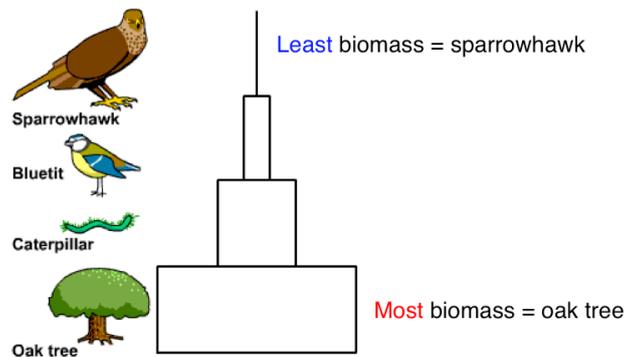


Plants & Photosynthesis Key Notes

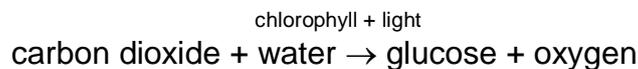
Photosynthesis & Biomass

Biomass is a measurement of how much biological material there is

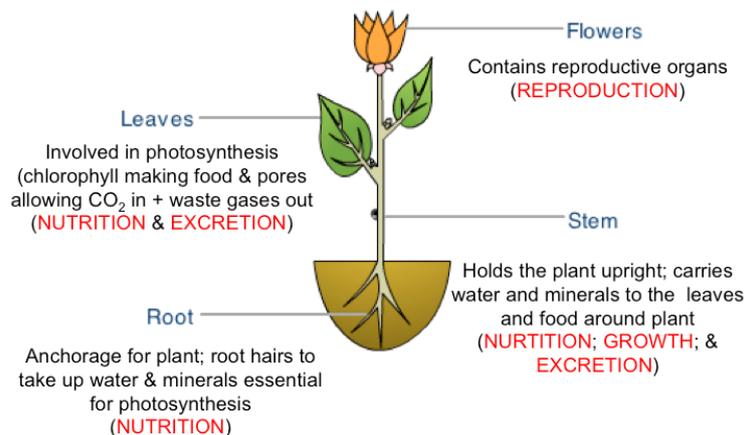


Plants make their own food using their leaves – they do not get any food from the soil. The roots absorb water and minerals, but the food for the plant is made entirely via the leaves in a process known as **photosynthesis**

This is the process of food production for the plant (producing biomass) and requires the leaves to take place...



There are four main structural parts to a plant: -



Photosynthesis needs carbon dioxide, water and light (as well as a variety of nutrients)

If any of these are taken away, they become a *limiting factor* of photosynthesis – reducing the amount of photosynthesis, which can take place

During photosynthesis glucose is produced (a simple sugar)

Plants cannot store glucose, so they convert it into starch (many small glucose molecules are joined together)

Starch is insoluble, so the plant can store it conveniently without it getting dissolved within the cell which is much more convenient than the soluble glucose – iodine is the test for starch, turning from **orange** to dark blue/black

