An ecosystem is the interaction of a community with the non-living parts of their environment.

All ecosystems are self-supporting – they get **energy** from the **Sun** ultimately and all other resources are present in the system. Animals depend on plants for oxygen and food. Plants depends on animals for pollination and seed dispersal.

Biodiversity is the range of different species that live in an ecosystem. This is important because it means there is a large range of food sources so organisms aren't dependant on just one source.

Population refers to the number of one species in an ecosystem.

A habitat is the place where an organism lives.

Abiotic factors are non-living factors that affect the conditions in a habitat:

- Temperature
- Light intensity
- Oxygen levels
- Carbon dioxide levels
- pH

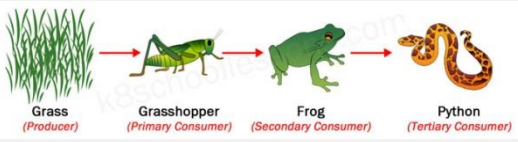
Biotic factors are factors caused by living organisms:

- Amount of food
- Pathogens
- Predators
- Competition between species

These factors will affect the **distribution** of different organisms – where they are found.

Habitats and ecosystems can be affected by humans or they can be natural. E.g. Seasonal changes, geographic changes, global warming, erosion. Humans can also cause changes by burning fossil fuels and intensive farming.

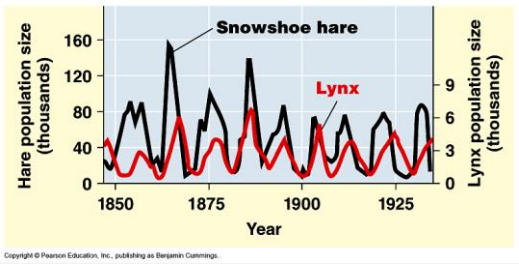
Producers make their own food – these are usually plants which make glucose through **photosynthesis** using energy from the Sun.



Parasitism is a relationship where one organism benefits but the other is harmed. E.g. Tapeworms, ticks etc.

Mutualism is where both organisms benefit.

Population cycles are caused by predator-prey relationships. As you can see below the predator population size lags behind its prey's.



Trophic levels describe the feeding positions in food chains.

Pyramids of biomass and numbers can be used to represent food chains. Pyramids of biomass represent the "dry" mass of organisms at each level and are always pyramid shaped because biomass is lost at each stage of the food chain. Some is lost because not all plant material can be digested and other material is used for respiration and lost as CO_2 and water.

Competition for resources is the main driving force for evolution. Successful competitions survive and reproduce and pass on the genes that made them successful competitors.

Competition can be **interspecific** (**between species**) or **intraspecific** (**within the same species**). Intraspecific is usually more significant, but both can affect the **distribution** and **population** size of a species.

Measuring the distribution and size of a population must be done with a sample selected randomly and with sufficient size to be **representative**. A sample of a habitat might be done in the following way:

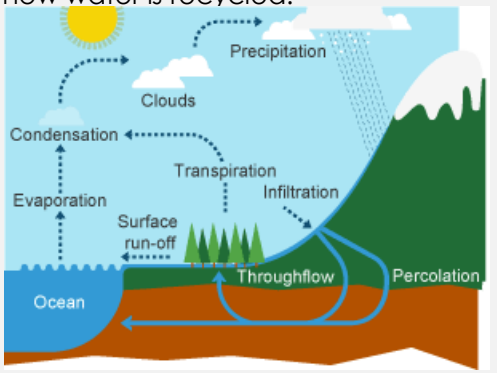
- Divide area into a grid
- Use a computer to **randomly** choose grids to sample
- Sample the grids using a quadrat/sweep net/ pooter

Once an area has been sampled, and the organisms counted. An average amount of organisms must then be calculated. By using a sample we can get an estimate of total organisms present n an ecosystem.

Adaptations are features of an organism that allows it to compete for resources better. These can be physical (e.g. camouflage, speed) or behavioural (e..g moving to colder/ warmer places when needed or hibernation). Plants can be adapted with spines to reduce surface area in hot climates. This will reduce the amount of water lost by **transpiration.** Most of the adaptations in hot climates are to reduce water loss. **All adaptations will have evolved to increase the chances of survival, and therefore reproduction.**

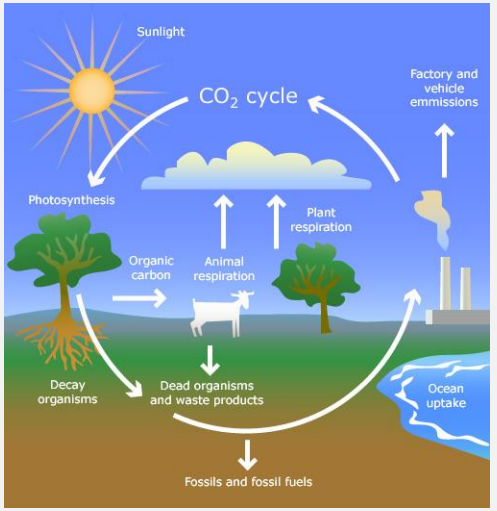
Extremophiles are adapted to live in extreme environments such as extreme heat/cold, high salt concentration or high pressure.

