



IN THE KNOW

Climate, Biomes and Vegetation Belts Simon Collis

Accurate and reliable background information to underpin your geography lessons

Introduction

Teachers talk about weather from the beginning of the primary years. However, understanding the relationship between weather and climate and how they affect the habitats of different animals and plants is a complex geographical skill. It is especially important to consider how climate and habitat are interlinked as human effects on climate become apparent. The information here will give you a firm basis for teaching about climate, biomes and different vegetation, and for tackling the kinds of questions that pupils may raise.

Key terminology

Weather reports, mobile phone apps, news reports, opinion pieces in newspapers or on social media – sometimes familiarity with geographical terms can obscure their meaning. An important starting point is to have a secure understanding of these key terms: weather, climate, climate zones and biomes.

Weather

Weather can be defined as how the atmosphere behaves and affects human activities on a short-term basis. This could include either data for, or a description of, temperature, precipitation, cloud cover, wind or atmospheric pressure (NASA, 2005). If you compare the amount of snow you experienced two winters ago with that of winter this year you are thinking about changes in weather.

Climate

Climate is the average of weather conditions in a location over a 30-year period. This could be expressed as average precipitation, temperature, humidity etc. Climate is affected by latitude, distance from the Equator, altitude and terrain. Climate change refers to trends over considerably longer periods of time.

Climate zones

Areas of the world with similar climates can be grouped and mapped into climate zones. These zones have climatic characteristics in common, e.g. temperature or precipitation patterns, although they may not be geographically close to one another.

Biomes

Biomes are large regions of the world with places that share a similar climate, and are home to similar vegetation and animals that have adapted to live in those conditions.

Vegetation belts

Vegetation belts (also known as vegetation zones) are large regions of the world that are home to certain plant species on account of the climatic conditions found there.

Sunlight and the shape of Earth

The sun's rays are not evenly distributed across the globe. Near the Equator, incoming solar radiation is concentrated over a smaller surface area leading to hotter climates. At higher latitudes, towards the poles, solar radiation is spread over a larger area, leading to cooler climates.

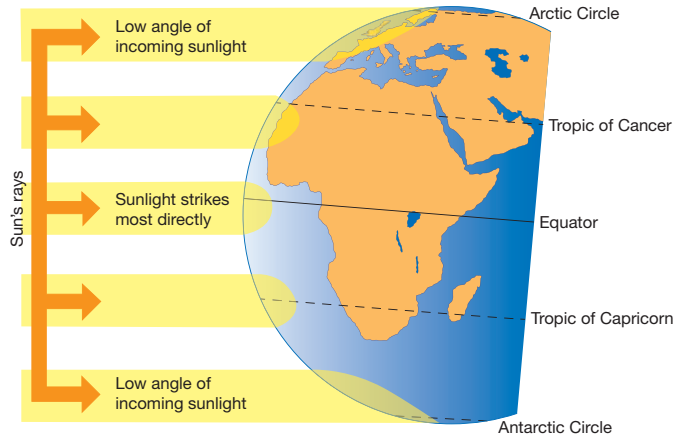


Figure 1: *Climates are hottest near the Equator, where the sun's rays are most concentrated, and coolest towards the poles, where the sun's rays are less concentrated as they are spread over a larger area.*

This can be demonstrated by shining a torch at a spherical object, to show how light is distributed differently at the circumference than at the poles (Figure 1).

Climate zones

As climate zones divide the world into areas with similar patterns of average temperature and precipitation, exploring a climate zone map is quite different from a map showing countries or altitude – it creates different boundaries that may seem unfamiliar or difficult to link to known locations (Figure 2).

Equatorial climate

The sun's heat is most concentrated around the Equator, between the Tropics of Cancer and Capricorn. An equatorial climate is characterised by consistent temperatures (around 25–35°C), heavy rainfall (between 100–200mm/month) and high humidity (the amount of water vapour in the air). All of the world's tropical rainforests are in equatorial climates.

Tropical climate

Tropical climate has two very different seasons: hot summers with heavy rainfall (150–200mm/month) and a dry and very hot (temperatures over 30°C) winter. This climate favours the growth of savannah: grassland with scattered trees and shrubs.

