



LHS

Social Science + LoTE Faculty

9 GEO

TOPIC 1: SUSTAINABLE BIOMES



Name:

Class:

SUSTAINABLE BIOMES

Introduction to biomes

A biome is a region that shares similar and distinctive climates, soils and vegetation. The tundra lands biome, for example (Source 1.1), is characterised by very cold climates, extreme winds and very limited plant and animal diversity. In contrast, the tropical rainforest biome is characterised by a warm and wet climate, highly weathered soils and thick, lush vegetation.

Source 1.1 : The tundra biome is the coldest of all the biomes. Tundra comes from the Finnish word *tunturia*, meaning 'treeless plain', and covers about 20 per cent of the Earth.



Question 1: What is a biome?

Geographers are interested in the diverse physical features of biomes, their spatial distribution and the way that humans use and alter biomes for food, fibre and material production. In this chapter you will explore eight diverse biomes: polar lands, tundra, boreal forest, mountain vegetation, temperate forest, grassland, desert and tropical rainforest. Biomes can be classified as 'terrestrial biomes'. That is biomes found on land. Biomes can also be classified as 'Aquatic biomes', biomes found in water.

Question 2: List 6 biomes that sustain life on earth.

The world's biomes

In order to better understand the Earth's natural and human environments, geographers divide the Earth's surface into a number of distinct regions. Each region has particular features that make it different from other regions. One region may be hot and rainy most of the time, for example, and another might be dry and cold. This

means the plant and animal life found there functions, adapts and interacts according to the conditions of the region it inhabits. Regions defined by landscapes that share similar climates and types of vegetation in this way are known as biomes.

Question 3: What features define what lives and thrives in biomes?

In some biomes, such as tropical forests and grasslands, there is an abundance of plants and animals and therefore they are more able to sustain life. This is because the conditions favour a huge variety of species. A recent study of a Colombian rainforest, for example, found 596 bird species, 150 different species of amphibians and more than 200 species of mammals. Scientists estimate that there are more than 100 000 insect species per hectare in this rainforest and more tree species in a single hectare here than there are in the whole of North America. This explosion of life is due to the year-round high temperatures and rainfall in the region.

Question 4: Why is there such an abundance of life in rainforest?

Question 5: Where are the world's tropical forests located? Why do you think they are located in these places?

At the other end of the scale are the tundra and the polar lands, which are the coldest biomes. The tundra biome circles the North Pole. Tundra, meaning ‘treeless plain’, has short growing seasons, very little plant diversity and very low temperatures. Antarctica, a polar land, is twice the size of Australia and contains virtually no native land species. Only two flowering species of plants exist on the continent and the largest native land animal is a 1-centimetre-long wingless midge. There are no native mammals, amphibians or trees in Antarctica. It is simply too cold, too dry and too windy for plants and animals to flourish.

Question 6: Describe the ‘tundra biome’?

Question 7: Is there an abundance of life found in the tundra biome? Why or why not.

In the mountain vegetation biome, too, cold conditions determine plant life and the animals that live there. Plants in the mountain vegetation biome tend to be low and hug the ground to preserve warmth. The mountain vegetation biome has a long winter period, and animals that live in these areas need to be able survive the cold and the exposure to UV radiation.

Question 8: Why does the fauna (animal) and flora (plant) need special adaptations to survive in the mountain biome?

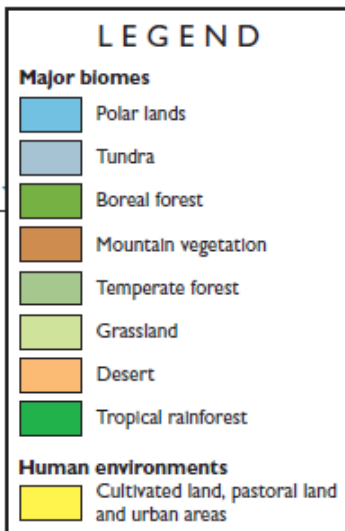
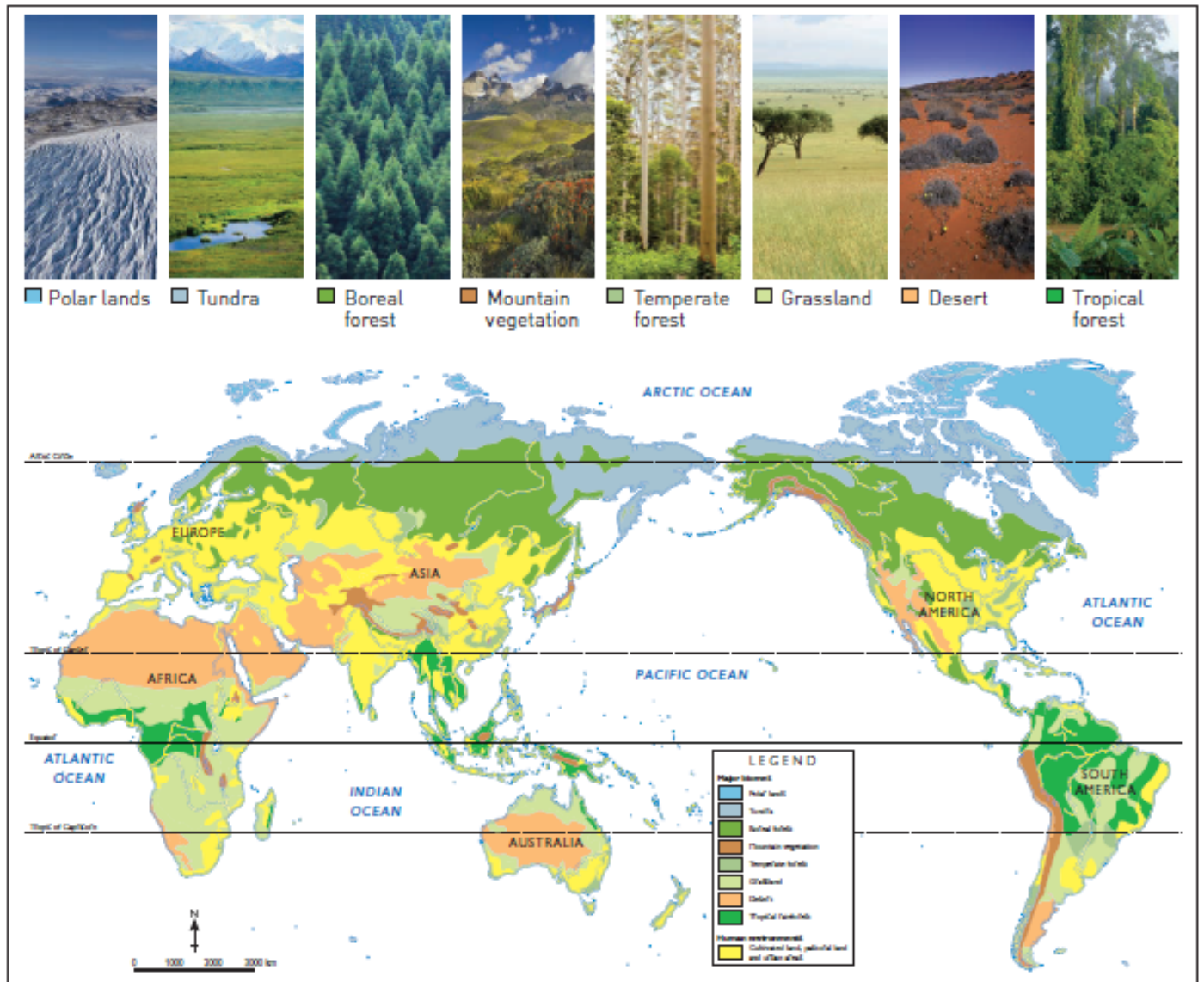
Aquatic biomes exist too. The world's oceans, freshwater lakes, coral reefs and wetlands are all examples of these biomes, which are dominated by water and the plants and animals that call them home.

