Triple Science - Biology

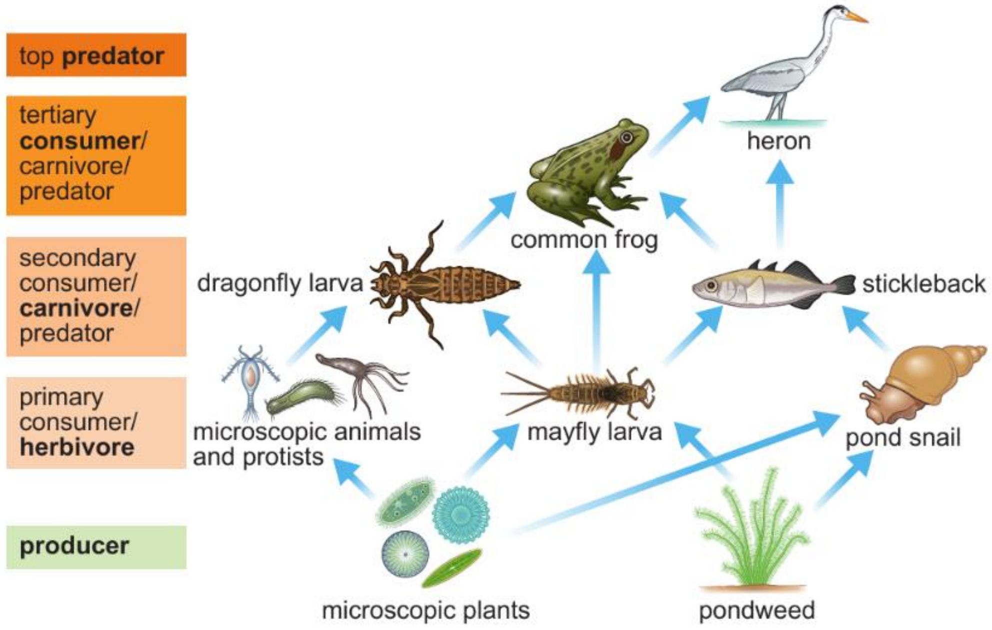
SB9 Knowledge organiser

B9: Ecosystems and Material Cycles

Lesson sequence

1. Ecosystems
2. Energy transfers
3. Core practical – quadrats and transects
4. Abiotic factors and communities
5. Biotic factors and communities
6. Assessing pollution
7. Parasitism and mutualism
8. Effect of humans on biodiversity
9. Preserving biodiversity
10. Food security
11. Water cycle
12. Carbon cycle
13. Nitrogen cycle
14. Rates of decomposition

1. Ecosystems	
Ecosystem	An area in which the interactions between all the living organisms and the all the physical factors forms a stable relationship needing no external input.
Habitat	A particular area within an ecosystem.
Community	All the organisms living in an ecosystem.
Interdependence	The way in which the organisms in an area depend on each other, for food, shelter, protection and so on.
Population	The members of one particular species within an ecosystem.
Abundance	The number of members of one species in an ecosystem.



Food chain	The sequence of transfers of matter and energy in the form of food from organism to organism.
Food web	Represents multiple pathways through which energy and matter flow through an ecosystem.
Quadrat	A metal square used to help find the number of small organisms living in an area.
Random sampling	Estimating the population of organisms in an area by randomly dropping a quadrat several times, finding the average number of organisms present and scaling up your answer.
Population size calculation	Population size = number of organisms in quadrat x (total area / quadrat area).

2. Energy transfers	
Biomass	The dry mass of living organisms in an area (habitat) at a particular time.

Trophic levels	The group of organisms within an ecosystem which occupy the same level in a food chain.
Sankey diagrams	Summarises all the energy transfers taking place in a process. Sankey diagrams are drawn to scale - the thicker the line or arrow, the greater the amount of energy involved.
Pyramids of biomass	Represents the mass of organisms at each trophic level.

3. Core practical – quadrats and transects (CP8)	
CP8 - Belt transect	A way to study how the population of a species changes as you move through an area but counting the organisms in a quadrat at regular intervals.
CP8 – Key question	How does the number of daises vary as you move away from the base of tree?

CP8 – Collecting data	Place a quadrat so it is touching the base of a tree and record the number of daisies. Repeat, moving the quadrat 1 m away each time until it is 10 m away. Repeat with three different trees.
CP8 – Calculate averages	Calculate the average number of daisies 1 m away, 2 m away and so on.
CP8 - Results	The number of daisies increases as you move away from the tree, and levels out at about 6 or 7 m.

4. Abiotic factors and communities	
Abiotic factor	A non-living factor that influences what can live where.
Important abiotic factors	Temperature, light intensity, rainfall, type of landscape, soil pH, soil nutrients, pollution.
Pollutants	Substances produced by human activities that can poison some or all of the organisms living in an area.