Carbon, nitrogen and water are all recycled. The water cycle describes how water is recycled:



Decomposers play important roles in the recycling of carbon and nitrogen. They will feed from dead organisms and release waste as CO_2 and minerals that plants can use.

The **carbon cycle** mainly involves plants removing CO_2 from the atmosphere by **photosynthesis** to make glucose, which is then released back into the atmosphere through **respiration**. Some CO_2 is released back into the atmosphere by burning wood or fossil fuels.



Decay can be used by gardeners to make compost and also to make **biogas**. Biogas is mostly methane and CO_2 with some water vapour.
Decay rates can be increased by having more microbes, more oxygen, higher temperatures and some moisture. Decay will occur best at around 37°C because this is the optimum temperature for enzymes.

Humans use land for many different purposes which affects the amount of resources available. This leads to less biodiversity. Increases human populations mean more land used for homes and agriculture and more pollution and waste.

Deforestation is happening to make more room for crops and livestock. This reduces biodiversity as forests are replaced with just one type of plant. It also increases CO_2 in the atmosphere due to the bacteria that break down the left over plants and the reduced photosynthesis. Most carbon is stored in trees so removing them has a big impact.
Waste products must be carefully managed to minimise impact on ecosystems. Pollution can come from fertilisers (eutrophication) or from toxic chemicals. Toxins will build up in food chains affecting higher trophic levels more. **Acid rain** is caused by fossil fuels. It damages plants and affects fish.

An **indicator** species is a species that is sensitive to changes in the environment. Lichens cannot survive in pollution so are a good indicator of pollution. There is one type of lichen that survives well in SO_2 so can be an indicator for that specific pollution.
Sludge worms can be used to indicate low oxygen levels in water, whereas alderfly larvae can only survive with no pollution present.

More specific instruments can be used to measure pollution such as probes and chemical tests.
Ecosystems can be protected and their biodiversity maintained through different measures such as:

- Hedgerows to reduce monocultures and provide more habitats
- Protecting rare habitats
- Replanting trees cut down
- Cloning plant species that are becoming extinct

Conservation is used to protect endangered species, protect plants for medical uses and to protect future food supplies.

Food security is making sure all people have access to consistent supplies of food. This is a problem due to increasing birth rates, pests and pathogen problems and environmental changes. Sometimes crops are grown that aren't staple foods such as coffee, which is sold to other countries.

Farming involves only a few species of plant, reducing biodiversity. Biodiversity is needed for crops to grow properly.
We can improve the production of food by:

- Using fertilisers
- Using pesticides and herbicides
- Feeding animals high protein feed
- Controlling temperatures
- Restricting animal movement so less energy is wasted

Biotechnology has created new methods producing food. Biotechnology is the using of living organisms to produce a product.
Examples include:

- GM crops

These can produce more food at more nutritious levels and can be pest resistant or disease resistant.

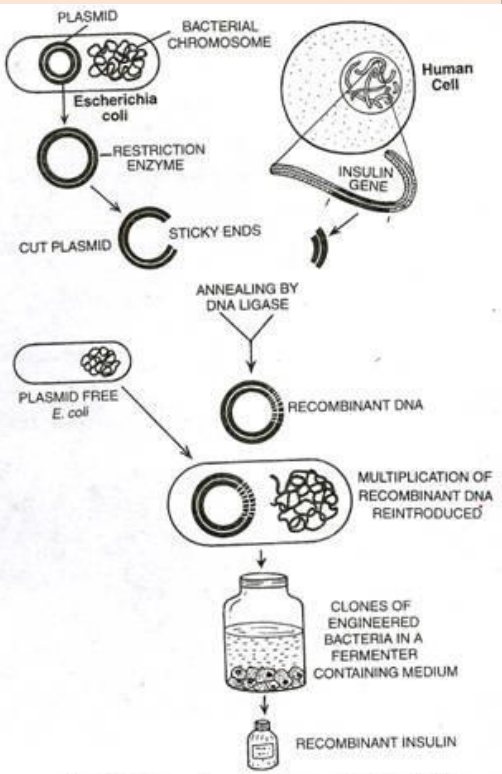
- Insulin

This is used to control human blood sugar in diabetics. Insulin can be injected to control the symptoms of diabetes. It is grown in bacteria using recombinant DNA technology.

- Mycoprotein

Fusarium fungus is used to grow mycoprotein (sold as Quorn^{tm}). This is a protein that can be grown rapidly and has less health drawbacks than meat.

Recombinant DNA technology is used to put the DNA from one organism into another for production in biotechnology.



Fermenters are used to grow microbes and maintain stable conditions. They have:

- A water jacket to maintain temperature
- Oxygen supplies
- pH and temperature probes
  - If these change then enzymes will denature and growth will slow
- Stirrers to spread heat and nutrients

In mycoprotein fermenters, oxygen is used to circulate the fungus as a stirrer would break the protein.