

STUDENT GUIDE

For the 2016 specifications



CCEA

AS UNIT 1

Geography

Physical geography

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Inputs of energy

Energy enters the ecosystem via photosynthesis, as green plants fix solar energy and convert it into chemical food energy.

Food chains and trophic levels

This input of food energy is the basis for a **food chain**, where the energy fixed by photosynthesis becomes available to subsequent levels of the ecosystem. Each level is known as a **trophic (energy) level**.

The first trophic level consists of the plants. As they can produce their own food directly, they are called **producers** (or **autotrophs**). All subsequent trophic levels have to consume plants and other organisms in the previous level, so they are called **consumers** (or **heterotrophs**).

In the second trophic level, the **herbivores** (plant eaters) consume plants from the first level. In turn, these herbivores provide food for the third trophic level, the smaller **carnivores** (meat eaters). The fourth, and usually final, trophic level is made up of the larger carnivores and **omnivores** (plant and meat eaters).

Thus food energy is transferred up through the trophic levels. However, on average only around 10% of the energy is transferred up to the next trophic level. The reasons for this are as follows.

- Energy is lost via life processes in organisms such as **respiration** (which ultimately causes energy to be outputted from the ecosystem as **heat**).
- The transfer of food energy is **incomplete** — not everything that can be eaten is actually eaten by animals in the next trophic level (e.g. animals might die of old age rather than being consumed by another animal).
- The transfer of food energy is **inefficient** — not everything actually eaten can be metabolised by animals in the next trophic level. This results in excrement (which is broken down by the **detritivores** and leaves the ecosystem, rather than being passed up the trophic levels).

Due to this energy loss, there are usually **no more than four trophic levels** in an ecosystem.

At each trophic level, the detritivores (such as bacteria, maggots and fungi) are consumers that act to decompose dead organic matter.

The energy available at different trophic levels can be shown in a trophic pyramid (Figure 22).

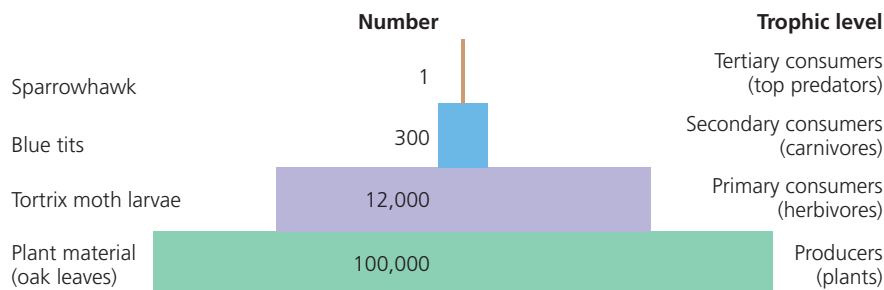


Figure 22 Trophic pyramid for the deciduous forest at Breen Wood, Ballycastle, Co. Antrim

Knowledge check 10

What are the terms you could use to describe the organisms at trophic levels 2 and 3?

Nutrient cycles

The key point here is that **nutrients mainly cycle around between stores within the ecosystem** (although there are inputs and outputs as well). This is shown in Figure 23 — note the inputs, outputs, stores and transfers.

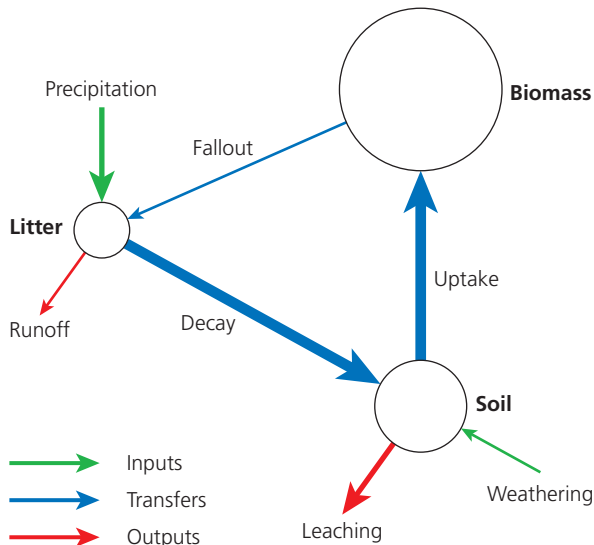


Figure 23 The Gersmehl model applied to Breen Wood (deciduous forest)

The nutrients leave the **biomass store** and are transferred by **fallout** into the **litter store**. This dead organic matter is broken down by the **decomposers** and transferred by **decay** into the **soil store**. Here, the nutrients are available to plants via their roots and are transferred by **uptake** into the **biomass store** and thus the cycle continues. In addition, there are two **inputs** of nutrients (such as carbon dissolved in **precipitation** or minerals **weathered** from the bedrock) and two **outputs** (losses via **runoff** from the **litter store** or **leaching** from the **soil store**).

The diagram can be drawn proportionally to show the relative amounts of nutrients in the stores and transfers: the larger the circles, the greater amount in the stores; the thicker the lines, the greater the volume being transferred.

The **rate of nutrient transfer** can be affected by factors such as:

- **climate** (in hot, wet tropical rainforests the rate of decomposition is very high and rates of leaching are also considerable)
- **soils** (acidic soils have fewer soil organisms and thus decomposition rates are slower)
- **vegetation type** (the leaves from coniferous trees take longer to decompose than those from deciduous trees).

