

Key Terms

Biome
Ecosystem
Diurnal temperature range
Inter-tropical convergence zone
Photosynthesis
Permeable
Impermeable
Weathering
Regulate
Intercept
Surface runoff
Transpiration
Abiotic
Biotic

Exam questions

1. State two local factors affecting biomes (2)
2. Describe the distribution of the tropical rainforest biome. (3)
3. Compare the characteristics of tropical rainforest and desert biomes. (4)
4. Explain the difference between bio-physical and bio-chemical weathering (4)
5. Define the term 'biotic' (1)

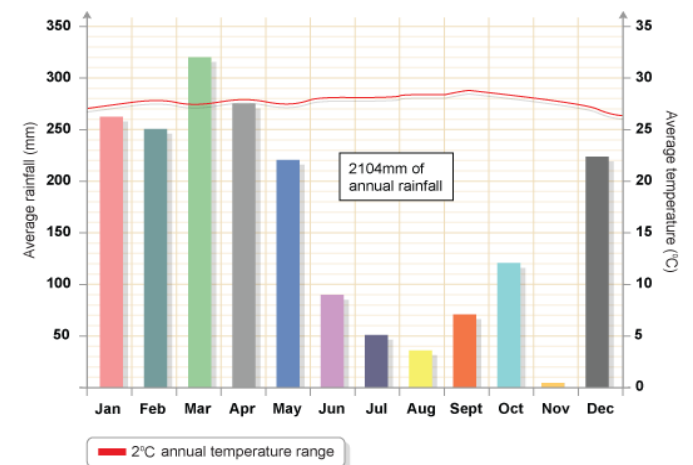
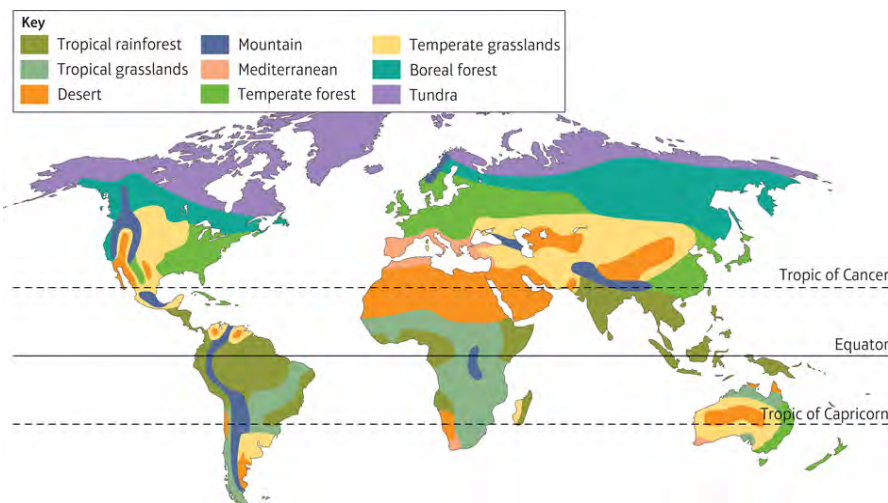
Topic 7: People and the Biosphere

The Earth is home to many ecosystems and their distribution is affected by many factors

Biomes are large scale ecosystems like the tropical rainforest. Distribution is a key concept that describe the location of something—To describe the location of a biome, you can state what the biome is located between, you can add more detail by stating the latitudes it is generally found between and use place location such as the continents. A good description would state : anomalies in the distribution of a biome.

Characteristics—The specific features that allow us to identify how one place/thing differs from another. Differences between th climate and vegetation of biomes—

- Tropical rainforest—Hot all year (25-30°C), wet all year (annual precipitation 200-3000mm). There is dense forest with several layers of trees.
- Tropical grasslands (Savannah) - Hot all year (25-25°C). 500-1000mm rainfall in a year with a distinct dry season. Tall grasses and drought adapted shrubs and trees.
- Deserts—Very hot all year (+30°C), with cool nights (large diurnal temperature range). Low precipitation (>250mm a year). Scarce plants that have water storage features and extensive routes.
- Temperate grassland—Hot in summer (25°C), very cold in winter (as low as -40°C). 500-900mm rainfall a year mainly in spring and summer. Short grasses with very few trees and bushes.
- Temperate forest—Warm summers (18°C), cool winters (5°C). Precipitation all year round with an average 1000mm year. Deciduous trees such as oak.
- Boreal (Coniferous) forest—Mild summers (10-20°C), very cold winters (Below 0°C). Low precipitation (less than 500mm) mainly in the summer.
- Tundra—Temperatures below 0°C for most of the year and only reaching around 10°C in the summer. >250mm precipitation. Mainly lichens and mosses as plants can't survive.



