

**Lesson
Five****How does Climate affect
what lives and grows there?****Aims**

In this lesson we are going to learn:

- what an ecosystem is and how a biome differs from it
- to establish the link between the plants and animals that live in an area and the climate zone they exist in
- how various plants and animals can manage to thrive in different ecosystems.

Context

Drawing this module to a close, the link between the living things that exist in an environment, and the conditions that have evolved there, is established, with a particular emphasis on the role climate plays.



Oxford Home Schooling

Introduction

An **ecosystem** is a community of living organisms (plants and animals) sharing an environment, that is, with similar climate, landscape and location. The largest ecosystems are called **biomes**. There are about a dozen of these altogether, but just in the same way as we only picked out a selection of climate zones, we will only pick out a few biomes, and it might be helpful to mention that they cover a similar area to the climate zones we looked at last time.

In order to prosper over time, the living organisms must change or **adapt** to the environment as it develops over millions of years. Part of exploring the relationship between climate zones and the biomes that grow up within them is to look at the ways in which adaptation has permitted different plants and animals to exploit what is available.

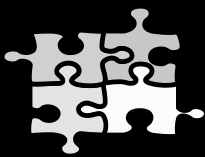


Log on to Twig and look at the film titled **Adaptation**

www.ool.co.uk/1125cg

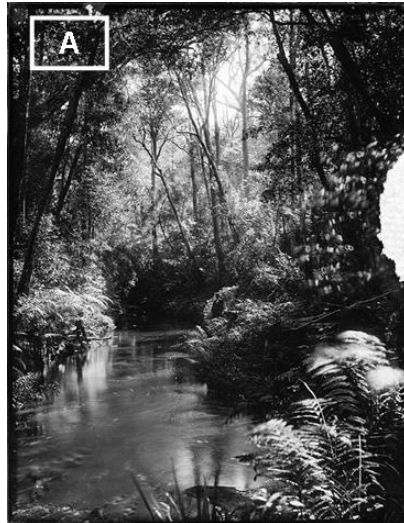
This film introduces examples of physical and behavioural adaptations which allow plants and animals to survive in different biomes.

Something to think about

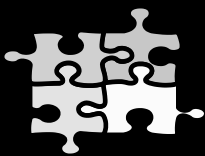


Make notes on the examples of adaptations to the environment in the film, together with any others that interest in the rest of the lesson.

Look at the two illustrations below, (A) and (B). Try not to look below the 'something to think about' box when you attempt to work out the answers to the questions.



Something to think about



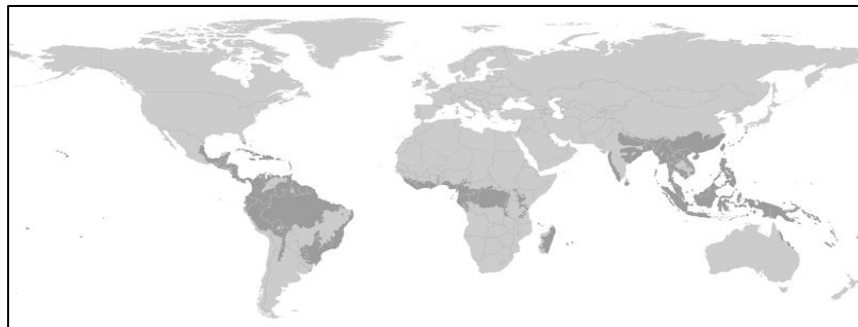
- (a) What feature is shared by (A) and (B)?
- (b) Why are there two different pictures for (B) but only one for (A)?
- (c) How might their climates be similar to each other?
- (d) How might their climates be different?
- (e) Where do you think the pictures may have been taken?

The puzzle is solved!

Picture (A) was taken in the rainforest and Picture (B) was taken in deciduous woods.

The rainforest in more detail

The largest rainforests are in Brazil (South America), Zaire (Africa) and Indonesia (South East Asia). Other equatorial rainforest places are in Hawaii and the islands of the Pacific & Caribbean.

