | 1 |
| 5 | 0 |
| 6 | 0 |
| 7 | 2 |
| 8 | 5 |
| 9 | 3 |
| 10 | 1 |
| **Total** | **21** |

4 RECORD THIS NUMBER IN A RESULTS TABLE AND REPEAT STEPS 1–3 UNTIL YOU HAVE RECORDED THE NUMBER OF YOUR CHOSEN PLANT SPECIES IN 10 QUADRATS.

5 ESTIMATE THE POPULATION OF DANDELIONS IN YOUR SURVEY AREA USING THE EQUATION:

$$\text{ESTIMATED POPULATION SIZE} = \frac{\text{TOTAL AREA}}{\text{AREA SAMPLED}} \times \text{TOTAL NUMBER OF DANDELIONS COUNTED}$$

TOTAL SURVEY AREA WAS 10 m × 10 m

$$= \frac{100}{10} \times 21$$

$$= 210$$

EACH QUADRAT IS 1 m × 1m AND 10 QUADRATS WERE PLACED

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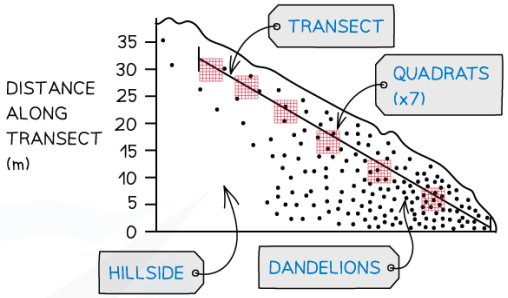
## REQUIRED PRACTICAL: Part 2 Investigating the effect of a factor on the distribution of this species

A tape or rope used in this practical that is put across a habitat is called a **transect**.

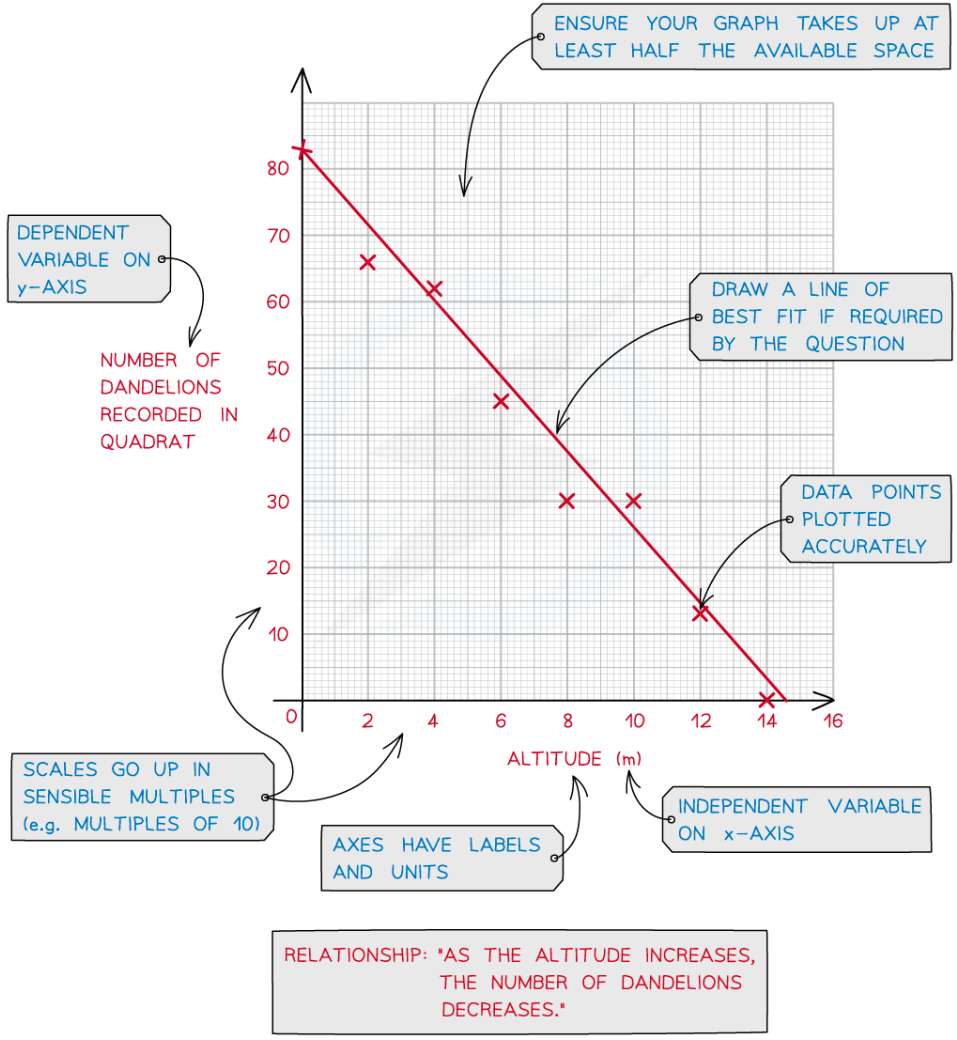
1 SET YOUR TRANSECT UP THROUGH THE AREA YOU ARE INVESTIGATING. IN THIS CASE, A 30 m TAPE MEASURE IS PLACED UP A HILLSIDE. PLACE A QUADRAT AT EQUAL INTERVALS (e.g. EVERY 5 m) ALONG THE TRANSECT.