Question 9: What are aquatic biomes?

Question 10: Biomes can further be grouped into two categories. What are they called?

WHERE ARE THE WORLD'S BIOMES LOCATED?

WORLD: BIOMES



Source 1.2: Distribution of the world's biomes.

QUESTIONS

1. Describe the distribution of biomes in Australia.

a. Which biome is most dominant in Australia?

2. Describe the distribution of biomes in Africa.

a. Which two biomes are most dominate In the continent of Africa?

3. Describe the distribution of biomes in Europe.

a. Which biome is most dominant in Europe?

4. Describe the distribution of biomes in Asia.

a. What is the most dominant biome in this continent?

5. Describe the distribution of biomes in North America.

a. What are the most dominant biomes in this continent?

6. Describe the distribution of biomes in South America.

a. What is the most dominant biome in this continent?

7. Match the biomes below with their definitions and images:

Coast

Underwater structure made by tiny animals



Coral Reef

An area of grass or grass-like vegetation



Desert

A large natural stream of water flowing to another body of water



Grassland

Dry, often sandy place with extreme temperatures and few plants



Wetland

Natural elevation of the Earth's surface with steep sides and a high summit



Mountain

Land that is mostly covered with still or slow moving water

Polar Land

Areas around the north and south poles dominated by ice caps

Rainforest

The part of the land near the sea

River

A dense green forest with high annual rainfall

Tundra

A large, flat treeless area in Arctic regions

RAINFOREST BIOME

It is estimated that about half of all the plant, animal and insect species in the world live in tropical forests. Many of these are among the wettest places on Earth and are therefore known as rainforests. They can be considered to make up the world's richest biome and the abundance of life can be astounding.

In Brazil, for example, researchers found that a single pond contained more fish species than exist in all of Europe's rivers. In Peru, a single tree was found to contain 43 ant species; this is more than the total number in all of the British Isles. One hectare of South American rainforest may contain over 750 different types of trees, and one-fifth of all of the world's birds live in the Amazon rainforest. This explosion of life is due to the ideal growing conditions that occur in the tropics.

Question 1: Explain why rainforests are an important biome?



These places experience the most stable climate conditions on the planet with virtually no seasonal changes in rainfall, temperature or available sunlight throughout the year. Most days are the same in the rainforest: hot and wet. It rains virtually every day, often in torrential downpours. The temperature hovers between about 26°C and 32°C all year round.

Source 1.3: Temperate rainforests are found in the temperate climate zone. Like tropical rainforests, they receive an abundance of rain and take in high amounts of carbon dioxide. However, they do not have the same levels of biodiversity as the tropical rainforests. The temperate rainforests of Tasmania and Victoria are characterised by ferns covering the ground and tall trees, some of them among the world's tallest.

Question 2: Describe the climatic conditions that allows fauna and flora to thrive in the rainforest biomes.

Question 3: Look at source 1.3. What are some similarities and differences between tropical and temperate rainforests?

Going with the flow in the rainforest

A rainforest, like all ecosystems, is a very dynamic place. Complex relationships between the climate (including rainfall, temperature, wind, humidity and sunlight), the shape of the land, soils, plants and animals have developed over millions of years and keep the rainforest alive and flourishing. A change to any part of the ecosystem can have devastating consequences for the whole ecosystem. The cross-section in Source 1.5 shows some of the flows of energy (intangible sources of power or nutrition) and matter (tangible sources of power or nutrition) that exist in a rainforest.

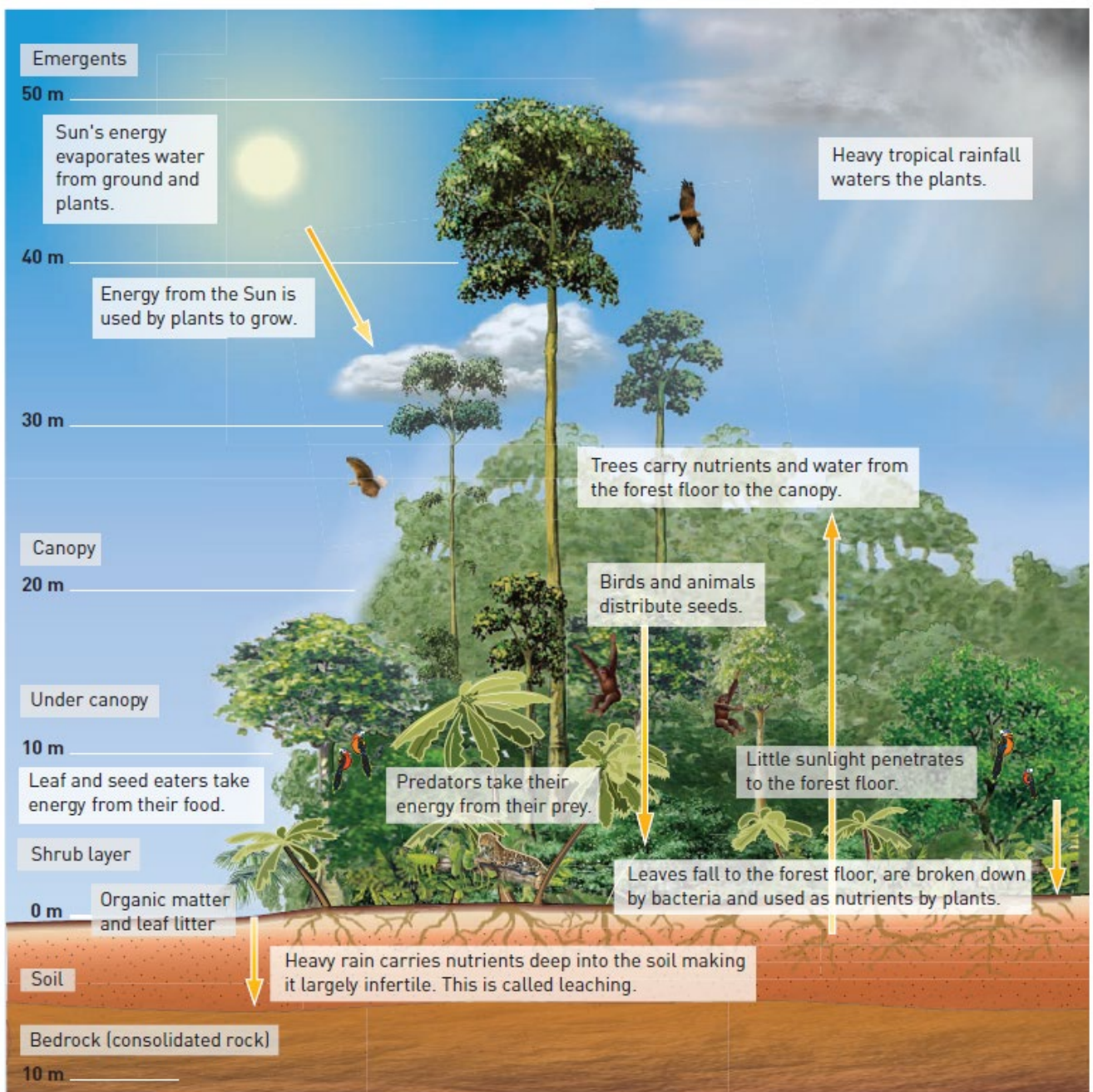
Question 4: List the abiotic factors that a rainforest cannot live without?