Climatic factors affecting the distribution of biomes:

- Tropical rainforest—Generally occur near the equator due to high solar radiation and rainfall. The sun is generally directly overhead all year and the heat causes the air to rise (warm air is less dense), as it rises it cools, causing the water vapour in the air to condense, forming clouds and precipitation. The low pressure system created is called the inter-tropical convergence zone.
- Tropical grassland—Occur further away from the Equator. They are located where temperatures are still high and there is a distinct dry season that prevents tree growth.
- Hot deserts—Occur along the Tropic of Cancer and the Tropic of Capricorn. A high pressure system is present meaning the air is sinking. As the air sinks it is warmed and can hold more moisture so there is little condensation and cloud formation. This leads to high temperatures during the day. At night it is cooler as the ground does not retain heat very well and there are few clouds to act as a blanket. With little clouds there is little rainfall.
- Temperate forests—Generally located in high latitudes. The atmosphere consists of low pressure systems; the rising air helps create year round rainfall. In winter there is less sunlight so less photosynthesis occurs therefore trees lose their leaves to conserve energy.
- Temperate grasslands—Occur at similar latitudes to temperate forests, but are generally on the interior of continents (away from coasts/large bodies of water). Seasons are more pronounced. They have mild summers and very cold winters which limits plant growth.
- Boreal forests— These occur further north than temperate forests, and are generally only located in the Northern hemisphere as there is little land at the same latitude in the Southern hemisphere. The temperatures are colder as there is a high pressure system so the air is sinking. There is also low precipitation. The conifer trees have adapted to the conditions having a waxy coat to prevent freezing and allow quick photosynthesis.
- Tundra biome—Occurs closest to the poles. Plant growth is limited by low precipitation and few sunlight hours. There is a consistent high pressure system here meaning evaporation is slow. Generally, mosses and lichen are the only things that can grow. There are also very high winds as there are few plants to slow it down.

Local factors affecting biomes

- Altitude— The temperature falls by 0.5-1°C for every 100m climb in height. Mountains are also exposed to higher winds making it hard for plants to grow. As slopes are steep they have thin soils preventing plant growth.
- Rock type—Some rocks are hard and prevent growth of plant life and others are soft so roots can easily break through them. Some rocks are permeable allowing water to go through them (Chalk) others are impermeable (Slate). Permeable rocks can encourage plant growth.
- Soils—These are a mixture of rock, dead plants and animals, air and water. Different plants grow in different soil. Sandy soil is extremely permeable and cannot hold water well, plants have to be drought tolerant to grow in sandy soil. Clay soil is slightly impermeable due to small pores; this generally creates puddles that last a long time collecting nutrients. Plants like Wheat grow well in this soil. Chalky soil is permeable and water drains quickly so only plants like barley and grass grow well. Peat doesn't contain rock, it's made from dead plants and animals. It is rich in nutrients and is acidic. It supports rough grazing and forestry.
- Drainage—If there are impermeable rocks, the surface can become waterlogged creating peat bogs and marshland. There would be very few trees here.

Biotic and Abiotic components interacting:

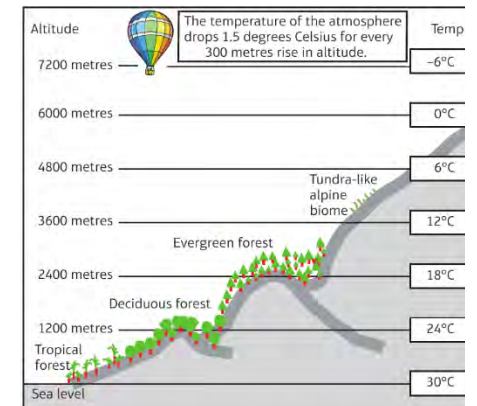
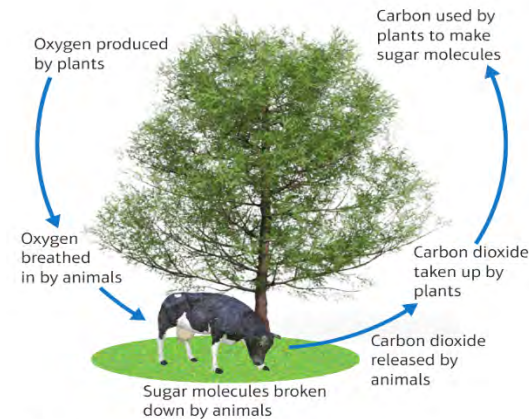
Biotic components are living things like flora and fauna. Abiotic components are non-living parts such as soil, water and climate. These components interact all the time to create an equilibrium.