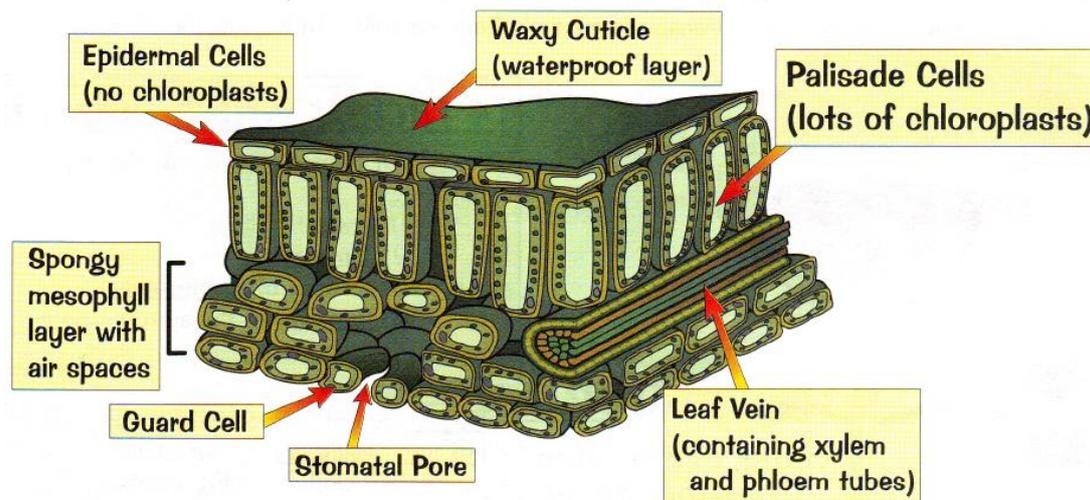
Leaf Adaptation

Leaves are designed for one thing – making food via photosynthesis

Leaves are broad and flat to capture lots of light

Veins carry water to the leaf, and food away to the rest of the plant (veins also support the leaf)

Small holes called stomata in the underside of the leaf allow gases in and out



- Cells in the epidermis make wax which covers the leaf surface (especially at the top) which limits water loss and acts as a protective barrier
- Palisade cells are full of chloroplasts (containing chlorophyll) which is where photosynthesis takes place
- The spongy mesophyll is full of air spaces which allows CO₂ to reach chloroplasts in the palisade layer
- Stomata are tiny holes which allow CO₂ into the leaf (they also allow water to escape) - controlled by guard cells
- Xylem transports water
- Phloem transports food

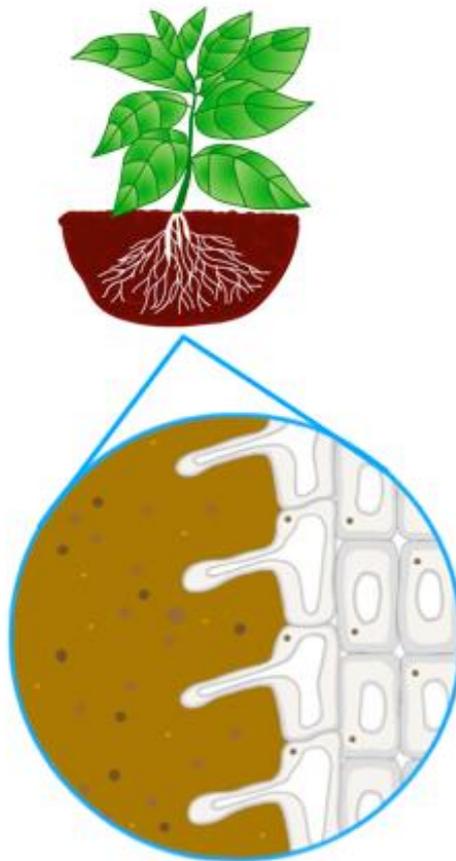
Root Adaptation

Roots: -

- Absorb water
- Absorb minerals
- Anchorage (hold the plant to the ground)

ž The roots are covered with millions of tiny root hair cells

ž These have a very large surface area, allowing the roots to absorb large amounts of water and minerals

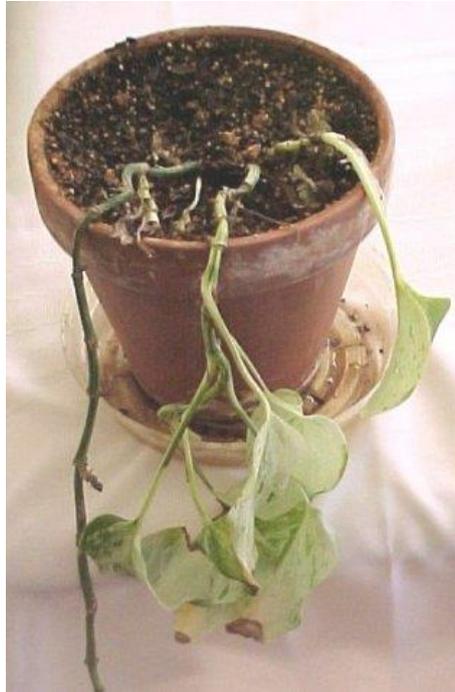


Water is needed for: -

- Photosynthesis
- Helps with transport around the plant
- Helps the plant stay rigid and upright
- Allows the plant to keep cool

ž There are three essential minerals plants need to stay healthy: -

- Nitrates – for protein manufacture
- Phosphates – for photosynthesis and respiration
- Potassium – for photosynthesis and respiration