Changes in the rainforest

It might seem logical that rainforests must have a deep rich layer of soil to support the great trees and other plants that flourish there. However, this is not the case. The heavy rain washes the nutrients of the soil deep into the ground where the roots of the plants cannot access them. The rainforest trees are able to survive in these soils because they have developed wide-spreading roots and the warm temperatures in the tropics allow leaf litter – dead plant material that has fallen to the ground – to be quickly recycled into plant nutrients.

When the rainforest plants are cleared to make way for farms, these nutrients are quickly lost and the soil becomes exposed to the heavy rain and tropical sun. Farmers often find, contrary to expectations, that their plants do not thrive in these conditions and the soil provides few of the nutrients the plants need.

Question 5: Explain how heavy rainfall can be damaging to the rainforest biome?



Source 1.5: Cross-section of a tropical rainforest

Question 6: Look at the source 1.5 of the rainforest and answer the following questions:

a) identify an interaction that takes place between animals and plants.

b) What effect do you think there would be on the rainforest ecosystem if this interaction no longer occurred?

c) Why are rainforest soils poor in nutrients?

The gifts of the rainforest

Rainforests have provided humans with many resources for thousands of years. These resources are known as ecosystem services . Rainforests provide many services, including the ones described in Source 1.4.



Ecosystem services

About 80% of the plants we eat began in the world's tropical rainforests. Potatoes, corn, rice, avocados, oranges, bananas, coffee, chocolate and hundreds of other foods are rainforest plants.

About 25% of the drugs we use to treat illnesses, from leukaemia to headaches, come from rainforest plants.

Rainforest plants take in carbon dioxide and produce oxygen. The Amazon rainforest alone is thought to produce about one-fifth of the world's oxygen.

Rainforests regulate the Earth's temperature and rainfall, and hold much of the world's fresh water.

Rainforests in Africa, Asia, South America and Australia are home to Indigenous peoples.

Products such as toothpaste, golf balls, rubber tyres, paints, cosmetics, steroids and cork are all made from rainforest plants.

Source 1.4: A scarlet macaw flies over the world's largest rainforest – the Amazon. The Amazon provides many ecosystem services.

Question 7: List as many ecosystem services that rainforests provide humans with.

Question 8: List three rainforests in the world.

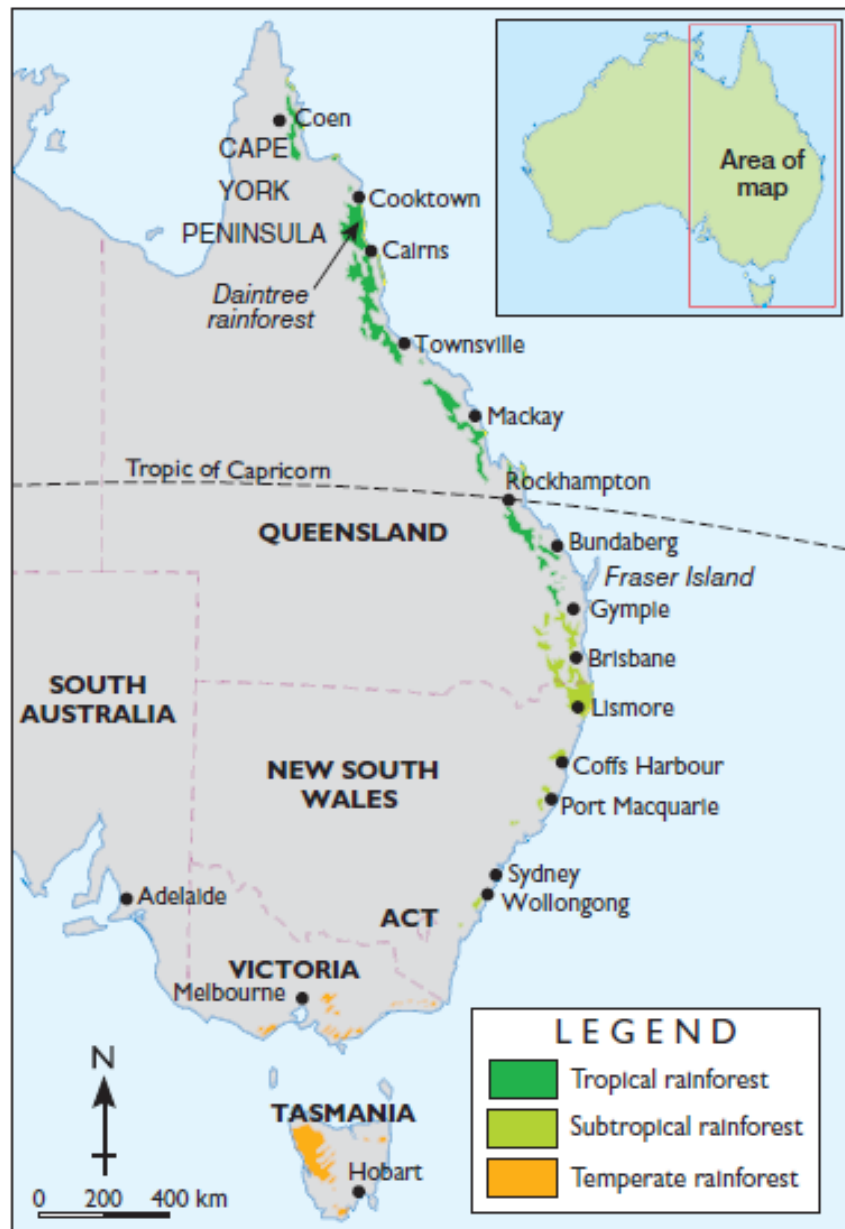
AUSTRALIA'S RAINFORESTS

Though much of Australia was once covered in forest, now there are only a few small pockets near the east coast (see Source 1.6). Rainforests now make up only 2.5 per cent of Australia's remaining native forest. This surviving forest, however, is a real Noah's Ark for many plant and animal species, many of which exist nowhere else in the world.

There are more than 1000 species of plants in Australian rainforests, of which about 700 exist nowhere else. These plants support thousands of insect species, hundreds of reptile and bird species and nearly 90 different types of mammals.

The subtropical rainforests of New South Wales and Queensland are also internationally recognised for their direct links to the world's first flowering plants, which happened about 100 million years ago.

EASTERN AUSTRALIA: RAINFOREST REGIONS



Source 1.6:
Australia's
distribution of
rainforests.

Question 1: Describe the distribution of Australia’s rainforests. Refer to particular places and states and use compass directions in your answer.

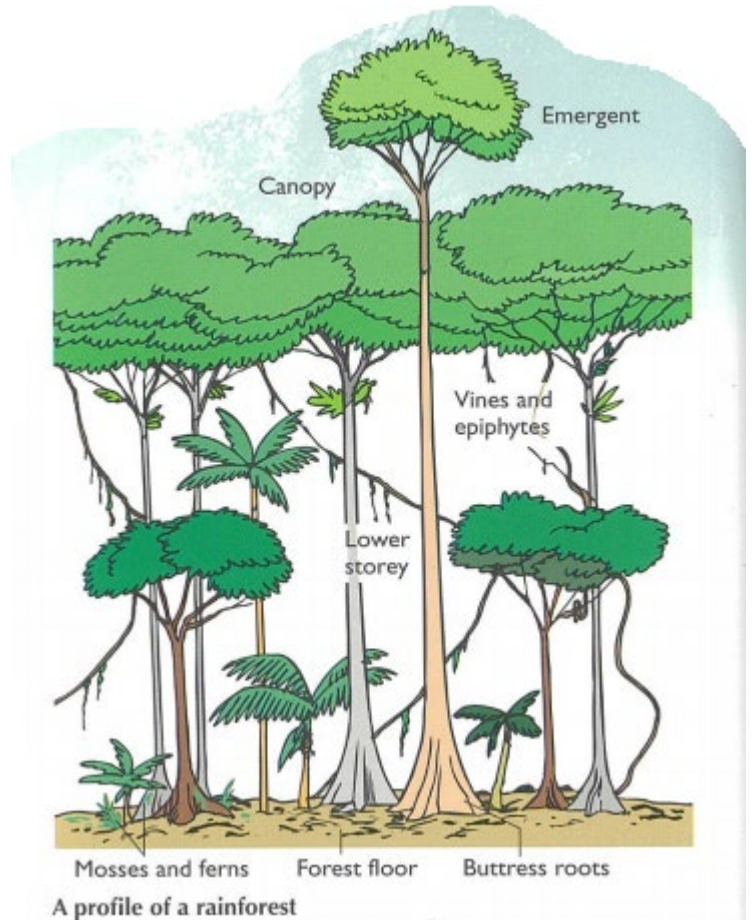
Question 2: Why do you think the amount of rainforest in Australia has decreased so much? Consider both natural processes and human activities.

