

Definitions

Ecosystem – a grouping of plants and animals that interact with each other and their local environment

Biome – a large ecosystem; a grouping of plants and animals over a large area of the Earth

Taiga biome

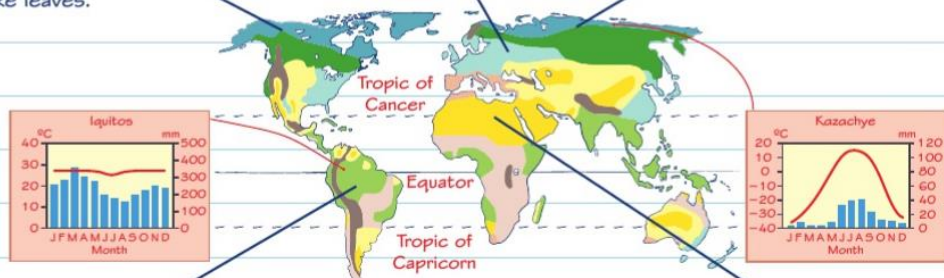
Taiga (boreal) forests are at higher latitudes where the Sun's rays are weak. Trees are adapted to the cold with needle-like leaves.

Temperate biome

Temperate forests have high rainfall and there are seasonal variations in the Sun's rays. Trees lose their leaves in the cool winters.

Tundra biome

The **tundra** is within the Arctic Circle. The Sun gives little heat here and there is little rainfall. Only tough, short grasses survive.



Tropical biome

Tropical rainforests are mostly found either side of the Equator. The temperature is hot and there is heavy rainfall.



Desert biome

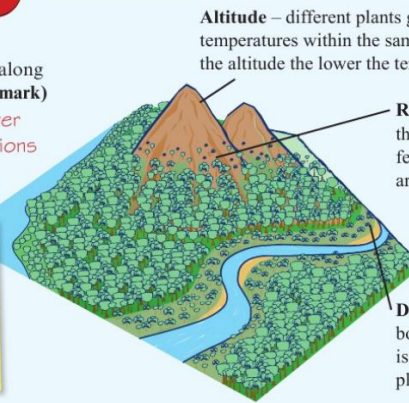
Deserts are close to the tropics of Cancer and Capricorn. This is where hot dry air sinks down to the Earth's surface and the Sun's rays are concentrated making it very hot in the day.

Worked example

Study the picture shown here. Explain why fewer plants grow along the river. (1 mark)

Poor drainage along the river means waterlogged conditions that are not suitable for most plants.

This is a good answer because it identifies a correct reason (poor drainage) and then explains why it affects vegetation growth.



Altitude – different plants grow at different temperatures within the same biome. The higher the altitude the lower the temperature.

Rock and soil type – this can affect how fertile different areas are within a biome.

Drainage – swamps and bogs occur where drainage is poor. Fewer, more specialist plants grow in boggy areas.

Biotic and abiotic components

Biotic and abiotic components of an ecosystem **interact**. For example: The taiga biome has low **biodiversity**.

Abiotic components – long cold winters, low precipitation, frozen soils

Biotic components – only specialist plants that can tolerate poor soils, low light, cold temperatures; small amounts of plant food = small numbers of animals

Definitions

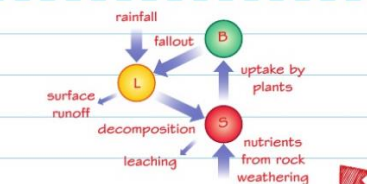
Biotic – the living components of an ecosystem: the plants (flora) and the animals (fauna)

Abiotic – the non-living components of an ecosystem – for example, soils, rocks, water, the atmosphere

Biodiversity – the variety of biotic components in an ecosystem (high biodiversity = thousands of different plants and animals)

Now try this

This photo is from the tropical rainforest biome in Brazil. Identify one biotic factor influencing the local distribution of tropical rainforest shown in this photo. (1 mark)



Nutrient cycles show how biotic and abiotic components interact. L = Litter store, B = Biomass store and S = Soil store. The size of the arrows shows the size of the nutrient transfer between each store.

Biome distribution depends on local factors: ARSD

- A – Altitude – higher land is colder, fewer plants grow, limits the number of animal species.
- R – Rock type – rocks can be easily weathered, this affects the nutrient quality, some rocks are permeable or impermeable
- S – Soil – Nutrient rich soils can support more plants. Peat soils are acidic so only acid tolerant plants such as conifers can grow. Clay soils are impermeable so water can't get through easily.
- D – Drainage – If drainage is poor, soils get waterlogged. Aquatic species thrive in wet areas.