A lack of nitrate can cause stunted growth and yellowing of older leaves

A lack of phosphate can cause poor root growth and purple younger leaves

A lack of potassium can cause yellow leaves with dead spots on them

Deforestation & The Importance Of Plants

Trees are valuable resources for both animals and humans

- Humans use them for a variety of purposes, including: -
- Fuel (being burnt)
- Building material
- Space (removing forests give valuable space for farming)

Forestry is sustainable, as long as all of the trees that have been cut down are replaced (new trees planted)

However, if this is not done, this leads to *deforestation* (where the amount of forest continually shrinks)

Deforestation can lead to some devastating consequences: -

- Destruction of habitats (decreasing biodiversity)
- Extinction of rare plants (with may contain medicinal properties)
- Flooding due to increased soil erosion

- Atmospheric changes (rises in carbon dioxide)



As well as providing the oxygen needed for respiration by animal and plant cells, plants also store the food they make from photosynthesis as starch

Energy, Food Webs & Fertilisers

A food chain shows the different organisms that live in a habitat, and what eats what

A food chain always starts with a producer, which is an organism that makes food (usually a green plant, because plants can make their own food by photosynthesis)

A food chain ends with a consumer, which is an animal that eats a plant or another animal

grass → cow → human

*The arrow points to the organism that is doing the eating

						
Grass	→	Grasshopper	→	Frog	→	Hawk
Producer		Consumer		Consumer		Consumer
		Primary consumer		Secondary consumer		Tertiary consumer
		Herbivore		Carnivore		Carnivore

The plant is the producer and the animals are consumers. The first consumer in the chain is also called the primary consumer, the next one is the secondary consumer and the one after that is the tertiary consumer...

- A consumer that eats plants is called a herbivore
- A consumer that eats other animals is called a carnivore
- An omnivore is an animal that eats plants and other animals

In most habitats organisms normally eat / are eaten by more than one other organism – to represent this we use food webs
The arrow shows the energy being transferred from one organism to the next

Between each step energy is lost in a variety of ways, including: -

- Growth of the organism
- Reproductive costs
- Lost through waste products (poo)
- Lost through heat

This is why food chains are not infinitely long – energy is lost from one stage to the other

The world population is constantly growing (>6 billion people). All these people require food, however crops cannot be grown in areas where there are insufficient minerals

Intensive farming is a practice which allows for huge amounts of food to be produced using a variety of techniques, however there are some associated problems with this practice...

Intensive farming results in: -

- Hedges removed to make large fields (this destroys the natural habitat and reduces biodiversity)
- Fertiliser misuse can pollute rivers and lakes
- Pesticides disturb food chains (many harmless insects are destroyed)

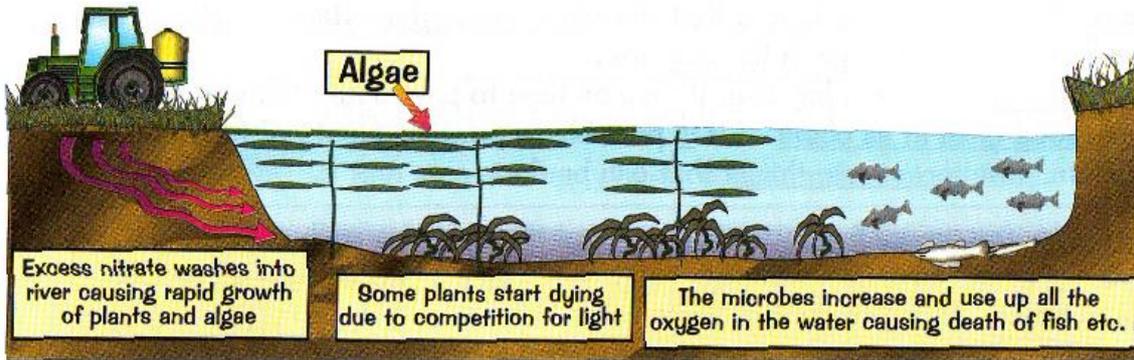
Fertilisers are essential to modern farming, as they allow crops to grow well, increasing their biomass (producing lots of food for us). Fertilisers are needed because plants remove minerals from the soil which need to be replaced

Fertiliser problems arise when the fertiliser finds its way out of the soil and into rivers and streams - eutrophication