RAINFORESTS ARE GREEN DINOSAURS

Dinosaurs used to exist on Earth, but are now extinct. Some rainforest species are disappearing at a very fast rate and could be extinct in the future. It has been estimated that between 20 percent and 50 percent of all rainforest species will be extinct by 2000. Scientists state that we are losing as many as six rainforest species per hour.

What is a rainforest?

A tropical rainforest environment is characterized by densely growing trees and plants. A hot, wet environment is ideal for rainforests. Rainforests have an enormous number of plant and animal species. For example, rainforests in South-east Asia contain 15,000 species of plants and 150,000 species of animals.



A rainforest is covered with dense, evergreen vegetation that grows in three layers. The trees grow so close together in three layers. The trees grow so close together that the *canopy* interlocks so direct sunlight only reaches the ground in small patches. If you fly over a rainforest, you cannot see the ground because of the canopy.

Plant species diversity

Rainforests have the greatest diversity of plant species. On average there are 300 species in every hectare of tropical forests. A rainforest in its natural condition is called a *Virgin* or *primary forest*. If it has been cleared for logging or for crops, but has regrown, it is called *secondary forests*.

Rainforests have three layers of vegetation all competing for light and space.

1. Emergents are the tallest trees. They can grow up to 60 metres in height.
2. Canopy trees are between 20-30 metres high and act like an umbrella, as they only allow two per cent of sunlight to reach the rainforest floor. These trees are densely woven and bound together with climbing plants such as *lianas* which can grow up to one kilometer long.

3. Lower storey plants are found nearer to the rainforest floor. There are very few plants as it is too shady for photosynthesis. Some plants have adapted to low light conditions, such as ferns, moss, fungi and lichen. The forest floor consists mainly of dead, decaying plants.

Plants growing in rainforest conditions would be almost consistently wet if they did not develop ways of removing water quickly from their leaves. A surface film of water reflects light, which makes photosynthesis difficult. Being consistently damp encourages the growth of fungi and other parasites. Rainforest plants therefore have the following adaptations to help them survive in a hot, wet rainforest environment.

- Drip tip leaves have a downward curve, which helps water run off the surface of the leaf quickly.
- Waxy coatings on leaves also help remove water fast.
- The leaves of rainforest plants are generally large, so they are less likely to break under the weight of heavy rainfall.
- The leaves of most rainforest plants are dark green. This is because the light energy (in the sunlight) for photosynthesis is trapped in the green parts of the plant. The darker green the leaves are, the more energy from sunlight is likely to be trapped.
- Huge emergent have roots on top of its ground to support their slender trunks. These are called buttress roots.

In the dark rainforest, insects and other pollinators have trouble seeing flowers. To overcome this problem, some plants produce strong smells. Others produce bright flowers to attract pollinators. Other plants in the rainforest include epiphytes, parasites and saprophytes.

Where are the world's rainforests?

Tropical rainforests are mostly found between the Tropic of cancer (23.5°N) and Tropic of Capricorn (23.5°S). It is very difficult to draw clear boundaries around rainforests because rainforests blend with other forests. Approximately half of the world's rainforests are found in South America; most are in Brazil. Rainforests are also found in South-east Asia including Indonesia, Malaysia and the Philippines, West Africa, Madagascar and eastern Australia.

QUESTIONS

1. Why do we say that rainforests are green dinosaurs?

2. What are the characteristics of a rainforest environment?

3. What type of climate is ideal for rainforests?

4. What do you understand by the following terms:

a. Emergents

b. Canopy

c. Lower storey

5. Describe how the plants in the forest canopy and the lower storey differ? Why do you think these differences occur?

6. Between which latitudes are most rainforest located in?

7. Why do you think there are no tropical rainforests in North America and North Africa?

8. Web search: Name ten countries where tropical rainforests are found.

9. What does the future hold for rainforests that have existed for millions of years?

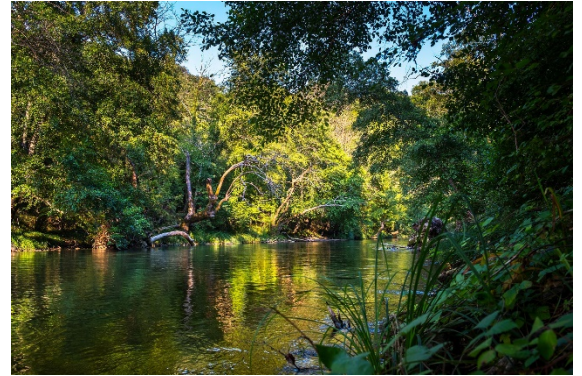
WHY ARE TROPICAL RAINFOREST SO HOT AND WET?

Tropical rainforests are found where there are both high temperatures and high precipitation.

For example, the average temperatures in Belem, Brazil, are as high 26°C and annual precipitation is more than 2300 millimetres. Some tropical rainforests receive more than 4000 millimetres of rainfall per year.

Why are rainforests so hot?

The sun's rays that reach the Earth near the equator have a smaller area of the Earth and atmosphere to heat than rays reaching the Earth at higher latitudes. It is therefore hotter at the equator than at higher latitudes. Tropical rainforests do not have the very high maximums that deserts record because they are covered with lots of clouds, which reflects some of the sun's rays during the day. But rainforests are generally warmer at night, because the cloud cover and high humidity help to keep the heat in. Tropical rainforests have a hot climate right throughout the year with no summer or winter.



Why are rainforests so wet?

High precipitation around the equator is mainly due to convectional rainfall and is often associated with thunderstorms. Convectional rainfall occurs when warm, moist air is heated when it moves over a hot surface on Earth. As the air is heated it expands and becomes lighter than the surrounding air. This causes it to rise. If the air continues to rise, condensation and precipitation occur.

The most widespread form of convectional rainfall is the thunderstorm. The clouds that are associated with thunderstorms are called cumulonimbus clouds. Thunderstorms are most likely to occur in rainforests during the afternoon, but can occur at any time.