Global factors: Climate (rainfall, sunshine hours, temperature) & longitude/latitude

ESQ - Explain how factors other than climate influence the global distribution of biomes (4)

Tropical Forests Have a Hot, Wet Climate

See pages 95-97 for more on tropical forests.

Climate

- 1) The climate is the same all year round — there are no definite seasons.
- 2) It's hot (the temperature is generally between 20-28 °C and only varies by a few degrees over the year). This is because near the equator the Sun is overhead all year round.
- 3) Because tropical forests are found near the equator, day length is the same (about 12 hours) all year round. This means the forests get plenty of sunshine all year.
- 4) Rainfall is very high, around 2000 mm per year. It rains every day, usually in the afternoon.

Characteristics

The climate affects the plants, animals and soil in tropical forests:

- 1) Plants — most trees are evergreen to take advantage of the continual growing season. Plants grow quickly and are adapted to take in maximum light.
- 2) Animals — the dense vegetation provides lots of food and different habitats, so there are lots of different species of animal, for example gorillas, jaguars, anacondas, tree frogs and sloths. There are loads of species of insects and birds.
- 3) Soil — plants grow quickly and shed leaves all year round. These decompose quickly, so there's a constant supply of nutrients in the soil, and these nutrients are cycled quickly.

Evergreen plants don't drop their leaves in a particular season.



1. Describe the global distribution of tropical rainforests. (2)
2. How hot can it get in the tropical rain forest? (1)
3. Describe the flora and fauna of the tropical rainforest. (4)
4. Why is the quality of the soil good in the tropical rainforest? (4)
5. Name 4 places tropical rainforests are found. (use an atlas) (4)

Temperate Forests Have a Mild, Wet Climate

Climate

- 1) Temperate forests have four distinct seasons. The summers are warm and the winters are cool.
- 2) Rainfall is very high (up to 1500 mm per year) and there's rain all year round.
- 3) Days are shorter in winter and longer in summer — the hours of sunshine vary through the year.

Characteristics

The climate affects the plants, animals and soil in temperate forests:

- 1) Plants — the mild, wet climate supports fewer plant species than tropical forests, but more than boreal forests (see next page). Forests are often made up of broad-leaved trees that drop their leaves in autumn (e.g. oak), shrubs (e.g. brambles) and undergrowth (e.g. ferns).
- 2) Animals — the mild climate and range of plants provides food and habitats for mammals (e.g. foxes, squirrels), birds (e.g. woodpeckers, cuckoos) and insects (e.g. beetles, moths).
- 3) Soil — plants lose their leaves in autumn, and the leaf litter decomposes quite quickly in the moist, mild climate. This means that soils are relatively thick and nutrient-rich.

1. What type of flora and fauna is found in the temperate forest? (4)
2. Why is the soil nutrient rich? (4)



Boreal Forests Have a Cold, Dry Climate

The boreal biome is also called the taiga.

Climate

- 1) **Boreal forests** have short summers and long winters. In winter, average temperatures are below -20 °C and can drop much lower. In summer, average temperatures are about 10 °C.
- 2) Precipitation is low — generally less than 500 mm per year. A lot of this falls as snow.
- 3) Boreal forests get lots of daylight during the summer months, but little or none during the winter. Skies tend to be clear, so during daylight hours there's plenty of sunshine.

See pages 101-102 for more about the characteristics of the taiga.

Characteristics

The climate affects the plants, animals and soil in boreal forests:

- 1) Plants — most trees are evergreen, so they can grow whenever there's enough light. Coniferous trees such as pine and fir are common, as are low-growing mosses and lichen.
- 2) Animals — there are relatively few animal species in boreal forests compared to e.g. tropical forests, because there is less food available and animals need to be adapted to the cold climate to survive. Animals that do live there include black bears, wolves, elk and eagles.
- 3) Soil — the cool, dry climate means that needles from the trees decompose slowly, so soils are quite thin, nutrient-poor and acidic. In some areas the ground is frozen for most of the year.