Hot desert climate

Deserts are found in areas of near-permanent high pressure that rarely produce rain. Not all deserts are hot – Antarctica is an example of a polar desert. Areas of hot desert are located in the lower latitudes, centred on the Tropics of Cancer and Capricorn. The temperature range is very wide, with high temperatures during the day and very low temperatures at night.

Temperate climate

Temperate climate is found in a range of mid-level latitudes with variable temperature and rainfall. These areas have four distinct seasons. Temperatures may fall below freezing in winter

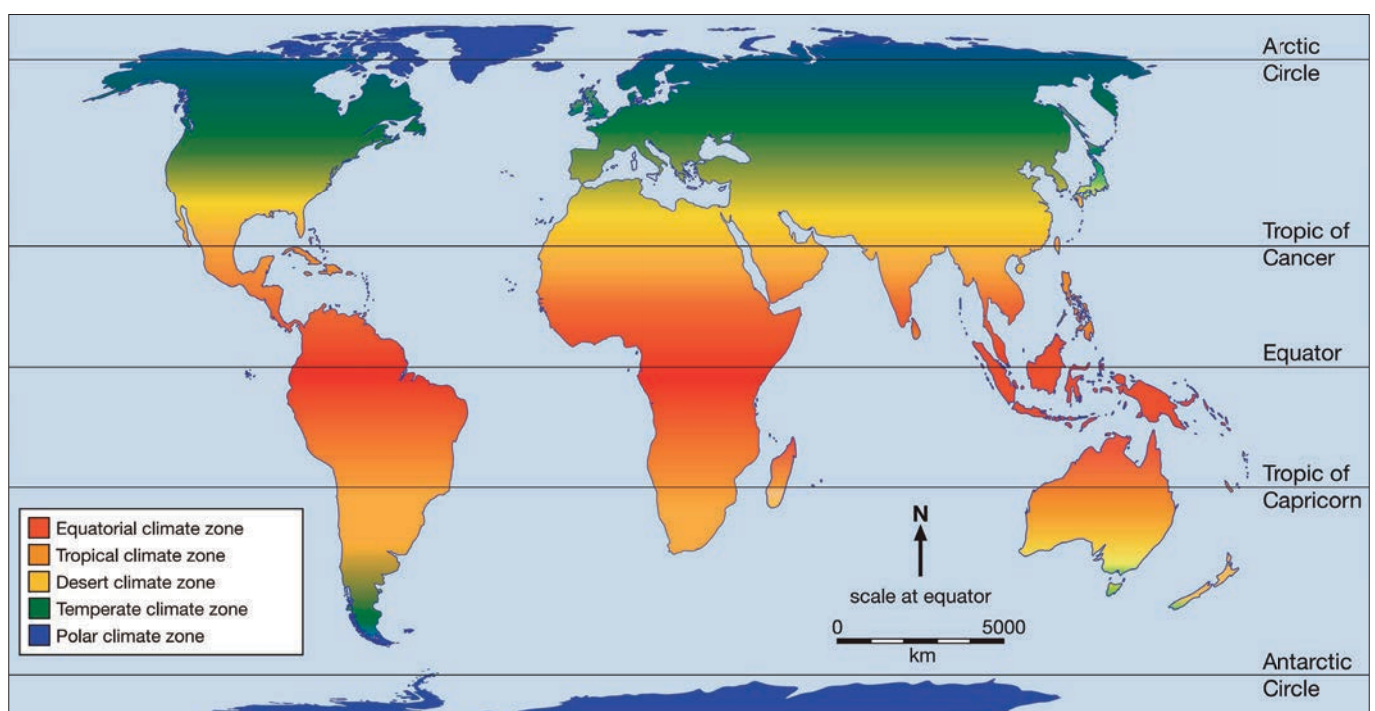


Figure 2: *Areas of the world with similar climates can be mapped as climate zones.*

and rise to over 20°C in summer. Rainfall is moderate, typically under 50mm/month.

Arctic and polar climates

The sun's heat is least concentrated in polar regions, making these the coldest places on Earth. They are also very dry. They have short wet summers, with temperatures from 1-10°C. The Arctic, because of the influence of the warmer Atlantic Ocean, is less cold than Antarctica, where temperatures can drop as low as -80°C.

Biomes

There have been many attempts to classify different biomes; definitions and boundaries have been modified over time. The classifications below are suitable for teaching at primary school level and broadly complement the climate zones (Figure 3). An exploration of biomes will demonstrate the diversity of Earth's flora and fauna (Figure 4, overleaf).