There are few sights in nature more awe-inspiring than the lightning and thunder display associated with a thunderstorm. The process that produces lightning is not fully understood, but it is known that an electrical charge builds up at the bottom of large cumulonimbus clouds. This is a negative charge, which causes a positive charge



to build up on the ground below. The electricity is then discharged between the positive and the negatively charged areas in the form of a bright flash of light. Each lightning strike that we see is actually made up of several flashes (up to 42) travelling both up and down, but our eyes cannot usually detect these individual strikes. Close to the

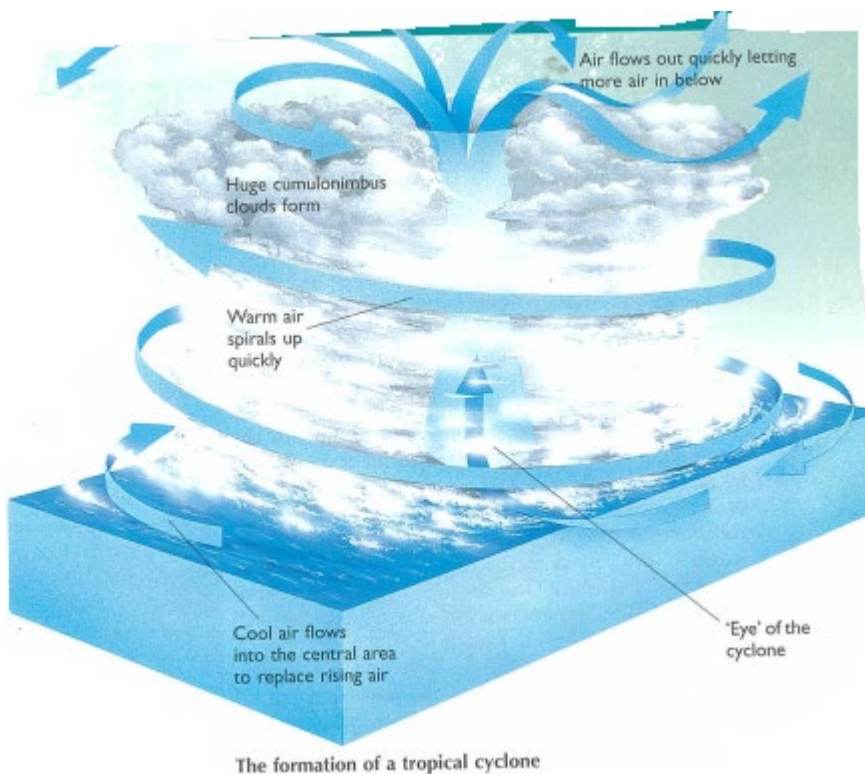
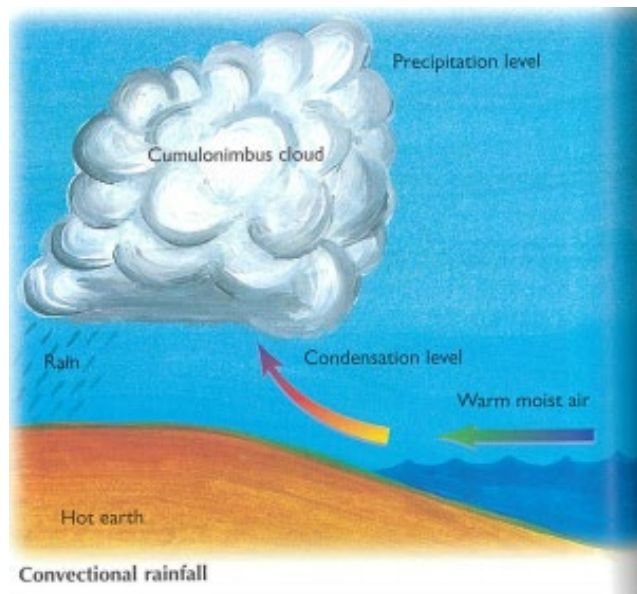
lightning the air is heated very quickly to about 30 000°C. This causes the air to expand explosively. This becomes a booming sound wave which we call thunder. There cannot, therefore, be thunder without lightning.

Thunderstorms occur very frequently in tropical; rainforests and are accompanied by lightning, thunder, and often, torrential rainfall.

Tropical cyclones

Along the equator and within the tropics there are large areas of low pressure. These are basically areas of rising air, which are very favorable for the development of convective rainfall and thunderstorms.

A tropical cyclone is a particular type of low-pressure system. They often develop in the warmer months in the areas a little north and south of the equator and close to the tropics. Tropical cyclones are areas of warm, moist air rising rapidly and rotating around a central core (known as the eye). They are often accompanied by very strong winds (gusts of 300 kilometres per hour have been recorded) and torrential rain (1800 millimetres in 24 hours has been recorded). If these severe storms occur near large population centres, they can cause a lot of damage to property and loss of life.



Tropical cyclones need the energy provided by warm water vapour (sea waters of at least 27°C), so they will usually die out if they move inland away from the water vapour, or out of the tropics, away from warmth.

This is why tropical, coastal areas, such as the Caribbean Sea (Central America), the north-west Pacific and north-east Australia are commonly affected by tropical cyclones.

Tropical cyclones bring heavy rain, to the tropical rainforests that are closer to the tropics than the equator. They do not form close to the equator.

QUESTIONS

1. Where are tropical rainforests found?

2. Provide three examples of tropical rainforests.

3. Why are rainforests so hot?

4. Describe how convectional rainfall develops.

5. Why do you think thunderstorms are most likely to occur in the afternoon?

6. What do tropical cyclones bring rainforests?

RAINFORESTS ECOSYSTEMS

A rainforest ecosystem is the interaction of all living things (biotic), such as plants and animals, and nonliving things (abiotic), such as temperature, rainfall and soil. Animals cannot live without plants. Plants convert energy from the sun, by the process of photosynthesis, into food for animals.

The removal of a plant species could result in the removal of a food source essential for the survival of an animal.

Rainforests provide habitats for many species of plants, animals, birds, and insects. Rainforests may cover only four per cent of the world's total area, but they have the greatest diversity of species. One hectare of rainforest contains 200 different species of trees, compared with only 20 in a coniferous forest.

Some plants and animals are food for others.

Orang-utans eat fruit and jaguars eat small monkeys. Insects join with fungi and bacteria to break down dead matter which becomes food for plants. This is all part of the natural balance of life on earth.

Plants co-exist with animals. Some animals only adapt to one type of fruit and have very simple food webs. Some flowers rely on only one type of pollinator. For example, an orchid in Madagascar has its nectar 15 centimetres down a thin tube. Only the long-tongued hawk moth can reach down the tube of the flower to pollinate it. The Rocky River fig tree needs to have seeds dispersed beyond its immediate area. The tube nose fruit bat does this successfully. Such interdependence makes rainforest ecosystems complex.

Rainforests are like giant lungs



Rainforests are vital to the Earth in helping to recycle carbon and oxygen.

Rainforests are part of the carbon-oxygen cycle. Rainforests are major producers of the Earth's oxygen which humans depend on for survival.