| Distance along transect (m) | Number of dandelions | Attitude (m) |
|---|---|---|
| 0 | 84 | 2 |
| 5 | 66 | 4 |
| 10 | 62 | 6 |
| 15 | 45 | 8 |
| 20 | 30 | 10 |
| 25 | 30 | 12 |
| 30 | 13 | 14 |

2 RECORD THE NUMBER OF YOUR CHOSEN PLANT SPECIES INSIDE EACH QUADRAT. RECORD YOUR ABIOTIC FACTOR (e.g. ALTITUDE) AT EACH QUADRAT. RECORD YOUR RESULTS IN A TABLE.

3 PLOT YOUR DATA IN A GRAPH AND DESCRIBE ANY RELATIONSHIP THAT CAN BE OBSERVED.



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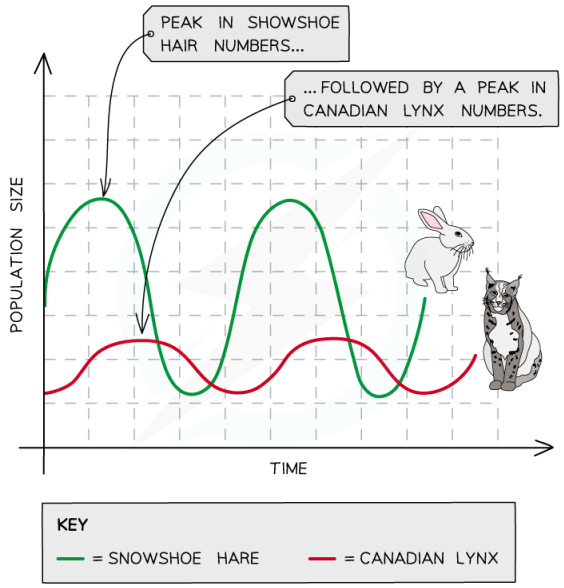
## Predator – prey relationships




An example of a graph used to model a predator-prey cycle between the Canadian lynx and the snowshoe hare

The graph demonstrates some of the key patterns of predator-prey cycles:

1. The number of predators increases as there is more prey available
2. The number of prey then decreases as there are now more predators
3. The number of predators decreases as there is now less prey available
4. The number of prey increases as there are now fewer predators
5. The cycle now repeats

## Materials Cycling

All the elements that make up all the molecules and compounds on this Earth were all created inside our Sun during the formation of the Solar System.

No new elements are being created and added to the Earth – so we're stuck with the limited materials we've got. Sustaining life on Earth would not be possible without a means of 'recycling' these materials to provide the building blocks for new life.