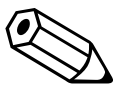


What is the climate of the rainforest like?

The rainforests are located around the equator where temperatures are hot all year. Rainforests often receive over 2000 mm of precipitation each year.

Activity 1

Refer back to Lesson Four to find the answers to these.



- (a) If the rainforest is 'hot' all year, what is the range of temperature?
- (b) If the rainfall is over 2000mm per year, what phrase describes that amount?
- (c) Comparing the map with the map of climate zones in the last lesson, what climate zone most closely matches the rainforest?

The living things in the rainforest

The rainforest is earth's most complex biome in terms of both structure and **species diversity** (the number of different plants and animals found there). It is mostly because there is a constant supply of water and it is always warm, so plants grow very rapidly and the animals in consequence have plenty to eat.

The plant distribution is not dissimilar to the centre of a city, lots of levels, all working at the same time, each with their own special role. It is because of this tight-packed plant life that so many different plants and animals can exist in one place. Rainforests cover only 6% of the Earth's surface, yet they contain more than 50% of the world's plant and animal species!

In order for so many plants and animals to exist together, each has special adaptations to permit this.

Investigate!



Use the internet or books, to find out about some of the plants and animals that live in the rainforest.

You could try

<http://www.srl.caltech.edu/personnel/krubal/rainforest/Edit560s6/www/plants.html>

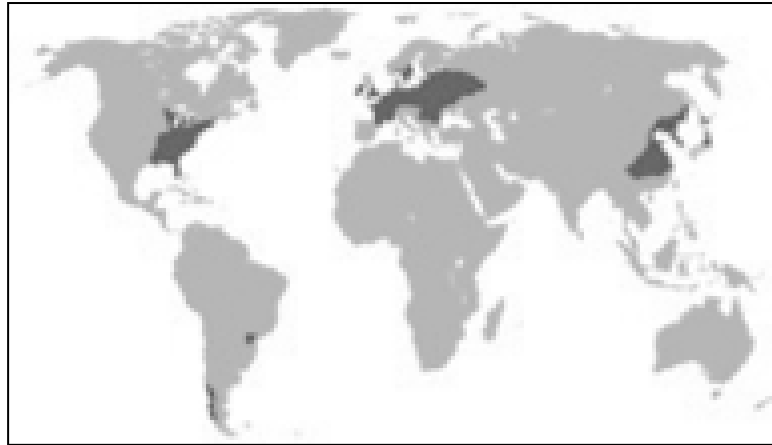
Or

<http://www.srl.caltech.edu/personnel/krubal/rainforest/Edit560s6/www/animals.html>

Not only are there a lot of plants in the rainforest but many of them are very useful to us, having already provided us with many remedies for human illnesses, after a search of only a small fraction of what is available.

The deciduous woodlands in more detail

Deciduous forests used to be found in the eastern half of North America, and the western part of Europe. There were many deciduous forests in Asia. But a lot of deciduous forests have lost land to farms and towns. The animals are losing their habitats, the place where they can exist, because of people building their homes.



One of the key differences between a deciduous forest and a rainforest is that deciduous forests have four distinct seasons, spring, summer, autumn, and winter. From early spring and throughout the summer, the trees are covered in flat green leaves, taking in sunlight to enable photosynthesis to take place. In the autumn the leaves change colour and then the trees lose their leaves. During winter their branches are bare until spring when buds grow and open out with new leaves.

Why might they do this? By losing their leaves in autumn, deciduous trees conserve water (since no evapotranspiration can take place), they survive snowfall better than evergreens who often suffer broken branches, and also their precious resources are not eaten by insects and woodland animals. Once the sun gets higher in sky and the days are longer, their new leaves arrive and they can photosynthesise effectively.

The animals that live there need to adapt to the climate by sleeping more, like squirrels, or by hibernating in the winter and living off the land in the other three seasons. The animals have adapted to the land, finding which foods provide the most nutrition from within the woodland. The trees also provide shelter for them. Animals use the trees for food and a water sources. Most of the animals are camouflaged to look like the ground or vegetation.