Tropical rainforests biome

Tropical rainforests are found in the equatorial climate zone. They consist of broad layers (emergent, main canopy, understorey and forest floor) with different flora and fauna in each layer, and are dominated by broad-leaved trees that form a dense canopy. Characteristic features of rainforest plants include 'drip tips' to help them shed water from the daily downpours, and

'buttress roots' to support the tallest trees. Animals found in tropical rainforests include jaguars, pumas, monkeys, frogs, butterflies, snakes and exotic birds. Tropical rainforests are located in the Amazon region in South America, the Congo basin in West Africa and Southeast Asia. Threats to this biome include deforestation and habitat destruction, leading to leaching of the rainforest soils.

FACT Equatorial rainforests are the world's most diverse biome, home to over half of plant and animal species. They also absorb more than fifty per cent of all atmospheric carbon dioxide each year.

Savannah biome

Savannahs are found in the tropical climate zone and are characterised by tall grasses and scattered trees and shrubs. Savannahs can be seen as a geographical transition between tropical rainforests and higher latitude deserts. Grasses and trees have long roots to keep them anchored in poor soils and help them obtain as much moisture from the soil as possible. Animals found in savannahs include large grazing mammals such as elephants, large carnivores including the lion, and small invertebrates such as grasshoppers and termites. Locations include Venezuela, Colombia, Zambia and Australia. Threats to this biome include desertification due to lengthening dry seasons, too little rain, and ranching/wheat farming.