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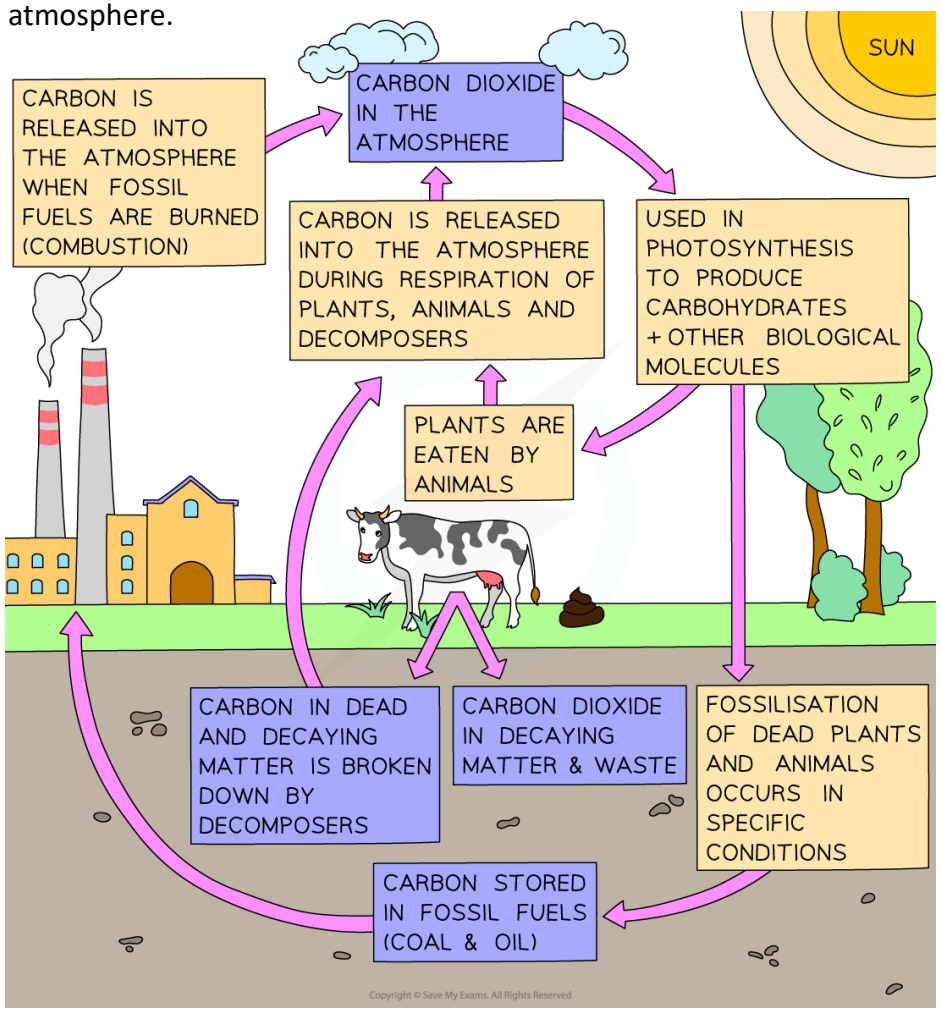
## The Carbon Cycle

Living material (biomass) is carbon-based. This means that almost every molecule an organism is made of contains carbon atoms (C). Carbon is cycled between living tissue, dead tissue and the Earth's atmosphere.