Activity 2

Refer back to Lesson Four to find the answers to these.



- (a) Comparing the map with the map of climate zones in the last lesson, what climate zone most closely matches the deciduous woodland?
- (b) What is the rainfall pattern associated with the climate zone you have identified?

Rainfall and plant type:

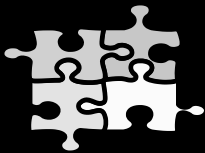
Trees growing in forests need water throughout the year as, being big plants, they live for many years and they need a lot of water to complete the process of photosynthesis. This is why you will not get dense forests without year-round precipitation. A tree here and there in grassland can survive well enough with seasonal rainfall. With little competition from other trees nearby, their long roots can spread and go deep into the soil to find enough water even in the dry season.

Two more places to think about





Something to think about



- (a) What feature is shared by (C) and (D)?
- (b) Why are there two different pictures for (C) but only one for (D), do you think?
- (c) How might their climates be similar to each other?
- (d) How might their climates be different?
- (e) Where do you think the pictures may have been taken?

The biome in (C) is called the Savannah and that in (D) is a desert.

The savannah in more detail

Savannah grasslands are found between tropical rainforests and desert. This includes areas such as Central Africa (Kenya), Australia, parts of Southern Asia and the North and East of South America (Brazil).



A savannah is rolling grassland scattered with shrubs and isolated trees, as not enough rain falls on it to support forests. Savannahs are also known as tropical grasslands. They are found in a wide band on either side of the equator on the edges of equatorial rainforests.

Activity 3

Refer back to Lesson Four to find the answers to these.



(a) Comparing the map of the savannah with the map of climate zones in the last lesson, what climate zone most closely matches the savannah?

(b) What is the rainfall pattern associated with the climate zone you have identified?

There are several different types of savannahs around the world. The savannahs we are most familiar with are the East African savannah which is covered with acacia trees. The Serengeti Plains of Tanzania are some of the most well known. Here animals like lions, zebras, elephants, and giraffes and many types of ungulates (animals with hooves) graze and hunt. Many large grass-eating mammals (herbivores) can survive here because they can move around and eat the plentiful grasses. There are also lots of carnivores (meat-eaters) who eat them in turn.

Brazil's *cerrado* is an open woodland of short twisted trees. The diversity of animals is very great here, with several plants and animals that don't exist anywhere else on earth.

There is also a savannah in northern Australia. Eucalyptus trees take the place of acacias in the Australian savannah.

There are many species of kangaroos in this savannah but not too much diversity of different animals, as sheep and cattle range over much of it now.

Plants of the savannahs are highly specialized in order to grow in this environment with long periods of drought. Many have long tap roots that can reach the deep water table, thick bark to resist annual fires, trunks that can store water, and leaves that drop off during the dry winter to conserve water. Many plants of the savannah also have storage organs like bulbs and corms for making it through the dry season.

Most of the animals on the savannah have long legs or wings to be able to go on long migrations. Many burrow underground to avoid the heat or raise their young. The savannah is a perfect place for birds of prey like hawks and buzzards. The wide, open plain provides them with a clear view of their prey and there is the occasional tree to rest on or nest in.

Animals don't sweat to lose body heat, so they lose it through panting or through large areas of exposed skin, such as ears, like those of the elephant. There are over 40 different species of hoofed mammals that live on the savannahs of Africa. Browsers (those who eat leaves of trees) and grazers, grass-eaters, can coexist in one area. They do this by having their own food preferences, browsing/grazing at different heights, times of day or year in a given area, and different places to go during the dry season.

The desert in more detail

Deserts are mainly found around the Tropics of Cancer and Capricorn. (23.5 deg N and S). The largest deserts are in Africa, Saudi Arabia and central Asia, but there other smaller ones in Chile, the western parts of the United States and Australia.



