Topic 7: Ecology

AQA GCSE Biology 8461 · spec 4.7 · sheets 7.1–7.4

Ecology: communities, cycles and human impacts

- describe communities, **competition**, **interdependence** and adaptations;
- explain abiotic and biotic factors, **food chains** and predator-prey cycles;
- sample organisms with quadrats and transects, and explain how carbon and water are recycled;

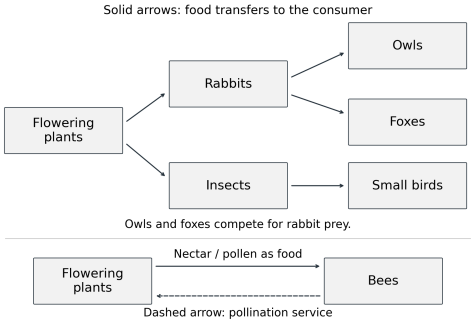
Ecology: communities, cycles and human impacts (2)

- explain how human activity affects **biodiversity**, and how it can be protected;
- (biology only) describe decay, **trophic levels**, **biomass** and food security.

Communities and competition

- Plants compete for light, space, water and mineral ions from the soil.
- Animals compete for food, mates and **territory** .

Figure: Communities and competition

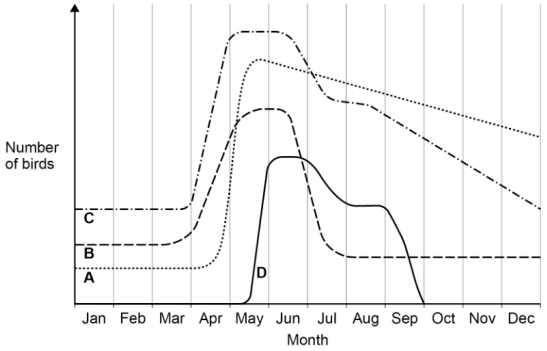


- Feeding and pollination link species in a **community**.
- Match each part of the diagram to the text.

Abiotic and biotic factors

- **Abiotic factors** are non-living.
- They include light intensity, temperature, moisture, soil pH and mineral content, wind speed and direction, carbon dioxide for plants, and oxygen for aquatic animals.
- **Biotic factors** are living.
- They include the availability of food, new predators arriving, new **pathogens** , and one species outcompeting another.

Figure: Abiotic and biotic factors



- Four bird populations through one year (AQA GCSE Biology Paper 2H, June 2023, Figure 2).
- Read the axes and units first.

Adaptations

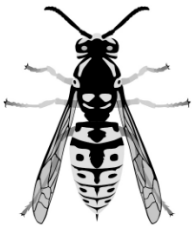
- Structural adaptations are features of the body, such as thick fur or a layer of fat for insulation in the cold.
- Behavioural adaptations are the ways organisms behave, such as **migration** to warmer places in winter.
- Functional adaptations are processes inside the body, such as making venom or producing very concentrated urine in the desert.

Figure: Adaptations

Figure 1



Hoverfly



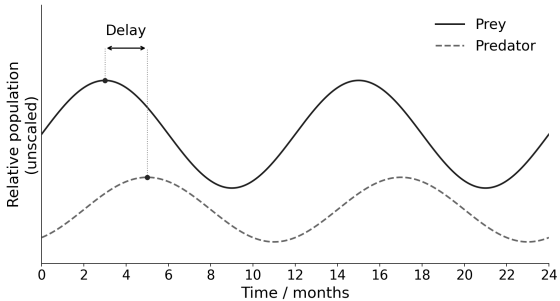
Wasp

- A hoverfly (no sting) and a wasp (AQA GCSE Biology Paper 2H, June 2024, Figure 1).
- Match each part of the diagram to the text.

Food chains and sampling

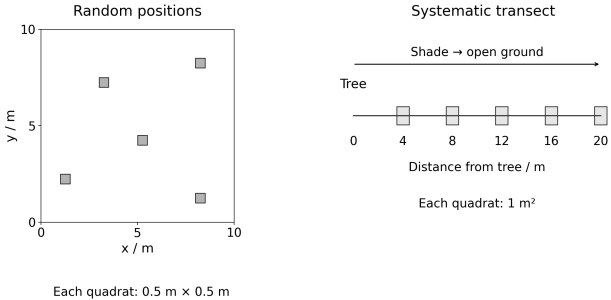
- To estimate a **population** in a field, place quadrats at random positions, using random numbers as coordinates, count the organisms in each, and calculate a mean.
- To see how a species changes across a habitat, for example from shade into open ground, lay a tape measure as a **transect** and place quadrats at regular distances along it. At each one, count the organisms and measure a factor such as light intensity.