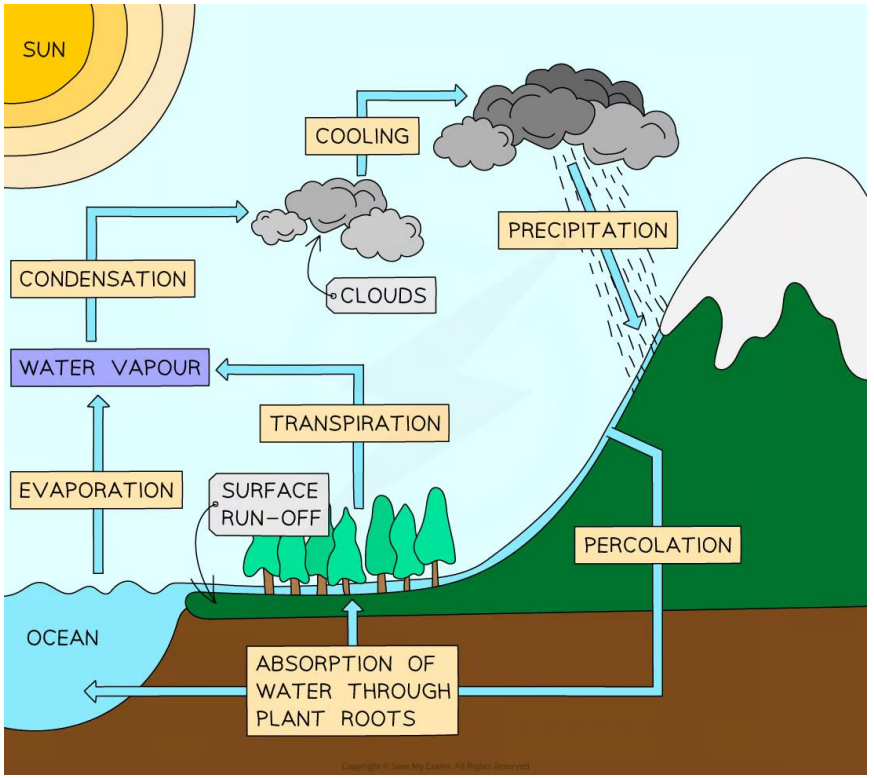



## The Water Cycle

The water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated. Water molecules move between various locations – such as rivers, oceans and the atmosphere – by specific processes:

Water enters the atmosphere as water vapour in one of two processes:

- Energy from the Sun heats the Earth's surface and water **evaporates** from oceans, rivers and lakes
- **Transpiration** from plants releases water vapour into the air
- The warmer air of the lower atmosphere rises, taking the water vapour with it
- The moist air cools down as it rises
- Water vapour condenses back into liquid water, forming clouds
- Water returns to Earth in the form of precipitation
- As the water droplets in the cloud get bigger and heavier, they begin to fall as rain, snow and sleet. This is called **precipitation.**



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## Biodiversity

Biodiversity is the variety of all the different species of organisms on Earth, or in an ecosystem. eg A high biodiversity ensures the stability of ecosystems, reducing the dependence of any one species on a single other (e.g. for food).

Biodiversity and species distribution can be affected by changes to the environment including:

- temperature changes
- availability of water
- composition of atmospheric gases

These changes can be natural (seasonal & geographic) or caused by human activities.