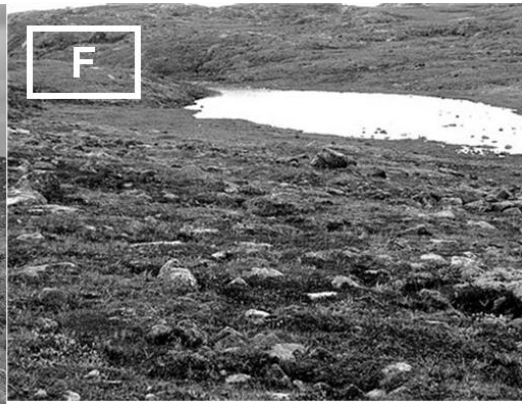
Finding the climate zone for this biome is unnecessary, as they both share the same name! However, please note that the desert biome is more widespread than the climate zone, although the general climate pattern follows for all the relevant areas; the only difference is that the deserts of Central Asia tend to have cooler temperatures, especially in the winter season.

Remember that the pattern of rainfall is of the 'very dry' variety and there is quite a wide range of temperature with two seasons based entirely on temperature difference. As there is so little rain, the sky is clear most of the time. This means that the sun warms up the sand and rock very quickly during the day, but equally they cool down once the sun has set and the heat is lost right out into space. This means the temperature range over each 24-hour period is high or, to use the technical term, the **diurnal range** is high. The sun can warm the sand in the day so that it is at least 'hot', while close to dawn, so much heat can have been lost that it is close to or below freezing.

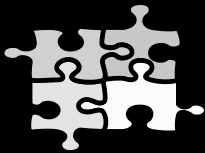
Most deserts do not have a great variety of plants. Those plants that do grow there are mostly ground-hugging shrubs and short woody trees. Examples of these kinds of plant are Turpentine Bush, Prickly Pears, and Brittle Bush. Some of the adaptations in this case are the ability to store water for long periods of time and the ability to stand the hot weather.

In many parts, the only animals that can survive have the ability to burrow underground. This is because they would not be able to live in the hot sun and heat and, in consequence, are nocturnal, as they only come out during the night when it is a little cooler. As there are few plants, the majority of animals are meat-eaters or carnivores.

The last pair of places to consider



Something to think about



(a) What are the last two climate zones we have left?

(b) Which of these two is E and which F?

E is known as the chaparral (US) or maquis (Europe) while F is called the Tundra.