1. How cold does it get in the boreal forest? (10)
2. Why does rain fall as snow? (2)
3. What type of vegetation grows in the boreal forest? (4)
4. Why is the soil thin and nutrient-poor in the boreal forests? (4)



There are Two Types of Grassland

Climate

- 1) Tropical grasslands have quite low rainfall (800-900 mm per year) and distinct wet and dry seasons. Temperatures are highest (around 35 °C) just before the wet season and lowest (about 15 °C) just after it. They are found around the equator, so they get lots of sunshine all year round.
- 2) Temperate grasslands have hot summers (up to 40 °C) and cold winters (down to -40 °C). They receive 250-500 mm precipitation each year, mostly in the late spring and early summer. Because they're further from the equator, the amount of light they receive varies through the year.

Characteristics

Rainfall is too low to support many trees in tropical or temperate grasslands, which affects animals and soil:

- 1) Tropical grasslands consist mostly of grass, scrub and small plants, with a few scattered trees, e.g. acacia. They are home to lots of insects, including grasshoppers, beetles and termites. Larger animals include lions, elephants, giraffes, zebras and antelope. Grass dies back during the dry season, forming a thin, nutrient-rich soil, but nutrients are washed out of the soil during the wet season.
- 2) Temperate grasslands are also dominated by grasses and small plants, and have very few trees. They are home to fewer animal species than tropical grasslands — mammals include bison and wild horses, and rodents such as mole rats. High temperatures in summer mean that decomposition is fast, so soils are relatively thick and nutrient-rich.

1. Describe the flora of grassland ecosystems. (2)
2. Describe the differences between tropical and temperate grasslands. (6)
3. What types of fauna are found in temperate grasslands? (4)
4. Why are soils in the grasslands nutrient rich? (4)



Deserts Have Low Rainfall

Not every desert is hot — some are mild (e.g. the Atacama desert) and some are cold (e.g. the Gobi desert).

Climate

- 1) Rainfall is very low — **less than 250 mm** per year. It might only rain **once** every two or three years.
- 2) **Hot** desert **temperatures** range from very **hot** in the **day** (e.g. 45 °C) to **cold at night** (below 0 °C).
- 3) Hot deserts get more **daylight** during the **summer** than the **winter**. Because there is little **cloud cover**, they get lots of hours of **sunshine** every day.



Characteristics

The climate affects the **plants**, **animals** and **soil** in deserts:

- 1) **Plants** — plant growth is **sparse** due to **lack of rainfall**. A few plants do grow, e.g. **cacti**, **thornbushes**.
- 2) **Animals** — relatively **few** animal species live in hot deserts — those that do are **adapted** to cope with the harsh climate. Animals that live there include **lizards**, **snakes**, **insects** and **scorpions**.
- 3) **Soil** — the **sparse** vegetation means that there is **little leaf litter**, and the **dry** climate means that organic matter is **slow** to **decompose**. As a result, soils are mostly **thin** and **nutrient-poor**.

Topic 7 — People and the Biosphere

1, Describe two characteristics of the hot desert climate. (4)

2. Why is there lots of sunlight in the desert?

3. What flora and fauna is found in the desert and how is it adapted? (4)



Tundra Has a Cold, Dry Climate

Climate

- 1) **Temperatures** are low — around **5-10 °C** during the summer and lower than **-30 °C** in the winter.
- 2) **Precipitation** is also very low — **less than 250 mm** per year. Most of this falls as **snow**.
- 3) Tundra is found at **high latitudes**, so it gets **near-continuous daylight** in the **summer** and little or **no daylight** in the **winter**. There is more **cloud cover** in the **summer**.

Characteristics

The climate affects the **plants**, **animals** and **soil** in tundra regions:

- 1) **Plants** — the **cold** climate and **lack of light** in winter make it hard for plants to grow, and there are hardly any **trees**. Vegetation includes **mosses**, **grasses** and **low shrubs**.
- 2) **Animals** — the **cold** climate and lack of vegetation means that relatively **few** animal species live in the tundra. Those that do include **Arctic hares**, **Arctic foxes**, **mosquitoes** and lots of **birds**. Some animals **migrate south** for the winter.
- 3) **Soil** — the **sparse** vegetation produces **little leaf litter**, and the **cold, dry** climate means that organic matter **decomposes slowly**, so soil is **thin** and **nutrient-poor**. There is a layer of **permafrost** (permanently frozen ground) below the soil surface, which can **stop** water from **draining** away.