Figure: Food chains and sampling



- **Predator** peaks come two months after **prey** peaks.
- Match each part of the diagram to the text.

Figure: Food chains and sampling (2)



- Random 0.25 m^2 quadrats (left) and 1 m^2 quadrats at regular distances along a **transect** (right).
- Match each part of the diagram to the text.

Figure: Food chains and sampling (3)

Table 2

	Distance from the tree in metres				
	4	**8**	**12**	**16**	**20**
Mass of fresh soil in grams	250	266	260	248	252
Mass of dried soil in grams	225	234	209	184	181
Mass of water lost from soil in grams	25	32	51	64	71
Percentage of water in soil	10	12	20	26	**X**
Number of daisies per m^2	0	7	15	28	32

- Soil water and daisies at five distances (AQA GCSE Biology Paper 2H, June 2025, Table 2).
- Match each part of the diagram to the text.

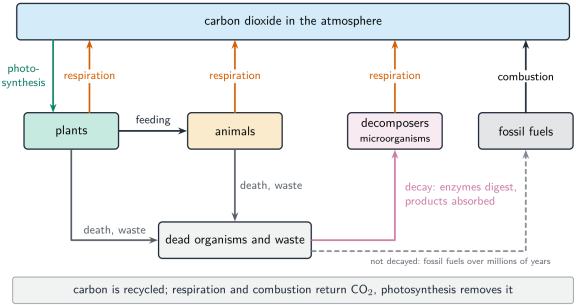
Recycling materials

- Photosynthesis by plants and algae takes carbon dioxide from the air and turns it into glucose and other carbon compounds.
- Feeding passes these carbon compounds along **food chains**.
- Respiration by plants, animals and microorganisms releases carbon dioxide back into the air.

Recycling materials (2)

- When organisms die, microorganisms (decomposers) break down their bodies and waste, and their respiration releases carbon dioxide.
- Combustion of wood and fossil fuels also releases carbon dioxide.

Figure: Recycling materials



- Feeding, decay and respiration are separate processes; combustion releases CO_2 but is not respiration.
- Match each part of the diagram to the text.

Decay (biology only)

- it is warm, because the microorganisms' enzymes work faster (but very high temperatures denature them);
- it is moist, because microorganisms need water;
- there is plenty of oxygen, for aerobic respiration.

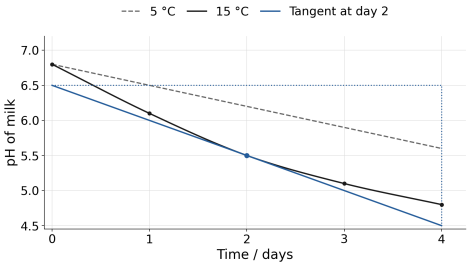
Figure: Decay (biology only)

Table 1

Time in days	pH of milk		
	5 °C	15 °C	25 °C
0	6.8	6.8	6.8
1	6.5	6.1	5.3
2	6.2	5.5	4.9
3	5.9	5.1	4.8
4	5.6	4.8	4.8

- Milk pH over time at three temperatures (AQA GCSE Biology Paper 2H, June 2023, Table 1).
- Match each part of the diagram to the text.

Figure: Decay (biology only) (2)



- The milk data plotted, with a **tangent** drawn at day 2 on the 15 °C curve.
- Read the axes and units first.

Biodiversity and human impacts

- in water, from **sewage** , **fertiliser** washed off fields, and toxic chemicals;
- in the air, from smoke and acidic gases;
- on land, from **landfill** and toxic chemicals.

Biodiversity and human impacts (2)

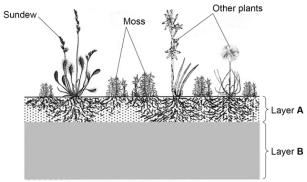
- run **breeding programmes** for **endangered species**;
- protect and regenerate rare habitats such as mangroves and **peat** bogs;
- put **field margins** and **hedgerows** back around fields of a single crop, giving food and shelter to many species;

Biodiversity and human impacts (3)

- reduce **deforestation** and carbon dioxide emissions;
- recycle resources rather than dumping waste in **landfill**.

Figure: Biodiversity and human impacts

Figure 2



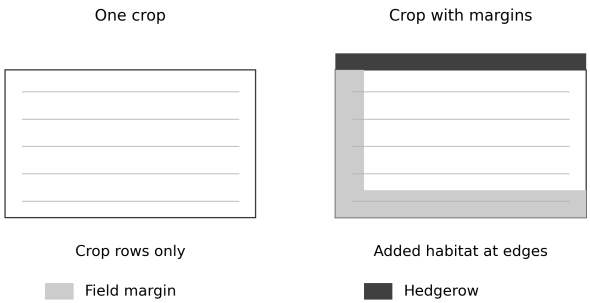
Layer **A** contains a lot of air.