Weathering—When rocks are broken in situ (without being transported). **Biological weathering** is when living things break up the rock such as tree roots growing in cracks in the rock. **Bio-physical weathering** is when the rock is physically forced apart such as molluscs that grind holes in rocks to create a home. **Bio-chemical weathering** is when flora or fauna secrete acids that dissolve rocks. Such as seabirds producing guano which dissolves rocks on cliffs.

Photosynthesis and respiration— Biotic components interact with the atmosphere such as producing greenhouse gases like methane when decomposing anaerobically or digesting. The main way they interact with the atmosphere is photosynthesis and respiration. Respiration takes in oxygen and produces carbon dioxide and photosynthesis takes in carbon dioxide and gives out oxygen. These processes regulate the atmosphere keeping it in balance.

Nutrient cycle—This is how nutrients are transferred in an ecosystem. Soil, litter and biomass are all stores for nutrients. The nutrients are transferred between the stores for example litter decomposition transfers nutrients into soils, as plants grow in the soil they take up the nutrients and become biomass. As the plants die the nutrients go back to being stored in the litter as plant tissue and the cycle continues. Nutrients can be lost in the system through leaching and can be added through rainfall and weathering from rocks.

Hydrological cycle—Plants help to regulate the water cycle, as plants intercept and absorb precipitation, slowing its movement to the ground. This reduces surface run off and the flood risk. At the same time transpiration in the rainforest creates water vapour during the day and at night condensation occurs creating precipitation again. In some biomes like



The biosphere is a vital life support system for people due to its goods and services.

The biosphere provides vital resources—Many people depend on the biosphere for basic goods such as food, medicine, building materials and fuel. Especially indigenous people. All food comes from the biosphere (except salt), but developed cultures tend to farm food rather than forage. Developed cultures also process food, transport it and store it, whereas indigenous people tend to eat fresh foliage and game they have collected.

Commercial exploitation—Modern technology has reduced our dependence on the biosphere from day-to-day. However, it has also led to increased exploitation of resources. Rapid population growth, modernisation of agriculture, industrialisation and urbanisation has led to a dramatic increase in demand for water. This means that parts of the biosphere is deprived of water. E.g. Hamoun Wetlands in Iran, drought, dam building, irrigation and population growth have caused the wetlands to dry up. Biofuels are also commercially exploited as they are an alternative to fossil fuels. Therefore, huge areas of land are being cleared to grow biofuel crops. This means local's food and fuel prices increase and any indigenous people living in the vicinity could struggle to collect the resources they need for survival. As well as this many habitats are destroyed. For example, the rainforest in Borneo is being cleared to grow palm oil. This is destroying the orang-utans habitat. Even though minerals are not part of the biosphere, the demand for them affects the biosphere. For example, mountain top removal mining, to collect coal developed in the Appalachian Mountains USA, has destroyed many habitats, created mass air pollution and has polluted water supplies.

Biospheres play a globally important role:

Regulating the atmosphere— The main way is through the regulation of carbon dioxide and oxygen in the atmosphere through respiration and photosynthesis. As an equilibrium has been created it prevents the earth plunging into a glacial period as the carbon dioxide keeps the earth warm.

Soil health—Most soils would be infertile if it wasn't for leaf litter decomposing in damp/wet conditions to produce humus. This is aided by earthworms which churn the humus and other dead organic matter to break it down chemically. Soils are vital for human existence to grow crops and the biosphere helps keep them healthy.

Managing water—The hydrological cycle helps prevent flooding and stores water. Mangroves can prevent flooding in coastal locations. Deforestation can reduce interception and absorption leading to increased flooding such as the flooding in Pakistan in 2010.

