OCR (A) Biology GCSE

Topic 4: Community Level Systems

Notes

(Content in bold is for higher tier only)

Ecosystems

Carbon water and water cycle (4.1a-c)

Lots of different materials are cycled through ecosystem. The carbon and water cycles are vital for life on Earth, by maintaining habitats, fresh water and flow of nutrients. Many different microorganisms play their parts in ecosystems to ensure the cycling of materials.

The Carbon Cycle

- CO_2 is REMOVED from the air in photosynthesis by green plants and algae – they use the carbon to make carbohydrates, proteins and fats. They are eaten and the carbon moves up the food chain.
- CO_2 is RETURNED to the air when plants, algae and animals respire. Decomposers (a group of microorganisms that break down dead organisms and waste) respire while they return mineral ions to the soil.
- CO_2 is RETURNED to the air when wood and fossil fuels are burnt (called combustion) as they contain carbon from photosynthesis.

The Water Cycle

- The sun's energy causes water to evaporate from the sea and lakes, forming water vapour.
- Water vapour is also formed as a result of transpiration in plants.
- Water vapour rises and then condenses to form clouds.
- Water is returned to the land by precipitation (rain, snow or hail), and this runs into lakes to provide water for plants and animals.
- This then runs into seas and the cycle begins again.

Decomposition (4.1d)

Biology only

Decomposition is the breakdown of dead matter, fallen leaves or animal droppings by decomposers, which can be bacteria or fungi. They secrete enzymes to break it down to smaller soluble food molecules.

Factors affecting decomposition rate

1. Temperature: Chemical reactions generally work faster in warmer conditions, but if it is too hot the enzymes can denature and stop decomposition.
2. Water: Microorganisms grow faster in conditions with water as it is needed for respiration. Water also makes food easier to digest.
3. Availability of oxygen: Most decomposers respire aerobically.

Compost

- When biological material decays it produces compost.
- It is used by gardeners and farmers as a natural fertiliser.
- To do this they have to provide optimum conditions for decay.
    - If more oxygen is available they respire aerobically, producing heat.
    - The increased temperature increases the rate of decay so the compost is made quicker.

Levels of organisation (4.1e)

You can draw a food chain based on what each organism eats. Multiple food chains can be linked in order to create a food web.
They always begin with a producer - a photosynthetic organisms (usually a green plant or algae) - that produces glucose. These producers are eaten by consumers, the first is called a primary consumer. These are eaten by secondary consumers and so on. Generally food chains do not continue past tertiary consumers.

A stable community will show population cycles between the predators and prey.

- If the population of prey increases, the population of predators will also increase.
- This will result in the number of prey decreasing after some time as more would be consumed by the increased number of predators.
- When there isn't enough prey to feed all the predators, the population of predators will decrease, which will allow the population of prey to increase again.

Communities (4.1f and g)

An individual is part of a species, but lives in its habitat within a population. Many different populations interact in the same habitat, creating a community. The populations are often dependent on each other. An ecosystem is the interaction of a community with non-living (abiotic) parts of the environment. Organisms are adapted to live in the conditions of their environment.

Factors affecting communities

Abiotic (non-living) factors:

1. Light intensity
    - Light is required for photosynthesis.
    - The rate of photosynthesis affects the rate at which the plant grows.
    - Plants can be food sources or shelter for many organisms.
2. Temperature
    - Temperature affects the rate of photosynthesis.
3. Moisture levels
    - Both plants and animals need water to survive.
4. Soil pH and mineral content
    - Soil pH affects the rate of decay and therefore how fast mineral ions return to soil (which are then taken up by other plants).
    - Different species of plants thrive in different nutrient concentration levels

Biotic (living) factors:

1. Food availability: more food means organisms can breed more successfully and therefore the population can increase in numbers
2. New predators

3. New pathogens: when a new pathogen arises the population has no resistance to it so they can be wiped out quickly
4. Competition: if one species is better adapted to the environment than another, then it will outcompete it until the numbers of the lesser adapted species are insufficient to breed

Competition and interdependence

Organisms which need the same resources compete for it.

- There can be competition within a species or between different species.
- Plants may compete for light, space, water and mineral ions.
- Animals may compete for space, food, water and mating partners.

Interdependence describes how organisms in a community depend on other organisms for vital services.

- These include for food, shelter and reproduction (pollination, seed dispersal), e.g. birds take shelter in trees, flowers are pollinated with the help of bees.
- The removal or addition of a species to the community can affect the populations of others greatly, as it changes prey or predator numbers
- A stable community is one where all the biotic (living) and abiotic (non-living) factors are in balance.
    - As a result the population sizes remain roughly constant.
    - When they are lost it is very difficult to replace them.
    - Examples include tropical rainforests, oak woodlands and coral reefs.

Pyramids of biomass (4.1h-j)
Biology only

Trophic levels

Level 1: Producers

- E.g. plants and algae
- They make their own food by photosynthesis.

Level 2: Primary consumers

- These are herbivores that only eat plants.

Level 3: Secondary consumers

- These are carnivores and they eat herbivores.

Level 4: Tertiary consumers

- These are carnivores that eat other carnivores.
- They have no predators and are at the top of the food chain – called apex predators.

Pyramids of biomass

Pyramids of biomass show the relative biomass at each trophic level.

- It shows the relative weights of material at each level.
- There is less biomass as you move up the trophic levels.

- Not all the food consumed by an animal is converted into biomass – this means the biomass of the organism in the level above another will always be higher, as not all the organism can be consumed and converted into biomass.

Producers (e.g plants and algae) transfer about 1% of the incident energy from light for photosynthesis, as not all the light lands on the green (photosynthesising) parts of the plant.

Only approximately 10% of the biomass of each trophic level is transferred to the next, as:

- Not all biomass can be eaten.
    - Carnivores cannot generally eat bone, hooves, claws and teeth.
- Not all of the biomass eaten is converted into biomass of the animal eating it.
    - Lots of glucose is used in respiration, which produces the waste product carbon dioxide
    - Urea is a waste substance which is released in urine
    - Biomass consumed can be lost as faeces - herbivores do not have all the enzymes to digest all the material they eat, so it is egested instead

Efficiency of biomass transfers: (Biomass transferred to the next level / Biomass available at the previous level) x 100

Because less biomass is transferred each time it is common to have a limited number of trophic levels and to find less animals in the higher trophic levels.