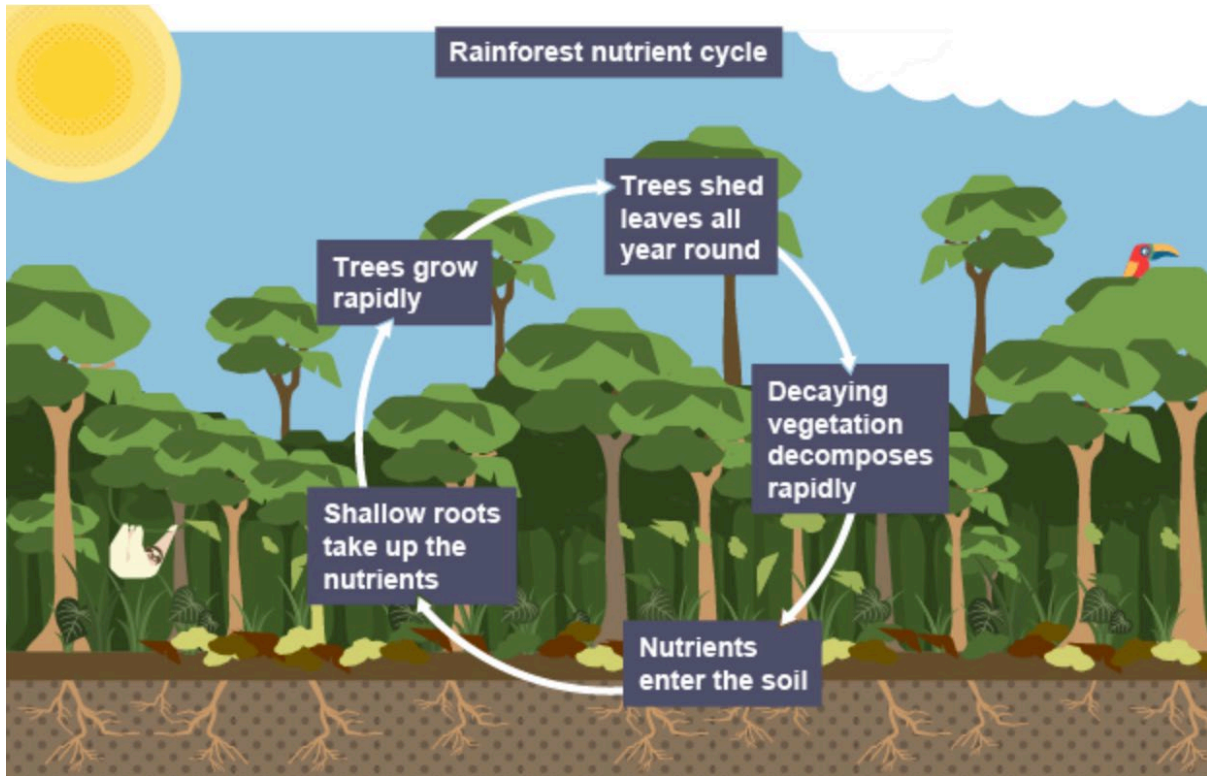
Rainforest trees remove carbon dioxide from the air and return oxygen in its place (carbon dioxide is a greenhouse gas that contributes to the warming of the Earth's atmosphere).

Scientists believe that nearly 50 per cent of the Earth's oxygen is produced in the Amazon rainforest. Nearly 40 percent of the world's carbon is contained in the rainforests. As rainforests are burnt or cut down, carbon dioxide is released into the Earth's atmosphere.

Rainforests are part of the Nutrient cycle

All students need carbohydrates to grow. But they also need nutrients, such as vitamins, to ensure they are healthy humans. Plants also need nutrients.

The rainforest depends on the recycling of nutrients for its existence. Leaves and flowers die and fall onto the soil. Animals also die. Plants and animals decompose and the decomposed material is reused by plants. Plants are the producers in the food chain. Consumers then eat the producers in the food web.

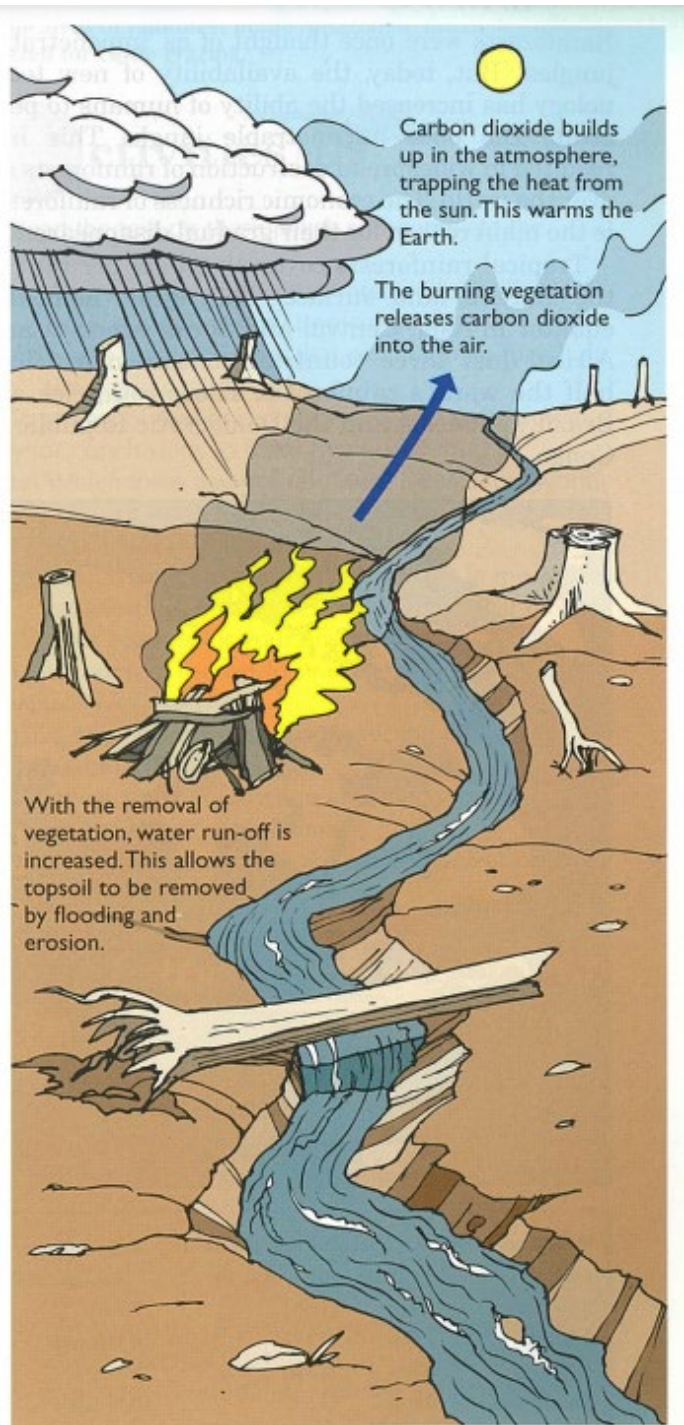


Rainforest soils are nutrient-poor

Rainforest soils give the impression of being fertile because they support an enormous number of trees and plants. But this impression is wrong, as the soil in rainforests is generally poor. Roots of trees must 'snatch' the nutrients from the soil before heavy rain washes them away. Buttress roots absorb nutrients from the leaf litter sitting on top of the ground. This means that the nutrients are caught by the tree roots before it rains. Otherwise nutrients are lost when they are washed down the soil profile. This is called leaching.



Source 1



Source 2

How a rainforest reduces carbon dioxide gas... How a cleared rainforest can cause environmental damage

QUESTIONS

1. Describe the rainforest ecosystem.

2. Why are rainforests important?

3. Source work: Analysing the diagrams.

a) Explain how a rainforest is able to reduce carbon dioxide and produce oxygen.

b) Describe what happens to the rainfall absorbed by a rainforest.

c) What do CO₂ and O₂ stand for?

d) What happens to carbon dioxide levels in the atmosphere when rainforests are cut down and burned?