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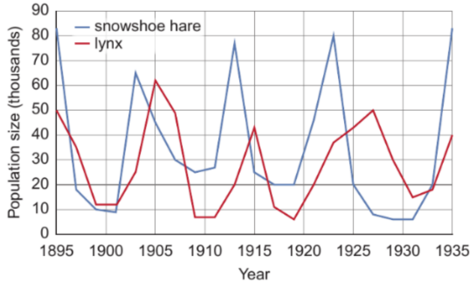
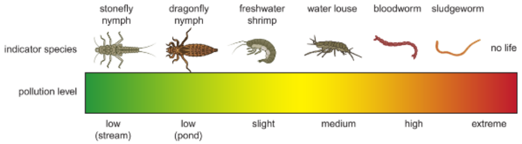
Adaptation to abiotic factors	Features of plants and animals that are suited to the abiotic factors where they live.
Changes to abiotic factors	If an abiotic factor changes – such as temperature increasing due to global warming – organisms may no longer be well adapted to where they live and may die out.

5. Biotic factors and communities	
Biotic factor	A living factor that influences what can live where.
Important biotic factors	The presence of food organisms, predators, competing organisms and disease.
Competition	Often two or more different organisms may compete for the same resource such as food, water or light.
Effects of reducing competition	Reduced competition when a species goes extinct can lead to unpredictable effects on other species with some benefiting from reduced predation, and others benefitting.
Predator-prey cycles	As the number of prey animals increases, the number of predators increase. The predators over-predate the prey leading to a fall in prey numbers which causes the number of predators to go down as there is less food. The number of prey increases again because fewer are being eaten.

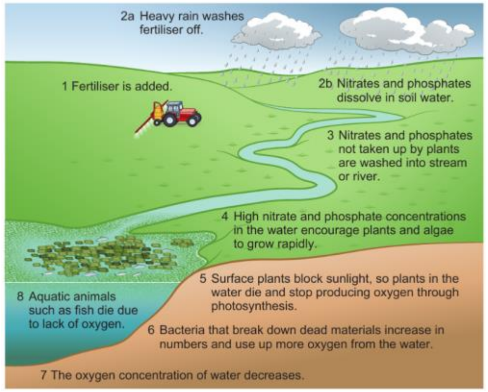


6. Assessing pollution	
Lichen	A composite organism consisting of a fungus and an alga living in a mutualistic relationship.
Indicator species	An organism whose presence, absence or abundance reflects a specific environmental condition.
Pollution	Something introduced into the environment that is dirty, unclean or has a harmful effect.
Blackspot fungus	Is a pathogen specific to roses. The fungus cannot grow well where there is a lot of sulfur pollution.
Aquatic invertebrates	Water living animals without a backbone. These can be used as indicator species.



7. Parasitism and mutualism	
Parasitism	A feeding relationship in which a parasite feeds off its host, causing harm to the host but (normally) not killing it.
Examples of parasites	Fleas and leeches sucking blood, tapeworms living in animals' intestines, mistletoe burrowing its roots into tree branches.
Mutualism	Organisms that live together in a relationship where both benefit.
Examples of mutualism	Cleaner fish that swim into a sharks mouths to feed without being eaten. Algae that live inside coral polyps gaining shelter and providing food.

8. Effect of humans on biodiversity	
Biodiversity	The number of different species living in an area. High biodiversity is good.
Fish farms	Farms based in water where fish are farmed in pens to reduce the need to catch them in the wild.
Effect of fish farming on biodiversity	The waste produced by the fish sinks to the sea floor, changing the conditions and harming the organisms living there.
Introduced species	Organisms introduced by humans – intentionally or accidentally – into a new ecosystem.
Effect of introduced species on biodiversity	Many introduced species upset natural ecosystems by changing the food web. Introduced species often lack predators that can control their numbers.
Eutrophication	Fertiliser used on farmland gets washed into lakes and rivers by rain. It causes algae to grow out of control and when the algae die, it sinks to the bottom and rots which uses up the oxygen in the water.



Effect of eutrophication on biodiversity	With less oxygen in the water, many species die, and biodiversity is reduced.

9. Preserving biodiversity	
Importance of biodiversity	Areas with high biodiversity recover more quickly from disasters such as floods and droughts. Many plants and animals are useful for new medicines and products.
Endangered	When a species is at risk of dying out, usually because it has been over-hunted, or its habitat has been destroyed.
Conservation	When an effort is made to protect rare or endangered species or their habitat.
Importance of conservation	Conservation can make the difference between a species dying out or surviving. It increases biodiversity.
Reforestation	Planting trees or allowing trees to regrow on old farmland. It increases biodiversity by increasing the range of habitats in an area.
Captive breeding programmes	Breeding animals in zoos – where they are protected from danger – in order to be able to release them into the wild.