Eutrophication occurs when excess nitrates make their way into rivers and lakes causing rapid growth of some plants and algae

Some plants then start dying due increased competition for light which results in micro-organisms feeding on the dead plant (they respire using up lots of oxygen)

This increased level of decomposition results in high levels of oxygen being taken from the water, making it very difficult for larger organisms such as fish to survive - a real danger



- Excess nitrates make their way into rivers and lakes causing rapid growth of some plants and algae
- Some plants and algae then start dying due increased competition for light
- Micro-organisms feed on the dead plant (which respire using up lots of oxygen)
- A lack of oxygen in the water can be very bad news for larger organisms such as fish

Herbicides, Pesticides & Biological Control

Organisms that share a habitat compete with each other for limited living resources

A weed is any plant that is growing where people do not want it, and these are a problem for farmers as they compete with the crops for resources such as light, water, living space and mineral salts

Weeds compete with crops for living resources and this can reduce crop yield. One way farmers can control weeds is to use chemicals called herbicides (weed killers)

Pests are animals that eat and damage crops, being a problem for farmers as they reduce crop yield and compete with humans for food

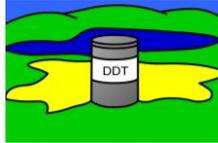
Pesticides can be used as a method of pest control by killing the pests. Pesticides contain poisonous chemicals (toxins)

However, pesticides can kill useful animals as well as the pests that they were meant to kill. Pests are also part of the food web - the toxins in pesticides can affect other organisms in a food chain or food web if they eat an infected pest...

Introducing a pesticide at the bottom of a food chain can have huge effects on the organisms above

Bioaccumulation takes place when a toxin is passed on in a food chain, getting more concentrated at each step

This happened with the pesticide DDT - DDT was sprayed on a lake to control mosquito larvae. DDT is a toxin that does not break down in the environment, staying in the body of an animal, even when it is eaten...



- DDT was sprayed on the lake to control mosquito larvae
- Plant plankton at the bottom of the food chain absorbed some of the DDT from the water
- Each zooplankton ate lots of plant plankton, getting several doses of DDT
- Each small fish ate many zooplankton and so consumed even more DDT
- Each large fish ate several small fish and so consumed even more DDT
- Each eagle ate several large fish therefore getting more than one dose of DDT

Organisms in a community compete for the resources there – they are in competition with each other

Animals compete for: -

- Food
- Water
- Space

Plants compete for: -

- Light
- Water
- Space
- Minerals (within the soil)

The number of predators or prey affect the number of organisms. Disease also affects the number of organisms in a habitat

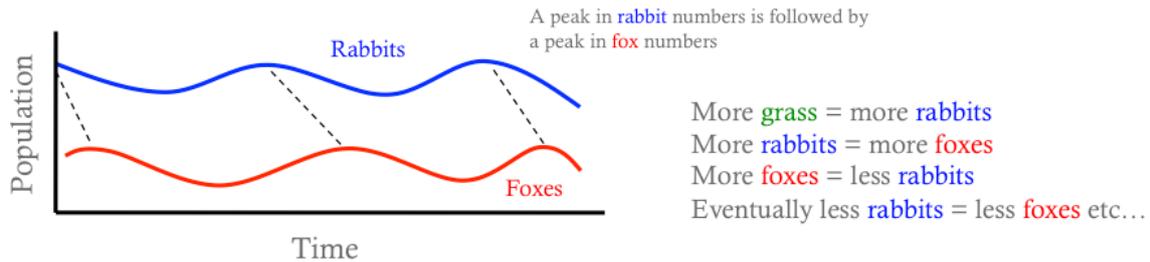
Organisms compete with each other for available resources in order to survive

Animals and plants that get more of these resources are more successful than animals or plants that get fewer of them

These successful animals and plants are more likely to survive to reproduce, so the size of their population is likely to increase

The population of a species is usually limited by the amount of resources available

If the population of the prey increases so will the population of the predators, however as the predator population increases the number of prey will decrease...



Pesticides can have unwanted side effects (such as DDT) – instead of chemicals we can use biological control

A natural predator can be introduced which eats the pest, reducing their numbers allowing for increased crop production

However, you need to ensure the predator does not become a pest itself – e.g.