Questions

- Explain how the biosphere provides resources for people. (4)
- Explain the importance of the biosphere on a global scale. (4)
- Explain how increasing resource demand can lead to exploitation of the biosphere. (4)
- Explain the difference between Malthus' and Boserup's theories. (4)

Key Terms

- Indigenous
- Biofuels
- Humus
- Affluence
- GDP per capita
- Consumerism
- Urbanisation
- Industrialisation
- Deforestation
- Open cast mining
- Epidemics
- Green revolution
- Carrying capacity



Over exploitation—global trends -

The demand for resources (food, water, energy and others) has constantly increased over time. Today we extract 50% more natural resources than 30 years ago (approximately 60 billion tonnes of raw materials a year). The main reason for this is the increasing world population. The natural environment provides us with the resources we need to survive. People in developed countries consume 10x more resources than those in developing or emerging countries.

As significant as the rising numbers of people is the rising affluence of people. Global GDP (gross domestic product) per capita has risen steadily from US\$6800 in 1993 to US\$13,100 in 2013. This has led to people buying more resources and consuming more than is needed.

Regional trends—Some developing countries are now becoming emerging economies such as Brazil, Russia, India and China (BRIC countries). These countries have grown rapidly. Collectively their GDP surpassed the USA's in 2006, although Russia and Brazil have declined slightly. The newest group of countries that are expected to develop quickly are Mexico, Indonesia, Nigeria and Turkey (MINT countries). As the people in these countries gain more wealth they spend more (consumerism), this means they can access more resources, which in turn means more resources are needed.

Urbanisation and Industrialisation— In the last 50 years' urbanisation and industrialisation have increased, leading to an extra demand on resources. This has directly impacted biomes. A city requires a lot of resources to support its population such as food, water, energy and shelter, however these resources are not always collected locally, they are collected nationally and even globally. This increases pollution, mining, dam building etc. Emerging countries such as China and India have been the major users of more resources. Again this is due to affluence (a 6-10% annual increase in GDP since 1990). These countries also have large populations and have rapidly industrialised and urbanised. In the next 35 years it is predicted that energy consumption would increase by 56%.

Exploitation -

The demand for resources has continued to increase leading to a lot of damage to the biosphere. Demand for beef (and soya to feed cattle) has led to mass deforestation in the Amazon rainforest. Destroying habitats and indigenous people's homes. The demand for palm oil has encouraged deforestation in Cameroon. Palm oil is used in pizza dough, shampoo, soap, noodles and ice cream. Water is a vital resource to species therefore dams have been created to store huge volumes of water as well as create electricity with HEP. However, this causes flooding displacing people and habitats such as the Santo Antonio Dam in Brazil which destroyed 400km² of tropical rainforest. Open case mining is also widespread due to demand for fuels and minerals. This has caused a lot of environmental problems in Alberta tar sands in Canada to extract oil.