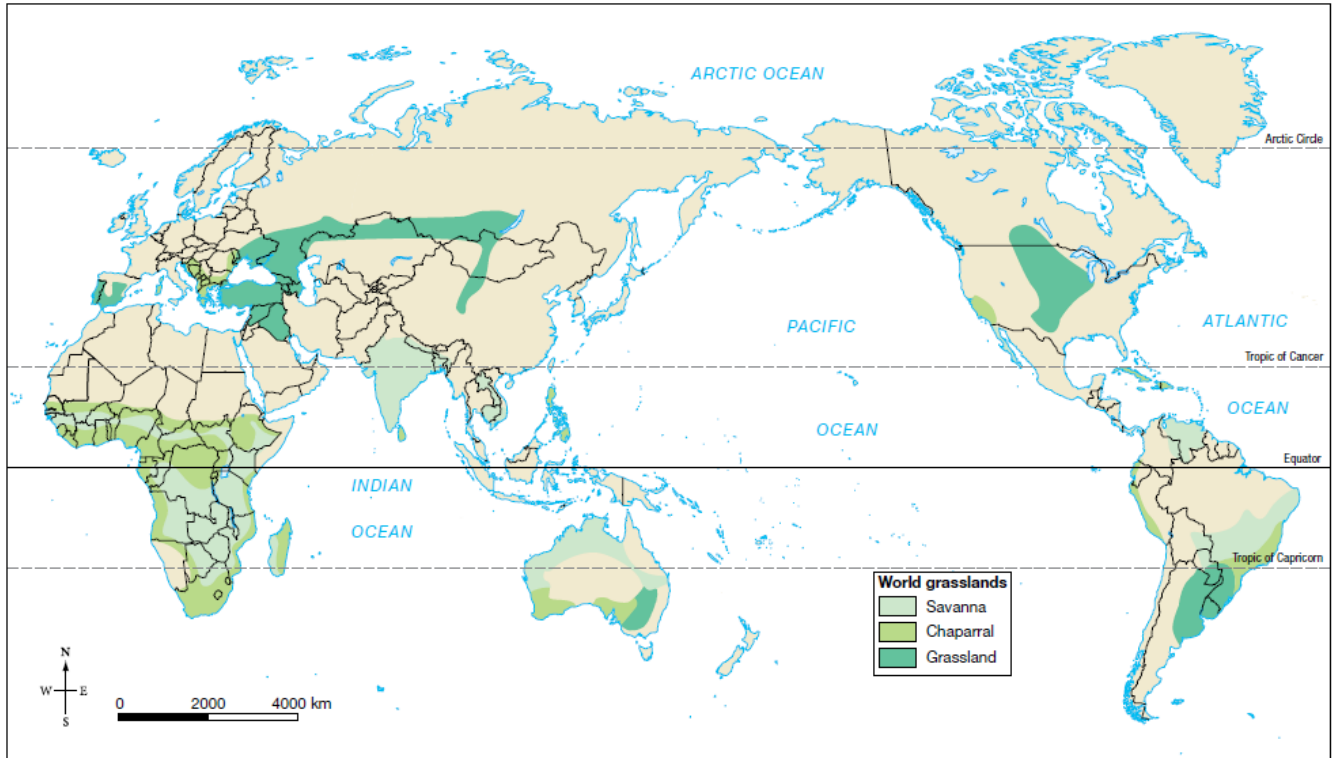
e) Describe what happens to rainfall when a rainforest is cut down.

f) Explain, in your own words, some of the benefits that rainforests provide to our environment.

GRASSLAND BIOME

Characteristics of the grassland biome

Grassland, pampas, savanna, chaparral, cerrado, prairie, rangeland and steppe all refer to a landscape that is dominated by grass. Once, grasslands occupied about 42 per cent of the Earth's land surface, but today they make up about 25 per cent of its land area. Grasslands are found on every continent except Antarctica (see source 1).



Source: Spatial Vision

Source 1: Grasslands occupy about a quarter of the Earth's land's surface

Question 1: Source analysis: Look at source 1 and answer the questions below

a) Which continent has the largest distribution of grassland biomes?

b) Which states in Australia has the grassland biome?

c) Explain why the regions in yellow do not contain the grassland, savanna or chaparral biomes?

The grassland biome, as the name suggests, is dominated by grasses, and generally has few or no trees. Grasslands develop in places where there is not enough rain to support a forest but too much rain for a desert; for this reason they are sometimes referred to as a transitional landscape.



Question 2: Define grassland.

Grasslands are found in both temperate and tropical areas where rainfall is between 250 mm and 900 mm per year. In tropical regions, grasslands tend to have a distinct wet and dry season.

In temperate regions, the summers tend to be hot and the winters cool. Generally, grasslands in the southern hemisphere receive more rainfall.

Question 3: Describe the global distribution of grasslands.

Grasslands are also one of the most endangered environments and are susceptible to desertification. The entire ecosystem depends on its grasses and their annual regeneration. It is almost impossible to re-establish a grassland ecosystem once desert has taken over. Grasslands often depend on fire to germinate their seeds and generate new plant growth. Indigenous populations, such as Australian Aboriginal peoples, used this technique to flush out any wildlife that was hidden by long grass.



Grasslands can occur naturally or as a result of human activity. The presence of large numbers of grazing animals and frequent fires prevent the growth of tree seedlings and promote the spread of grasses. Unlike other plant species, grasses can continue to grow even when they are continually grazed by animals, because their growth points are low, close to

the soil. Because grasses are fast growing plants, they can support a high density of grazing animals, and they regenerate quickly after fire.

Some grasses can be up to two metres in height, with roots extending up to a metre below the soil.

Grasslands are the most useful biome for agriculture because the soils are generally deep and fertile. They are ideally suited for growing crops or creating pasture for grazing animals. The prairies of North America, for example, are one of the richest agricultural regions on Earth.

Question 4: Outline why grasslands are an important environment.

Almost one billion people depend on grasslands for their livelihood or as a food source. Grasslands have been used for livestock grazing and are increasingly under pressure from urbanisation. Grasslands have also become popular tourist destinations, because people flock to them to see majestic herds such as wildebeest, caribou and zebra, as well as the migratory birds that periodically inhabit these environments.

All the major food grains — corn, wheat, oats, barley, millet, rye and sorghum — have their origins in the grassland biome. Wild varieties of these grains are used to help keep cultivated strains disease free. Many native grass species have been used to treat diseases including HIV and cancer. Others have proven to have properties for treating headaches and toothache.



Grasslands are also the source of a variety of plants whose fibres can be woven into clothing. The best known and most widely used fibre is cotton. Harvested from the cottonseed, it is used to produce yarn that is then knitted or sewn to make clothing. Lesser known fibres include flax and hemp. Harvested from the stalk of the plant, both fibres are much sturdier and more rigid than cotton but can be

woven to produce fabric. Hemp in particular is highly absorbent and has UV blocking qualities.

Question 5: What type of resources does the grassland biome provide humans?

In Australia today, less than one per cent of native grasslands survive, and they are now considered one of the most threatened Australian habitats. Since European settlement, most native grassland has been removed or changed by farming and other development. Vast areas of grassland were cleared for crops, and introduced grasses were planted for grazing animals, such as sheep and cattle.

Question 6: Describe the major threats to this environment.

Question 7: Explain why grassland biomes are referred to as ‘transitional landscapes’? (Hint: transitional landscapes means that it changes).

Question 8: Explain why so little of Australia’s grassland biome remains.

IMPACT OF THE CLIMATE, SOILS AND VEGETATION OF A BIOME ON ITS PRODUCTIVITY

Rainforest biomes

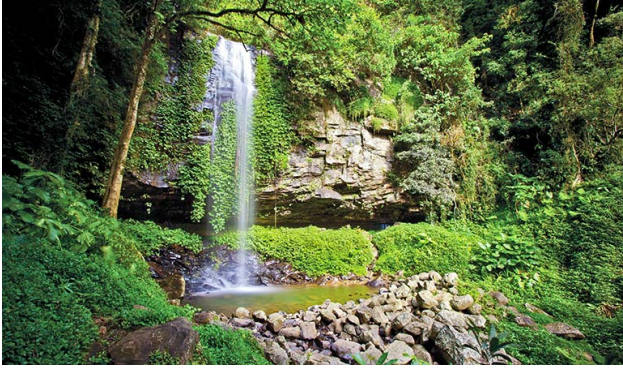
In rainforests, one major impact of the climate is the relationship between plants, animals and the soil. Rainforests are among the most magnificent expressions of life on Earth. The profusion of plant life and the size of the forest – in terms of height and area – have led people to believe that this biome grows on very fertile soils. What else could account for the prolific growth?

