

1. Introducing ecosystems

(a) **Ecosystem:** Interaction of a community of living organisms with non-living parts of their environment.

(b) **Organisation in an ecosystem:**

- Individual organisms
- Populations - groups of same species
- Communities- many populations together

(c) To survive species **compete**.

Animals – Food, mates, territory

Plants – light, water, space, mineral ions from the soil

(d) **Interdependence:** Species depend on other species for food, shelter, pollination and seed dispersal, Removing one species can effect the whole community. In stable communities populations are constant as species and environmental factors are balanced.

(e) **Adaptations:** Feature of an organism that enables them to survive.

(f) **Extremophile:** Organisms living in extreme environments such as high temperatures, pressure or salt concentration.

- Bacteria living in deep sea vents.

2. Interdependence (triple only)

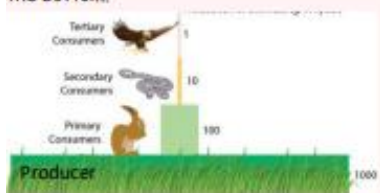
Trophic levels in ecosystems:

(a) **Trophic levels** are represented by numbers

1. Producers = plants/algae
2. Primary consumers = Herbivores
3. Secondary consumers = Carnivores
4. Tertiary consumers = Carnivores (Apex predators are carnivores with no predators).

(b) **Decomposers** break down dead plant/animal matter by secreting **enzymes** small soluble food molecules then diffuse into the microorganism.

(c) **Pyramids of Biomass:** constructed with trophic level 1 at the bottom.



- Approximately 10% of Biomass is transferred to the next trophic level.
- Loss of biomass means less energy is available and therefore fewer organisms at higher levels.

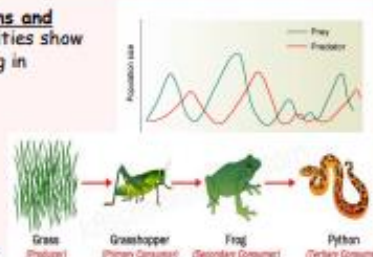
(d) **Biomass is lost between levels by:**

- i. Some food passed out as faeces
- ii. Large amount of glucose used in respiration
- iii. Excretion of carbon dioxide, urine and water during respiration

2. Interdependence

(a) **Feeding relationships are shown by food chains and always begin with a producer.** Stable communities show the number of predators and prey rising/ falling in cycles.

- Producer**- photosynthetic organism
- Consumers** (primary → secondary → tertiary)
- Predators**- kill and eat other animals
- Prey**- eaten by consumers
- Trophic level**- feeding level of the food chain



Adaptations of organisms to biotic/abiotic factors:

Abiotic	Biotic
Light intensity	Availability of food
Temperature	New predators arriving
Moisture levels	New pathogens
Soil pH	One species out competing another
Wind intensity	
CO ₂ levels for plants	
O ₂ levels for aquatic animals	

(b) **Estimating population:**

Sampling using a quadrat:

1. Place quadrat on ground at random
2. Count number of species in quadrat.
3. Repeat and calculate the mean population.

(c) **Estimating distribution:**

Sampling using a transect line:

1. Place transect line in an area
2. Place quadrat along line at regular intervals
3. Count plants in quadrat each time

3. Gathering the reactants for photosynthesis

(a) **Osmosis:** Water may move across cell membranes via osmosis. Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.

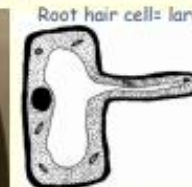
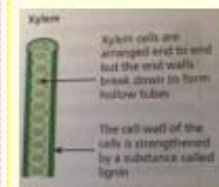
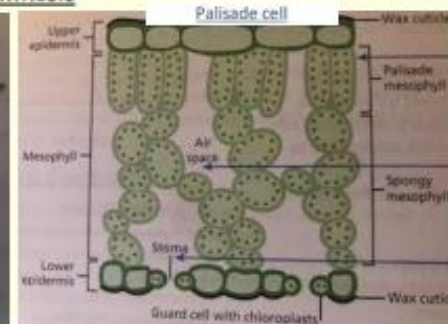
(b) **Active transport:** moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration.

(c) **Active transport examples:**

- i. allows mineral ions to be absorbed into plant root hairs from very dilute solutions in the soil.
- ii. Sugar molecules absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration.