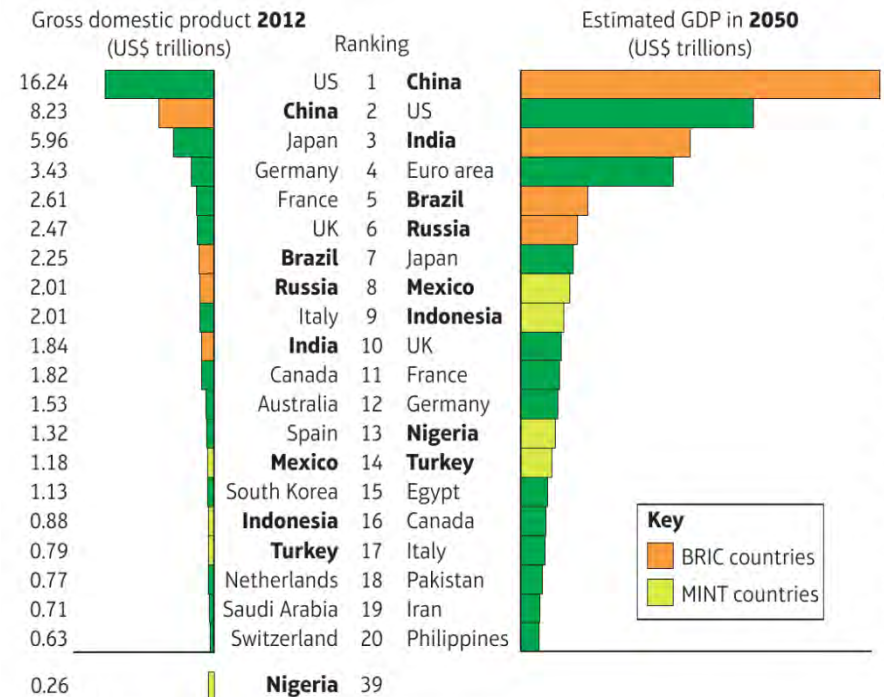


Figure 15 GDP levels in 2012 and projected to 2050

Theories of consumption

Malthus-

Reverend Thomas Robert Malthus in the 18th century wrote an essay about his beliefs that human population would grow faster than resources. Therefore, a disaster may occur. He believed as resources ran out there would be wars, epidemics and famine. This would lead to a crash in the population until the numbers balanced with resource supply. Malthus believed that populations grew geometrically and resources only increased arithmetically. This would lead to the situation in which there would not be enough resources for the global population. The evidence that supports his theory is wars, civil wars which have taken place over resources, as well as famines in Ethiopia and South Sudan due to droughts. Also many diseases have spread such as Ebola and Bird Flu. However, others disagree stating the Green Revolution has allowed us to increase crop yields therefore we can grow more food for the growing populations. Also developed countries have socially changed as they have become wealthier, meaning they have less children on average than emerging and developing countries. This means that in some cases the population is remaining stable or even decreasing such as Japan.

Boserup-

Ester Boserup a Danish economist in the 1960's suggested that Malthus was incorrect. She believed that as the population grew to the point that resources were becoming sparse, technology would find ways to increase supply to fit the demand. As the carrying capacity of a country or the world is approached people will find solutions to be supported. The evidence for Boserup's theory includes the Green Revolution which used selective breeding, irrigation, pesticides and fertilisers which has dramatically improved crop yields. Her supporters also argue that the world's population has continued to increase rapidly (over 7 billion today) and there has been no worldwide crash in the world's population due to a lack of resources. The development of renewable technologies has led to a reduction in the need for fossil fuels and cultures are changing to become more sustainable. However, critics suggest that there are still epidemics and diseases spreading such as HIV that is killing a lot of people and there is a growing number of refugees due to disasters such as war, drought and hazards.

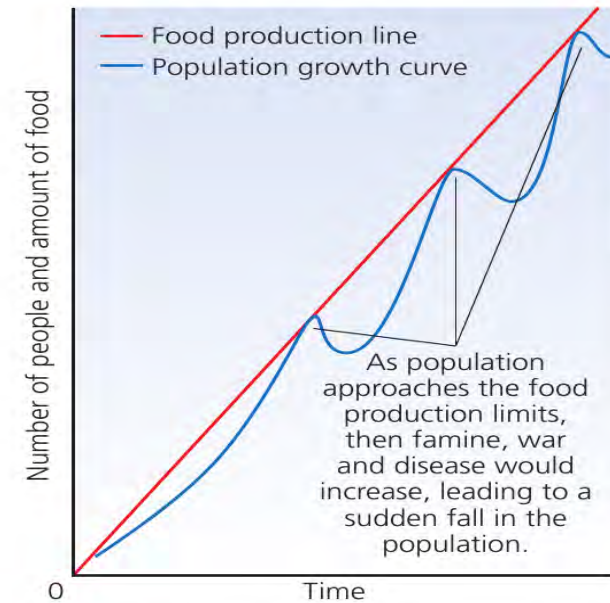


Figure 16 The relationship between food supply and population, according to Malthus

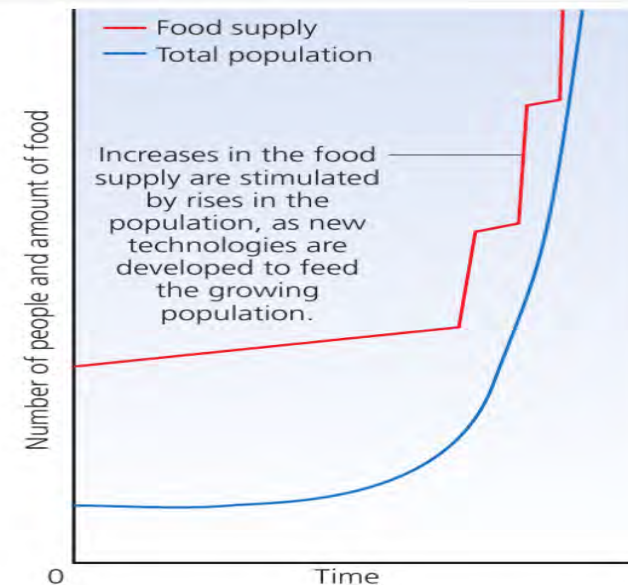


Figure 17 The relationship between food supply and population, according to Boserup