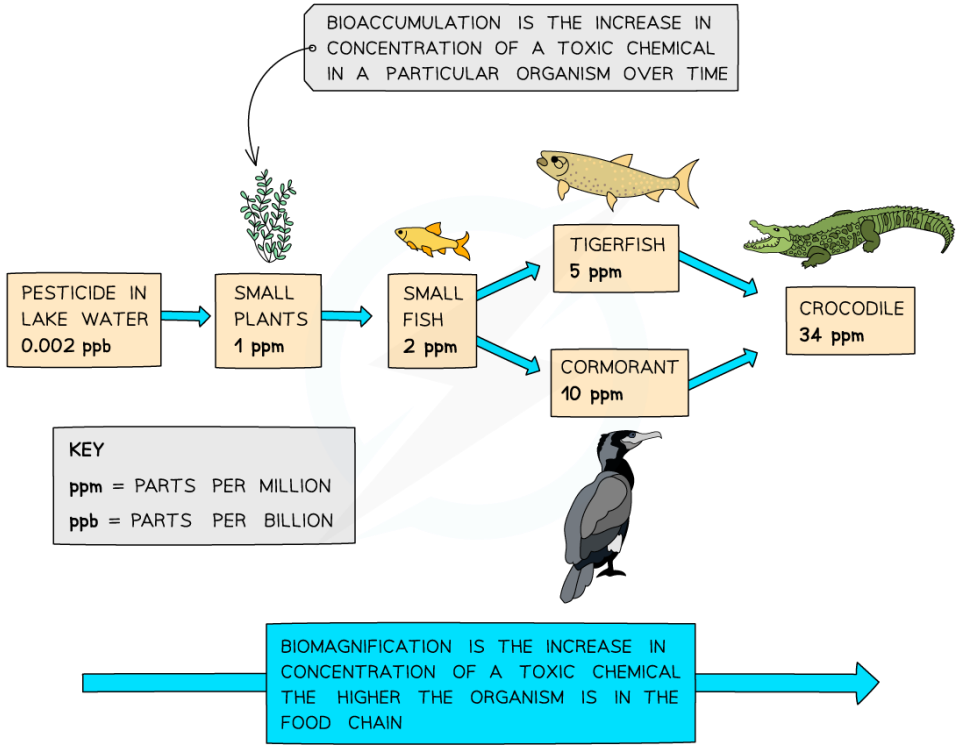
## Pollution

Human population growth globally has been increasing **exponentially** for the last 150 years. As increasingly more resources are used to sustain the growing human population, more **waste** is produced and more **pollution** is created.

| Types of pollution | |
|---|---|
| Water | From sewage, fertiliser or toxic chemicals |
| Air | From smoke and acidic gases |
| Land | From landfill and from toxic chemicals |

## Water pollution

Toxic chemicals (pesticides and herbicides) sprayed on crops to prevent damage by insects and growth of weeds. Runoff occurs from agricultural land if these toxic chemicals are applied in too high a concentration, causing them to enter watercourses.




These chemicals cannot be broken down by organisms. They can be absorbed by aquatic plants or invertebrates and can build up in the tissues of these organisms over time. This is called **bioaccumulation**. At each stage of the food chain, increasing levels of the chemicals build up in organisms, which can eventually build up to dangerously toxic levels in top predators, Leading to death or failure to breed. This is called **biomagnification**.

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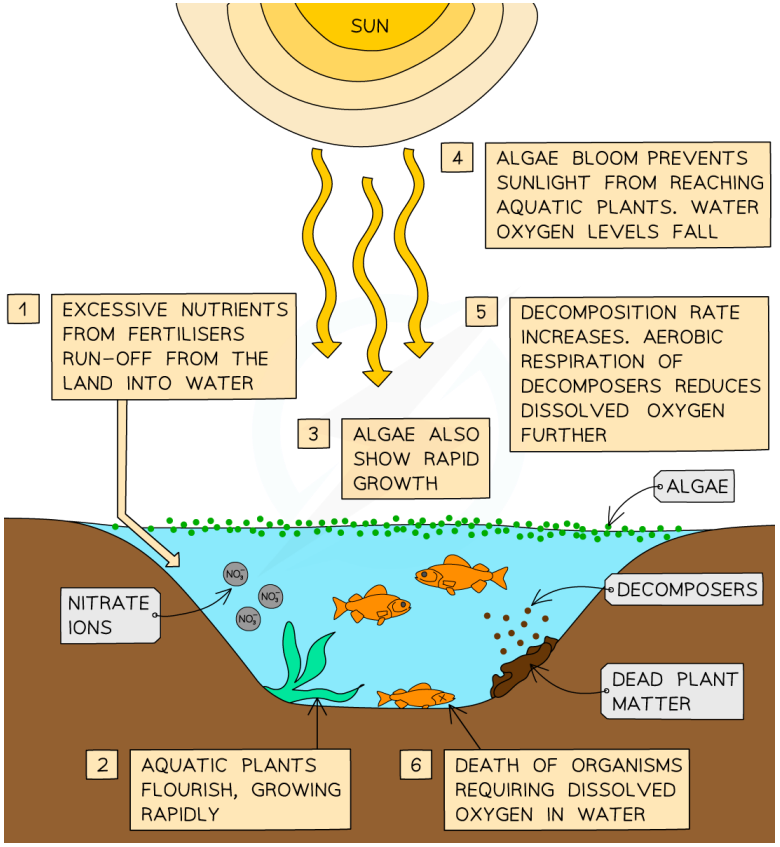
## Water pollution

Runoff occurs from agricultural Land if fertilisers are applied in too high a concentration, causing fertilisers enter watercourses. Fertiliser causes increased growth of algae and water plants. The resulting ‘algal bloom' blocks sunlight so water plants on the bottom start to die, as does the algae when competition for nutrients becomes too intense. Dead plants and algae are a good source of food for bacteria. this eventually leads to **eutrophication** and the death of many aquatic organisms.