The Tundra in more detail

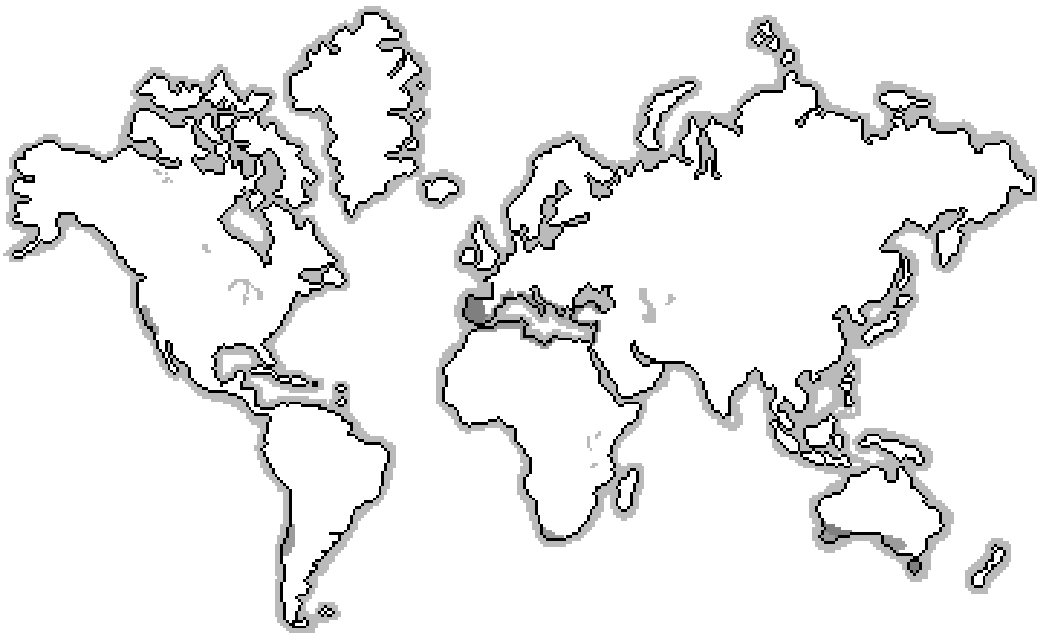


The arctic tundra occupies earth's Northern hemisphere, circling the North Pole all the way down to the evergreen forests of the boreal biomes. (Were you right about the climate zone of F?). The arctic tundra sees little rainfall. The soil is poor in nutrients, which accounts for the low amount of vegetation. There is an under-layer of soil called permafrost which remains completely frozen at all times, allowing little room for deep rooting plants and trees.

The plants that do survive the frozen landscapes are extremely resilient, and their roots are close to the surface of the hard soil, to absorb what little water falls upon the ground; most of the arctic tundra's plant life consists of shrubbery, lichen, moss, and flowers. Icy rivers flow through the tundra to the Arctic Ocean, and are home to trout, salmon and other freshwater fish. Sometimes rainfall produces small, temporary ponds, which serve as mating areas for flies and mosquitoes.

Other animal species occupying the tundra consist of polar bears, caribou, musk ox, grey wolves, lemmings, rabbits, squirrels, and birds such as penguins, falcons, ravens, terns, and loons. All are greatly adapted to their environment, with extra layers of fat, and the animals have the ability to hibernate during the colder months, although this has more to do with the lack of food than the cold. Birds of the tundra migrate south during the winter months, causing constant change in the animal population.

The chaparral or maquis in detail



The chaparral biome is found in a small part of most of the continents – the west coast of the United States, the west coast of South America, the Cape Town area of South Africa, the western tip of Australia and the coastal areas of the Mediterranean.

The chaparral biome has many different types of terrain. Some examples are flat plains, rocky hills and mountain slopes. It is sometimes used in movies for the 'Wild West'. Chaparral is characterized as being hot and dry, especially in the summer. The winter is very mild and is usually about 10°C.

Fortunately, the plants and animals are adapted to these conditions. Most of the plants have small, hard leaves which hold moisture. Aromatic plants and herbs, such as rosemary, thyme, sage, and oregano do well in this biome. These aromatics do contain highly flammable oils which could contribute to forest fires. Cactus is common in many chaparral areas.

Many of the shrubs have lots of flowers, and so it is a great place to see butterflies and other insects. The shelter provided by the dense thicket of shrubs makes it an ideal place for snakes and lizards although you are unlikely to see them as they keep undercover. Birds are many and varied as they can arrive when there is plenty of food, such as winter and spring, then leave for a less hostile environment during the summer heat. Other forms of wildlife include wild goats, sheep, cattle, and horses. The land supports lynx, wild boar, rabbits, vultures and eagles. These areas are often used by local people for grazing goats, sheep, cattle, donkeys, and horses on this rugged land. The chaparral of Spain is known for the breeding of the famous bullfighting bulls.

Animals have adapted to this sparse and rough terrain by becoming agile climbers, foraging over larger areas, and varying their diet to include the often scrubby brush. Plants have adapted by storing water with thick bark or waxy coverings, and by growing thorns to prevent animals from eating them. Adaptations also include regeneration after fire.

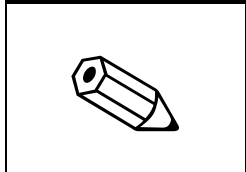
People have adapted by grazing herds over large areas, even tying them to the roadsides to make the most of the roadside vegetation. Herding them from area to area maintains adequate feeding grounds for their herds.