Layer **B**:

- contains the dead remains of plants
- has a low pH
- contains very little oxygen
- contains carbon dioxide and methane.

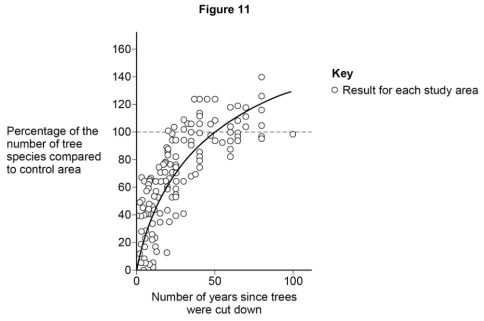
- Layers in a **peat** bog (AQA GCSE Biology Paper 2H, June 2024, Figure 2).
- Match each part of the diagram to the text.

Figure: Biodiversity and human impacts (2)



- **Field margins** and **hedgerows** give food and shelter to many species.
- Match each part of the diagram to the text.

Figure: Biodiversity and human impacts (3)



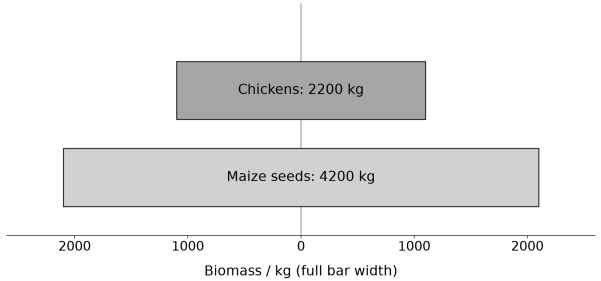
- Recovery of tree species after clearing (AQA GCSE Biology Paper 2H, June 2023, Figure 11).
- Match each part of the diagram to the text.

Trophic levels and biomass (biology only)

- not all of an organism is eaten, such as roots and bones;
- not all the food eaten is absorbed; some passes out as **faeces** ;
- much of the absorbed glucose is used in respiration, releasing carbon dioxide and water, and some is lost as urea in urine.

$$\text{efficiency} = \frac{\text{biomass transferred to the next level}}{\text{biomass available}} \times 100$$

Figure: Trophic levels and biomass (biology only)



- **Pyramid of biomass** for maize and chickens, drawn to scale with producers at the bottom.
- Match each part of the diagram to the text.

Food security (biology only)

- **Food security** means having enough food to feed a **population**.
- It is threatened by a rising birth rate, changing diets in richer countries that need more food from poorer ones, new pests and **pathogens**, environmental changes such as droughts, the cost of farming, and conflicts.

Food security (biology only) (2)

- **Efficient food production.** Farmers can raise animals more efficiently by limiting their movement and keeping them warm, so that less energy is used in respiration for movement and keeping warm, and more goes into growth.
- They are fed high-protein food.

Sources for this lesson

- AQA, *GCSE Biology (8461) specification*, section 4.7 Ecology, and the required practical handbook.
- National Park Service, *Yellowstone Wolf Project Annual Report 1995*, and D. W. Smith and G. Ferguson, *Decade of the Wolf: Returning the Wild to Yellowstone* (2005).
- AQA, *GCSE Biology* Paper 2 Higher (June 2023 to June 2025), the bird **population**, hoverfly, soil water, milk decay, **peat** and chicken questions, adapted.

Common errors

- Defining a **community** as one species; it is all the populations in an area.
- Saying plants compete for food; they compete for light, space, water and mineral ions.
- Reading food chain arrows as "is eaten by" backwards; they point to the organism that eats.

Common errors (2)

- Placing quadrats where the plants look interesting instead of at random.
- Saying respiration and combustion are the same process.
- Saying **biodiversity** is the number of organisms; it is the variety of species.

Common errors (3)

- Using 10% when the question gives the actual masses.
- Saying keeping animals warm stops them respiring; it reduces the energy used to keep warm.

Key terms

- **Ecosystem**: a **community** of organisms interacting with the non-living parts of its environment.
- **Interdependence**: species depending on each other for food, shelter, pollination and seed dispersal.
- **Abiotic factor**: a non-living factor that affects organisms.

Key terms (2)

- **Biotic factor**: a living factor that affects organisms.
- **Quadrat**: a square frame used to sample organisms in an area.
- **Biodiversity**: the variety of all the different species in an area.

Key terms (3)

- **Trophic level**: a feeding level in a food chain.
- **Food security**: having enough food to feed a **population**.

Check yourself

- 1.
- Name three things plants compete for and three things animals compete for. 2.
- Give two abiotic and two biotic factors. 3.
- Explain the shape of a predator-prey graph. 4.