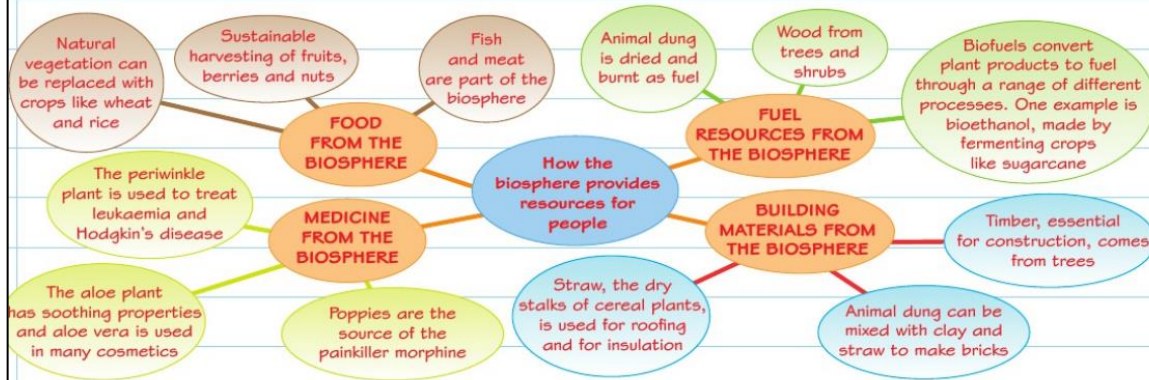
1. Describe the climate of tundra environments. (2)

2. Describe the vegetation type of the tundra biome. (2)

3. Why is the tundra soil nutrient-poor? (4)

Biosphere resources

The **biosphere** provides humans with some of our most essential resources: the food we eat and many of our medicines, building materials and sources of fuel.



The biosphere provides resources for indigenous and local people: food, medicine, building materials and fuel resources. In developed countries few people now use resources directly from the biosphere.

The biosphere is increasingly exploited for its resources – for example, the demand for some fish species has led to overfishing and huge declines in fish numbers.

Goods: FRM

- F – Food (fruit, vegetables, nuts, meat)
- R – Raw Materials (wood, straw, sap)
- M – Medicines (quinine to treat malaria)

Services: CAWS

- C – Climate regulation
- A - Atmospheric balance
- W- Water cycle flow
- S – Soil health

How do humans exploit the biosphere? CLUMPH

- C – Cattle ranching – Demand for meat / dairy products
- L – Logging – For timber for construction and furniture
- U – Urbanisation – Growing populations need space for housing
- M – Mining – gold & iron are used for building and electrical items
- P – Palm oil - palm oil is used as a cooking oil and cosmetics
- H – Hydroelectric power (HEP) Creating dams for energy demands

Worked example

Study this satellite image of the Athabasca Oil Sands mine in the taiga biome of Canada. Explain the impacts this mining operation could have on biosphere services for local people. (4 marks)



The mine is extensive (the scale suggests around 20km²) and it is located next to the Athabasca River. A large area has been disturbed, destroying plants and animals that may have provided food, fuel, building materials and medicines for local people. Because the mine is extracting oil, there is a high risk of water and air pollution. Drinking water is a vital biosphere resource; if the river became polluted that could have a very negative impact on local people.

Always check whether satellite images have a scale. If they do, you can use the scale to make your answer more precise.