Question 1: Describe what is meant by the term ‘prolific growth’ in a rainforest?

However, in many rainforest areas the soil was not originally fertile. Over time, the rainforest converts the soil on which it grows into fertile soil that will support its growth. Rainforests expand their area by converting the soils around their edges into soils suitable for this growth. Rainforests are not the only plant communities that change the nature of the soil they grow on, but they are the best at this process. How does a plant community change a soil type?

Question 2: How do rainforests develop fertile soils?

When you see a fallen tree, one of the things you may notice is how shallow the root system is. The root system which supports and nourishes the tree may be only a few centimetres deep. Only in certain areas do trees have very deep root systems.



Similarly, for crops at your home or on a farm with shallow root systems, the size of the area and the type of soil don't matter. Around the time of planting, three things occur:

- The soil is turned over to aerate it.
- Water is added.
- Fertilisers are added.

The rainforest does all this by itself

- The soil is turned over by the developing root systems, and by the animals which inhabit the soil, such as worms.
- The 'drip-tipped' leaves ensure that water reaches the ground.
- Fertiliser is added. Rainforests create their own fertiliser: a deep layer of what is known as 'humus' is created by fallen branches, leaves and eventually the rest of the trees. These decay rapidly in the moist, humid environment and provide the plant food necessary to sustain the life of the forest. Fertiliser is thus provided for the whole rainforest system, including the epiphytes and parasites.

Savanna biomes

The main characteristic of the climate that has created the savanna vegetation pattern is seasonal change. In savanna areas, the climate changes from hot and wet to hot and dry. The hot and wet season brings an explosion of plant growth, especially grasses, to the savanna. This vegetation change has a major impact on the animal life of this biome.

Question 3: Describe the climate in savanna biomes and the impact this may have on animal life.

There are many special adaptations that plants have developed to survive in this environment. These include:

- Plants' canopies have a spreading shape, to shade the root layer.
- Many plants have developed thorns and prickles to prevent animals eating the vegetation.
- Some plants have developed tissues that retain a supply of water they can use during the dry season.

These are not the only adaptations associated with this landscape, but they are the ones that help make it a distinctive biome.



Question 4: List some plant adaptations in savannas.

Alpine biomes

There are two climatic factors that affect alpine biomes. Firstly, many mountain ranges are close to the coast. They block rain-bearing winds that move onto land from the sea and force these winds to rise. As the winds rise, the air cools and water condenses out of the air to form clouds. This often results in heavy rainfall, known as orographic rainfall. This can produce biomes associated with high rainfall, particularly rainforests, on the coastal sides of the mountains. The inland slopes of the mountains often receive little rainfall, so very different biomes, such as savanna and desert, may be found on these slopes. These areas are said to be in a 'rain shadow'.

Question 5: What is the impact of 'orographic rainfall'?

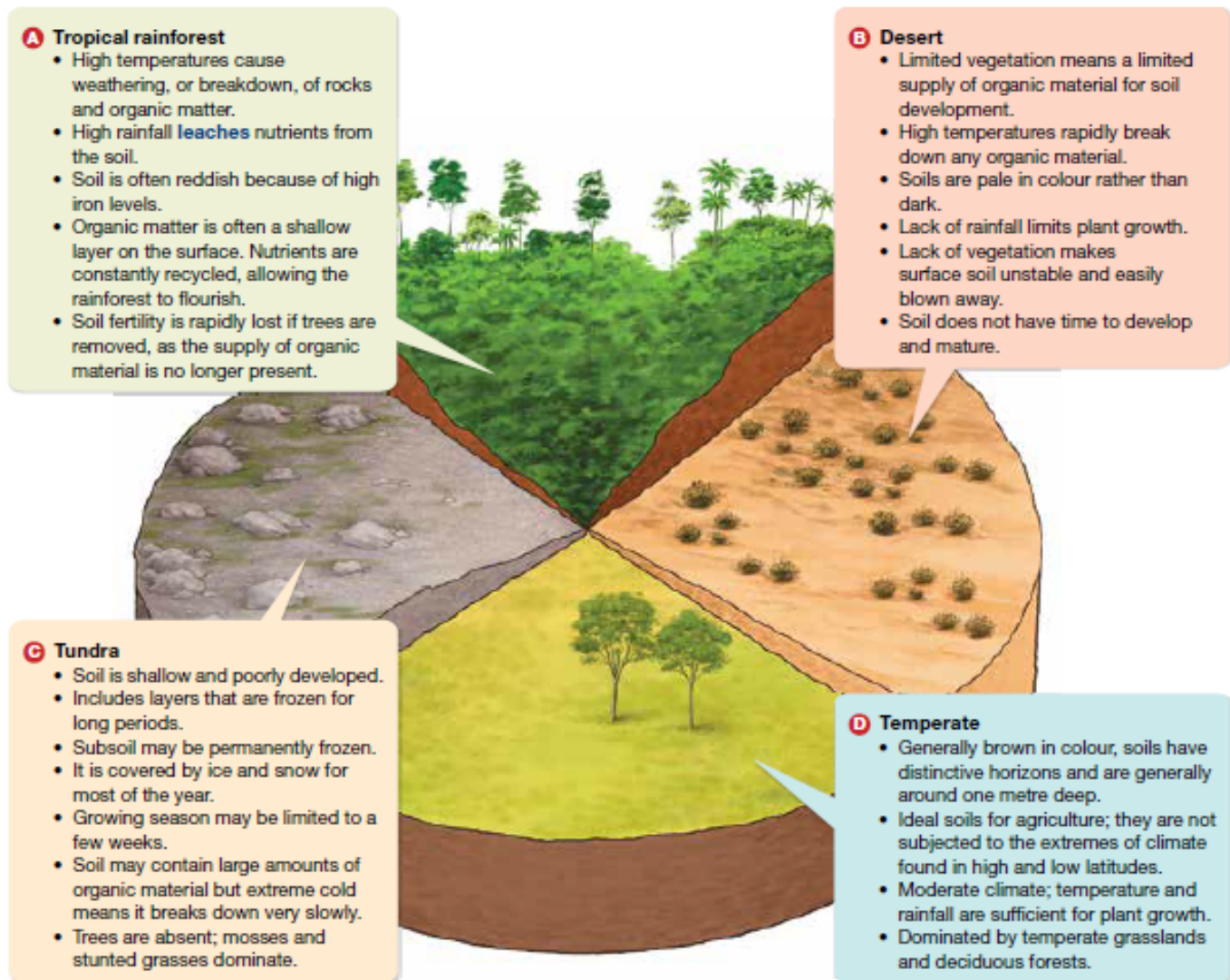
Question 6: What is the 'rain shadow' effect?

The other factor that makes mountain biomes so complex is the impact of the sun's rays as they warm the land. Mountain slopes that receive direct heat from the sun lose their snow cover quickly. Mountain slopes that do not are cooler, and have a slightly different vegetation pattern. This warming effect is known as aspect. It affects mountain biomes closer to the Poles most: some slopes only receive sunlight for a few months of the year.

Overall, factors such as climate, soil and vegetation types have a great influence on the productivity of a biome. An alpine biome, for instance, would not be best suited to the human need to produce food, industrial materials or fibres due to climatic conditions and their effect on soil and vegetation.



FIGURE 7 Different biomes have different soil and vegetation characteristics.



Question 7: Task description: Look at figure 7 and answer the following questions.

a. Define the term ‘Agricultural production’.

b. Which biome would be most suited for agricultural production and why?