## Land pollution

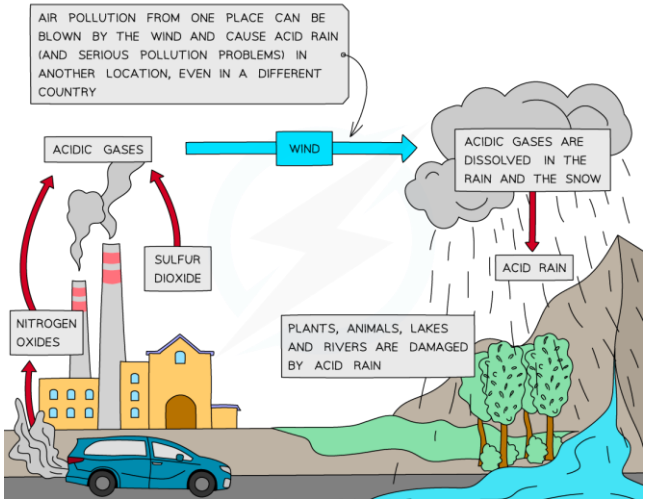
Toxic chemicals (pesticides and herbicides) sprayed onto crops, these toxic chemicals also get into the soil. These chemicals cannot be broken down by organisms. They can be absorbed by plants or taken in by other organisms Living in the soil and can build up in the tissues of these organisms over time. This is called bioaccumulation. At each stage of the food chain, increasing levels of the chemicals build up in organisms, which can eventually build up to dangerously toxic levels in top predators, Leading to death or failure to breed.

Household waste that cannot be recycled is buried in landfill sites. Landfill sites take up a lot of room and their creation often results in the destruction of natural habitats. Toxic chemicals can spread from the waste into the soil. Much rubbish, such as that made from plastic, is non-biodegradable and remains in the environment for hundreds of years.

## Air pollution

Combustion of fossil fuels that contain sulphur impurities creates sulphur dioxide. Nitrogen oxides are also produced during fossil fuel combustion. These gases react with oxygen and dissolve in rainwater to produce dilute sulphuric acid and nitric acid, which leads to acid rain.

Acid rain can damage the Leaves, buds, flowers and roots of trees and other plants. It can make rivers and Lakes too acidic, resulting in the death of certain aquatic organisms. It can also cause the leaching of minerals that are toxic to fish, such as aluminium, into lakes.



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## Land use

Humans reduce the amount of land available for other organisms because land is needed for: **building, quarrying, farming and dumping waste.**

**Peat** is found in peat bogs, which form over thousands of years. Peat is the semi-decayed remains of ancient plants. It can be used as a potent compost by farmers and gardeners and also as a **fuel**.

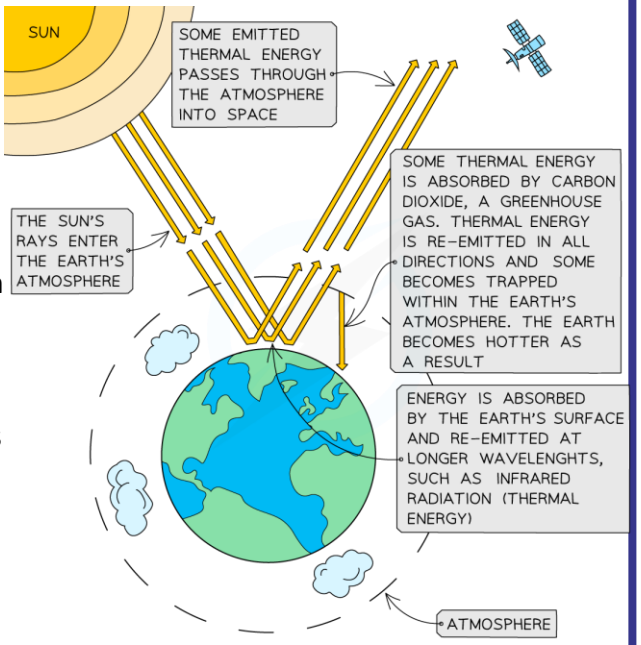
| Pros | Cons |
|---|---|
| Peat as a compost increases yields for farmers. | Destroying peat bogs reduces the area of that habitat and thus reduces biodiversity. |
| Peat is cheap and readily available. | When peat decays or is burned, it releases CO2 , contributing to g |