	Osmosis	Passive Transport	Active Transport
Allows molecules to move	✓	✓	✓
Movement is down a concentration gradient	✓	✓	✗
Always involves the movement of water	✗	✓	✗
Needs energy from respiration	✗	✗	✓

3. Gathering the reactants for photosynthesis



4 x factors that can affect transpiration:

1. changing temperature
2. Humidity
3. Air movement
4. Light intensity

(a) The roots, stem and leaves form a **plant organ system** for transport of substances around the plant.

(b) **Transpiration** : Loss of water from the leaves

(c) **Translocation:** The movement of food molecules through phloem tissue

(d) **Stomata:** The role of stomata and guard cells are to control gas exchange and water loss.

(e) **Root hair cells** are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.

(f) **Xylem tissue** transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes and transports water in the transpiration stream.

(g) **Phloem tissue** transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage.

Using the products of photosynthesis

(a) **Photosynthesis**: endothermic reaction in which energy is transferred from the environment to the chloroplasts by light

- carbon dioxide + water → glucose + oxygen
- $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

(b) **Limiting factors of photosynthesis:**

- Temperature
- Carbon dioxide concentration
- Light intensity
- Chlorophyll concentration

(c) **Products of photosynthesis**

Glucose is used for:

- used for **respiration**
- converted into **insoluble starch** for storage
- used to produce **fat or oil** for storage
- used to produce **cellulose**, which strengthens the cell wall
- used to produce **amino acids** for protein synthesis.

To produce proteins, plants also use nitrate ions that are absorbed from the soil.

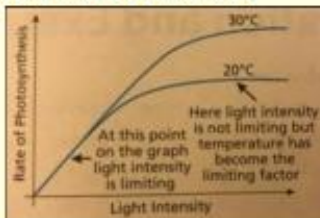
Higher only

Limiting factors of Photosynthesis:

Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit.

Photosynthesis and light intensity:

Doubling the distance between a lamp and pondweed will reduce the light intensity by a quarter. This is called **inverse square law**.



5. Plant Hormones (triple only)

(a) **Plant Hormones**: coordinate and control growth and responses to light (phototropism) and gravity (gravitropism or geotropism). Unequal distributions of auxin cause unequal growth rates in plant roots and shoots.

HT only

Auxins are used:

- as weed killers
 - as rooting powders
 - for promoting growth in tissue culture.
- Ethene** is used in the food industry to control ripening of fruit during storage and transport.
- Gibberellins** can be used to: • end seed dormancy • promote flowering • increase fruit size.

7. Humans and the environment

(a) **Biodiversity** is the variety of all the different species of organisms on earth, or within an ecosystem. A great biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment.

(b) Many human activities are **reducing biodiversity**:

- Waste management**- pollution in water, air and land from sewage, chemicals, smoke and fertiliser
- Land use** -Destruction of peat bogs to produce peat, releasing carbon dioxide.
- Deforestation**- providing land for cattle, rice fields and to grow biofuels
- Global warming** - Carbon dioxide and methane contribute to global warming

(c) Programmes to **reduce** the negative effects of **humans on biodiversity**:

- breeding** programmes for endangered species
- protection and **regeneration** of rare habitats
- reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop
- reduction of deforestation and carbon dioxide emissions by some governments recycling resources rather than dumping waste in landfill.

Triple Only

(a)**Factors effecting 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.

(b)**Sustainability: Methods with increase production but leave resources for future generations**

Sustainable Fisheries: Fish stocks are declining and need to be maintained or some species will disappear. Prevent this by:

- Control the net hole size
- Introduce fishing quotas

(c) **Improving food production efficiency:** Restrict energy transfer from food animals to environment

- Limit movement
- Controlling surrounding temperature
- High protein diet to promote growth

(d) **Biotechnology: enables large quantities of microorganisms to be grown for food**

- The fungus *Fusarium* is useful for producing **mycoprotein**, a protein-rich food suitable for vegetarians. The fungus is grown on glucose syrup, in aerobic conditions, and the biomass is harvested and purified.
- A genetically modified **bacterium** produces human insulin. When harvested and purified this is used to treat people with diabetes.
- GM crops could provide food with an improved nutritional value such as golden rice.

6. Natural recycling

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

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

Triple only

Decomposition - affected by temperature, moisture levels and oxygen levels

Optimum conditions for rapid decay : suitable temperature, moisture (water) and oxygen produces compost used as a natural fertiliser for growing garden plants or crops.

Biogas generators can be used to produce methane gas as a fuel. Anaerobic decay produces methane gas.