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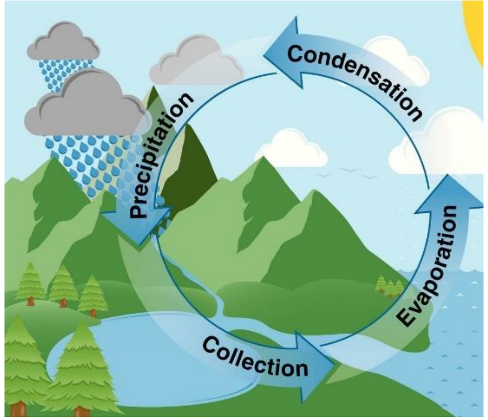
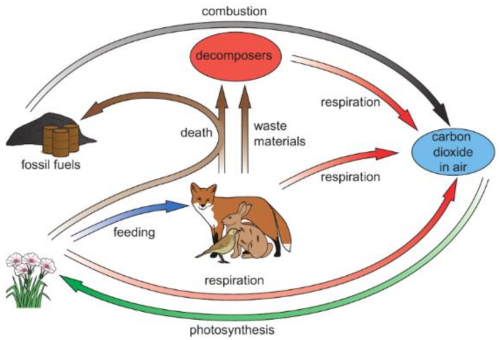
10. Food security	
Food security	The ability of human populations to access food of sufficient quality and quantity.
Yield	The amount of product obtained.
Sustainability	A process or state can be maintained at a certain level for as long as is wanted.
Climate change	A long-term shift in global or regional climate patterns.
Vector	An organism that does not cause disease itself, but which spreads infection by conveying pathogens from one host to another.
Biofuels	A fuel that is produced through contemporary processes from biomass.

11. The water cycle	
Water cycle	The way in water is continuously moved around different parts of the environment.
Water cycle stages	Precipitation, surface run-off and infiltration, evaporation, condensation.
Precipitation	Water falls to the ground as rain, snow and hail.
Surface run-off and infiltration	Water soaks into the ground (infiltration) or runs off into streams and rivers into lakes and oceans.
Evaporation	Water evaporates as water vapour from oceans, lakes and rivers.
Condensation	Water vapour condenses into tiny droplets to form clouds.
Potable Water	Water that is safe for humans to drink
Desalination	Producing potable (drinking water) from salty water, for example by distillation. Useful in areas with low rainfall.

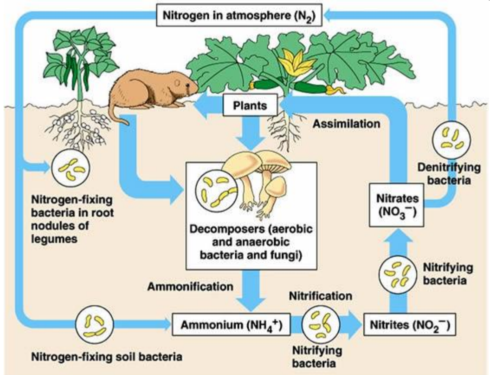


12. Carbon Cycle	
Carbon cycle	The way carbon is continuously moved between different stores in the environment.
Carbon cycle - photosynthesis	Carbon is transferred from the carbon dioxide in the air into plants.
Carbon cycle - feeding	Carbon is transferred from plants into animals, and from animals into other animals.
Carbon cycle – death and excretion	Carbon in waste (urine and faeces) and dead bodies is transferred to decomposers or to fossil fuels.
Carbon cycle - respiration	Plants, animals and decomposers transfer carbon back to the air as carbon dioxide by respiration.



Carbon cycle - combustion	Humans transfer carbon back to the air by burning fossil fuels.

13. Nitrogen cycle	
Importance of nitrogen	Nitrogen is used to make amino acids which are used to make the proteins needed for growth and repair.
Nitrogen cycle	The way nitrogen is continuously moved between different stores in the environment.



Nitrogen cycle – nitrogen fixation	Nitrogen in the air is converted to nitrates in the soil by nitrogen fixing bacteria.
Nitrogen cycle - plants	Plants absorb nitrates from the soil and convert them into amino acids and proteins.
Nitrogen cycle - feeding	Animals eat plants (and other animas) transferring nitrogen into them in the form of protein.
Nitrogen cycle – death and excretion	Nitrogen in the form of urea and protein is transferred to decomposers in the soil by death and excretion.
Nitrogen cycle – decomposers	Decomposers convert nitrogen in urea and proteins into nitrates.
Nitrogen cycle - denitrification	Denitrifying bacteria in the soil convert nitrates back into nitrogen gas in the air.

14. Rates of decomposition	
Preservation	A process that keeps organic things from decomposing.
Methods of preservation	Reducing temperature, Reducing water content, Irradiation, Reducing oxygen.
Irradiation	The process by which an object is exposed to radiation. Irradiation is sued to kill decomposers.
Compost	A mixture of decayed plants and vegetable waste which is added to the soil to help plants grow.
Soil fertility	The ability of **soil** to sustain agricultural plant growth, i.e. to provide plant habitat and result in sustained and consistent yields of high quality.
Decay	The breaking down or rotting of organic matter through the action of bacteria, fungi, or other organisms.
Rate of decomposition	Calculated from a quantity that change over time. Rate of decomposition = Mass lost / number of days

Worked example

The mass of a fresh apple was 153 g. The apple was placed in a compost heap. Ten days later its mass was 37 g. Calculate the rate of decomposition of the apple, using the formula:

$$\text{rate of decomposition} = \frac{\text{mass lost}}{\text{number of days}}$$

mass lost = 153 − 37 = 116 g

$$\text{rate of decomposition} = \frac{116}{10} = 11.6\text{ g/day}$$