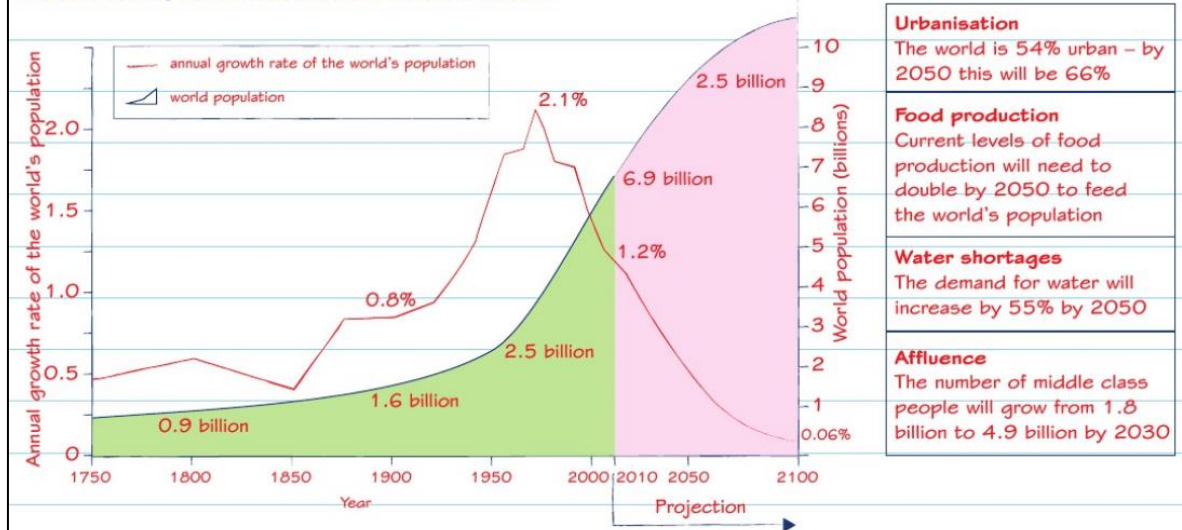
Now try this

A decline in the number of orangutans in Malaysia and Indonesia has been linked to the increase in plantations for the biofuel palm oil. This is an example of commercial exploitation of the biosphere for which of the following? (1 mark)

- energy resources water resources mineral resources

Pressure on resources

The world's population has grown **exponentially**. More people means more demand for resources – food, energy and water. Other trends also increase resource demand: urbanisation, industrialisation and affluence.



Thomas Malthus (1766–1834)



Malthus' theory was that it was impossible to increase food production as rapidly as population growth. Therefore if a population was allowed to grow too much, it was inevitable that food supply would run out and famine would result, reducing the population size.

Ester Boserup (1910–99)



Boserup's theory was that human innovation will be sparked by demands on resources. So if there is a high demand for food resources, new techniques to increase food production will be invented. The same applies to water supplies (e.g. desalination) and energy supplies.

Worked example

In 2010, Chinaautoweb reported in an article that in 1990 there were 5.6 million vehicles on China's roads. By 2014 this was 264 million vehicles (104 million of which were cars).

By what approximate percentage has the number of vehicles in China increased between 1990 and 2014?

(1 mark)

- 46 per cent 460 per cent 4614 per cent

The vehicle statistics are a good example of the impact of growing affluence in China: more people have enough money to afford a vehicle. More vehicles means more demand on raw materials and energy.

To work out percentage increase, first take the smaller number away from the bigger number to find the difference between them. Then divide your answer by the smaller number and multiply by 100 to get your percentage.

Now try this

Explain how urbanisation or industrialisation increases demand for water resources.

(2 marks)

Neither theory has been proved completely right or completely wrong. There have been famines in some areas, but on a global scale, food production has kept up with population growth.

Demand for Resources:

1. The world's population is increasing, more people require more resources and demand increases.
2. The world's population is currently 7.3 billion and is predicted to increase to 10 billion by 2100.
3. Population projections are predictions of how many people there will be in the future.
4. Wealth, urbanisation and industrialisation are increasing the demand for resources.
5. In emerging countries like China and Brazil there has been rapid industrialisation and urbanisation and people are getting wealthier.
6. Over the next few decades most economic growth is expected to take place in Africa.
7. Wealthier people have more money to spend on cars, electrical appliances and food which all require energy.
8. Urbanisation means that the number of people living in towns and cities is growing in an area. Street lights and neon signs use energy.
9. Industrialisation means a shift from primary sector work like farming to secondary sector work like manufacturing. Making goods like cars, and electrical appliances requires a lot of energy. Manufacturing can also waste a lot of water.
10. More processed goods increases the demand for palm oil which are grown on large plantations.
11. **Indigenous people** use resources in a sustainable way because they aren't being used quicker than they can be replaced. None of the resource is wasted.

Exam Style questions:

6. What is a biome? (1)
7. Describe the climate of a Tropical rainforest (4)
8. How does the biosphere regulate the composition of the atmosphere? (4)
9. Explain two reasons why the demand for resources is increasing. (4)
10. Explain two ways the biosphere regulates nutrients (4)

Exam Style questions:

1. What sorts of animals are found in the tundra biome? (3)
2. What impact does urbanisation have on the demand for resources? (4)
3. Give two abiotic components of biomes. (2)
4. What goods are provided by the biosphere? (3)
5. Explain one way the biosphere helps to regulate droughts or floods (2)