**Deforestation** is the act of cutting down forests. Large-scale deforestation frees up land for human use. In tropical areas, it has specifically occurred to: provide land for cattle & rice fields, grow crops for biofuels.

| Pros | Cons | |
|---|---|---|
| Allows humans to obtain useful resources and grow enough food to feed growing populations | Reduces biodiversity - trees needed as shelter/food for many | Less trees = less CO2 removed from the atmosphere by photosynthesis - contributes to global warming |
| Expanding settlements provides economic benefits & jobs | Increases the risk of drought & flooding | Burning the trees releases CO2, also contributing to global warming |

## Global Warming

Global warming is an increase of the average global temperature. This occurs as part of a natural cycle of warming and cooling of the planet driven by the **greenhouse effect**. The greenhouse effect traps heat from the Sun. However, global warming is increasing rapidly due to rising **greenhouse gas emissions (e.g. of $CO_2$ and methane)** from human activities.



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## Consequences of Global Warming Global Warming

| Effect | Consequence |
|---|---|
| Loss of Habitats | Melting of polar ice caps would cause rises in sea levels which could flood coastal habitats. |
| Changing Distributions | Changes to temperature & climate would change the suitability of habitats for some species. This may cause changes in species populations and their ranges . |
| Changing Migration | Temperature changes could affect migration behaviours. |
| Reduced Biodiversity | Loss of habitat & species in an ecosystem would make it less stable, possibly causing more extinctions. |

There is **scientific consensus** (almost all scientists agree) that global warming is happening and that **human activities are largely responsible** for the most recent warming.
This scientific consensus is based on systematic reviews of thousands of scientific research papers that have been '**peer reviewed**' by other scientists (the method used by scientists to check each other's work in order to ensure that research findings are valid).
Although they can make good **predictions**, it is **difficult for scientists to say for certain** what the **consequences** of global warming will be.

## Maintaining Biodiversity

The increasing human population and the activities of humans (including waste production, peat bog destruction, deforestation and our contributions to global warming) are causing a reduction in global and ecosystem-level biodiversity. Methods to reduce negative impact:

| Method | Impact on biodiversity |
|---|---|
| **Breeding programmes for endangered species** | • Breeding programmes have been set up to save endangered species from extinction.<br>• Endangered species are bred in captivity.<br>• Individuals can then be released back into their native habitats to help support or in some cases re-establish endangered wild populations. |
| **Protection and regeneration of rare habitats** | • Protection of vulnerable habitats such as rainforests, mangroves, heathland and coral reefs helps to preserve the biodiversity within them and stabilise these ecosystems. |
| **Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop** | • A single crop-type (known as monocultures) can only support a low level of biodiversity.<br>• Hedgerows, as well as the wild flowers and grasses that grow when field margins are created, support a high level of biodiversity. |
| **Reduction of deforestation and carbon dioxide emissions by some governments** | • Deforestation results in habitat destruction and increased carbon dioxide in the atmosphere.<br>• Reducing deforestation and carbon emissions will reduce the rate of current global warming, which is threatening habitats and biodiversity. |
| **Recycling resources rather than dumping waste in landfill** | • Reduces the amount of waste produced and the amount of space required for landfill sites, reducing habitat destruction.<br>• Reduces the rate we are using up natural resources, reducing habitat-destroying activities such as quarrying and mining. |