Log on to Twig and look at the film titled **What is an Ecosystem?**
www.ool.co.uk/1213dg
 Review what an ecosystem is and how this relates to the different biomes, some of which we have explored and others in less detail.

Activity 4

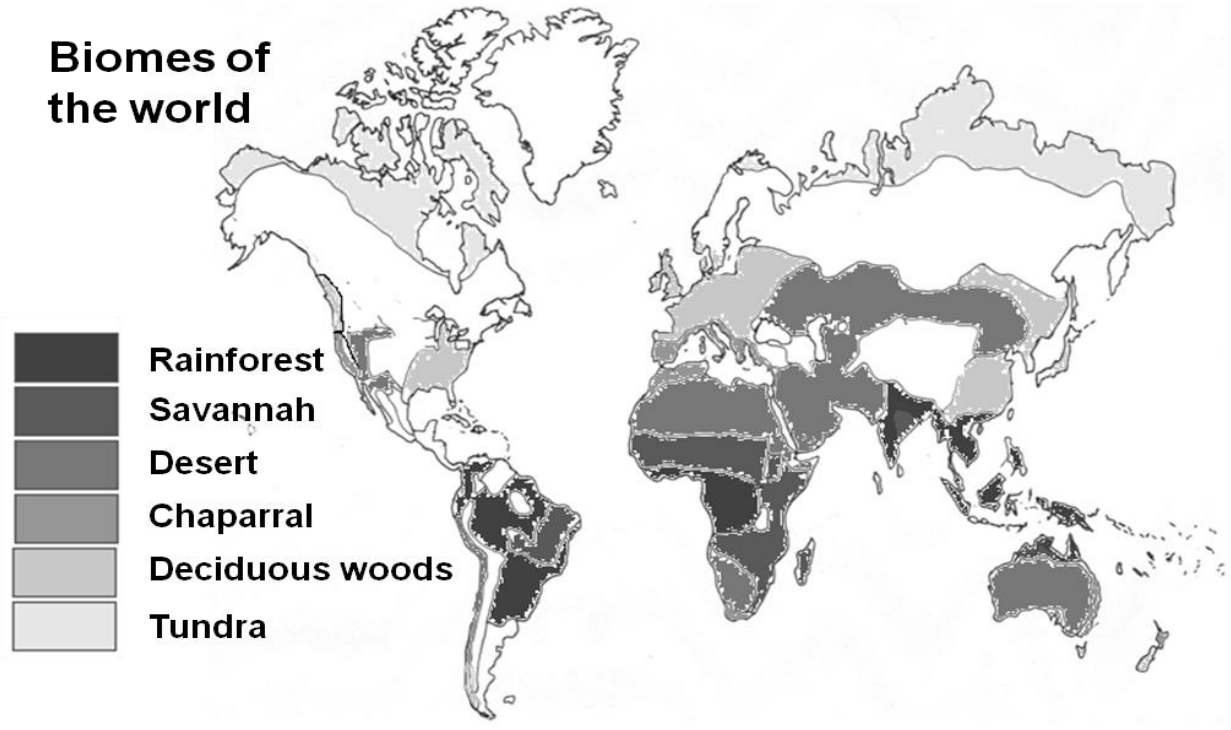
Look back through the lesson to join the plants and animals to the climate zone and the climate zone to the biome!



Plants/animals	Climate Zone	Biome
Trees that lose their leaves in Autumn	Polar	Desert
Drought resistant shrubs together with wild sheep and goats	Temperate Maritime	Rainforest
Grass with some trees, herds of ungulates, lions.	Equatorial	Tundra
A few shrubs with few animals, mostly nocturnal	Tropical Wet and	Deciduous woodland
Contains more plants and animal species than anywhere else	Desert	Chaparral
Low growing plants, few trees and animals that hibernate in winter	Mediterranean	Savannah

In conclusion:

All the pieces of our jigsaw put together!



If you find it hard to distinguish between the levels of grey in this diagram, please refer back to the relevant passages on each biome.