Exam tip

Exam questions often ask about how energy flows or nutrients cycle in your case study. Make sure you can refer to plenty of specific examples of soils, plants and animals from your case study as you discuss each aspect in your answer.

Exam tip

Be familiar with all these terms so that you can use them accurately in any exam answer on this topic.

Knowledge check 11

Distinguish between how energy and nutrients move in an ecosystem.

Section A

Question 1 Rivers: short structured questions

(a) (i) With the aid of a well-annotated diagram, describe and explain the role of deposition in the formation of a floodplain.

(6 marks)

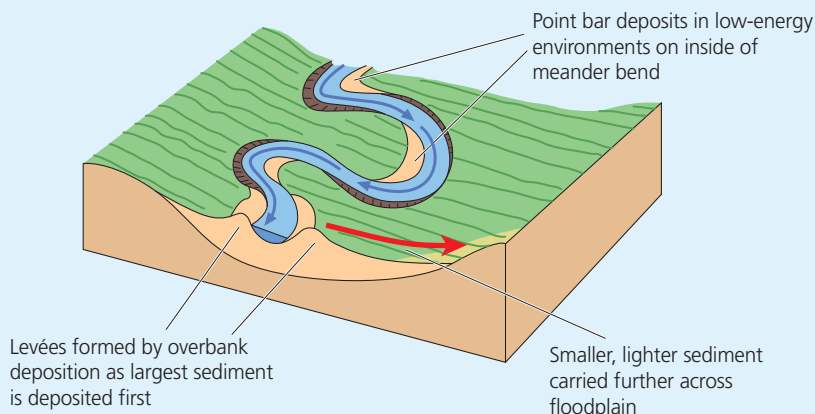
e Level 3 (5–6 marks): The answer uses a well-annotated diagram and specialist terminology to explain the formation of the floodplain and associated river processes.

Level 2 (3–4 marks): The answer might use a less-well-annotated diagram of the feature and/or a less detailed explanation of its formation. Alternatively, an accurate and detailed explanation with no diagram might be marked at this level.

Level 1 (1–2 marks): A very limited response that fails to offer any meaningful explanation of the processes at work.

Student answer

(a) (i) There are two main sources of deposition. The first are called point bar deposits, which are deposited on the lower energy inside bends of migrating meanders. As the meanders weave across the floodplain, they leave these point bar deposits all across the floodplain. Second, if a river floods onto the floodplain, it experiences a lot of friction as it comes into contact with the ground and the vegetation on it. This friction slows the velocity of the river, causing deposition to occur. The largest particles need most energy to transport them, so they are deposited first (forming levées along the edge of the channel), while the smallest particles are carried furthest across the floodplain.



e 6/6 marks awarded. This detailed answer shows good understanding of the depositional processes at work in the formation of a floodplain. There is good use of terminology and a well constructed and annotated diagram is included.

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(ii) Briefly explain how deposition contributes to the formation of another river feature apart from floodplains.

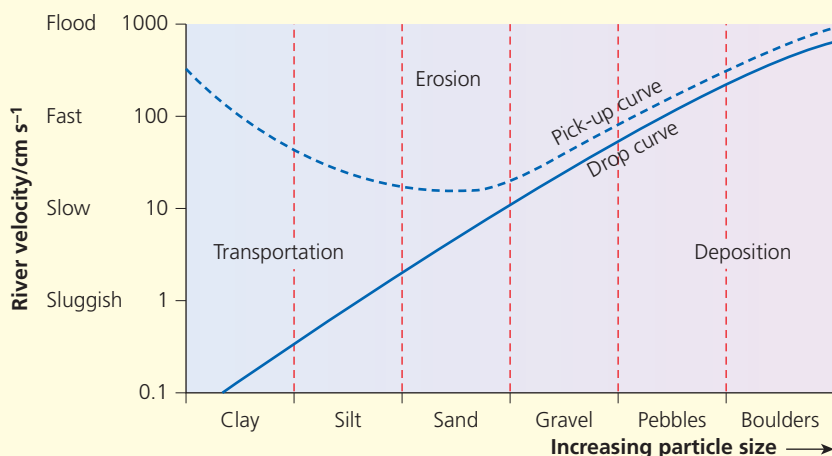
(3 marks)

e Award 1 mark for an answer that identifies another river feature and 2 marks if it outlines how deposition occurs to help form the feature, with appropriate use of terminology. Award 1 for an answer that lacks detail in explanation of the contribution that deposition plays.

(ii) Deposition is also significant in the formation of meanders. On the inside of the river bend, velocities are lower here than on the outside. This means that, as river energy drops here, sediment is deposited to form a gently sloping bank made up of point bar deposits.

e **3/3 marks awarded.** A relevant river feature is identified and the role deposition plays is discussed, with good use of appropriate terminology.

(b) Study Resource 1, which shows the Hjulström curve. After a rainstorm, the discharge in a river falls from 100 cm s^{-1} to 1 cm s^{-1} . Use the Hjulström curve to describe and explain how this impacts on the river's load. (6 marks)



Resource 1 Hjulström curve

e **Level 3 (5–6 marks):** A detailed and thorough answer, which makes effective use of the resource to discuss the changes over time.

Level 2 (3–4 marks): A general but accurate answer, which discusses how the load changes over time. Use of the resource may be restricted.

Level 1 (1–2 marks): A limited answer, which fails to address the changes over time and/or makes no meaningful reference to the resource.

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