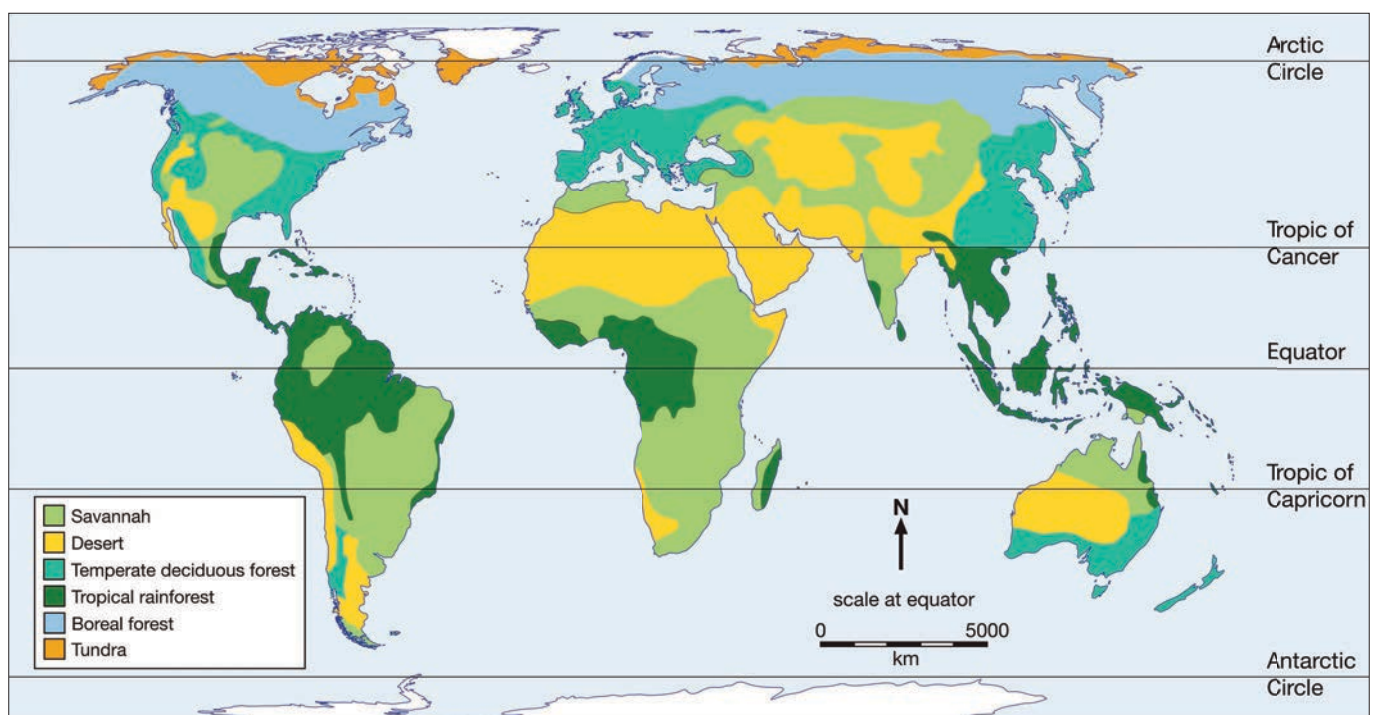


Figure 3: A simple map of world biomes clearly shows the correlation with climate zones.

Hot desert biome

Hot deserts are based in the desert climate zone. The arid environment means they are characterised by extremely sparse vegetation. Desert plants have tough leathery leaves to help them conserve water and spines to protect them from being eaten. Animals found in hot deserts include reptiles such as lizards and snakes, mammals such as camels and rabbits, and desert birds such as finches and vultures. Some desert animals are nocturnal and live much of their life

underground. Hot deserts include the Sahara, Gobi, Namib, Kalahari, Atacama and Australian deserts. Threats to this biome include human activities such as mining, damage from off-road vehicles and tourists digging up cacti for souvenirs,

Temperate deciduous forest biome

Temperate deciduous forests are found in the temperate climate zone, in eastern North America and most of Europe, China and Japan. They are characterised by broad-leaved deciduous trees or



Figure 4: The world's biomes are home to a diverse range of plants and animals.

Photos:

Desert landscape © Christopher Michel, Desert snake © Erik Wilde



Savannah acacia trees © Güldem Üstün, Savannah ibis © Lip Kee Yap



Temperate forest autumn © Nicholas A Tonelli, Temperate deer © Anna Grandfield



Tropical forest © Jar [0], Tropical red eyed tree frog © Swallowtail Garden Seeds



Tundra © Anna Grandfield, Tundra puffin © Theo Crazzolara.

mixed deciduous and evergreen forests. Deciduous trees lose their leaves during winter, and the resulting leaf litter produces a rich supply of humus for smaller plants and fungi. Deciduous forests provide habitats for nesting birds and smaller mammals such as bats and squirrels, predators such as foxes and badgers, and insects, such as centipedes and beetles that live in the leaf litter. Human activity – clearing the forests for farming, fuel or building materials – has caused significant damage to modern temperate forests. Threats to this biome include continuing clearance for farming, housing and road/rail links.

Boreal forest biome

Apart from the oceans, boreal forest is the world's largest biome. Boreal forests are found in northern latitudes between tundra and temperate forests, where the temperate climate zone gives way to arctic and polar climates, characterised by long winters and moderate to high annual rainfall.

There are a limited number of conifer species – pine, spruce, larch and fir – all needle or scale-leaved evergreen trees that bear cones. These trees have adapted to withstand extreme winter cold as their narrow leaves or needles reduce water loss due to transpiration. Thin soils mean they tend to have shallow roots, and downward-sloping branches help them to shed snow.

Because of the harsh climate boreal forest can support only a limited range of animals, including large herbivorous mammals such as moose or caribou, rodents such as beavers and squirrels, and large hibernating mammals such as bears. It also supports predators such as lynx, wolves and foxes. Boreal forests are found in northern Russia, especially Siberia, Canada and Alaska, Scandinavia and Japan. Threats to this biome include fire (either from human activity or lightning), intensive forest clearance or harvesting and oil spills from leaking pipelines.

Tundra biome

The world's coldest biome, tundra is located in the arctic or polar climate zones or above the timberline (above which trees cannot grow) on high mountains. The subsoil is permanently frozen, and the topsoil only thaws for a few weeks, during the brief summer. When snow and the topsoil thaw, the surface can become wet and boggy, attracting mosquitoes to the tundra during summer. Few plants can survive in this

harsh environment: those that can include grasses, lichens and mosses. Animals adapted to this environment include Arctic foxes, wolves, reindeer, hares and lemmings. Birds include the ptarmigan and several kinds of waterfowl. Tundra is located in the far north of Canada, Scandinavia and Russia, and in South Georgia and the South Sandwich Islands. Threats to this biome include climate change, tourism, oil drilling and oil spills.

Vegetation belts

Although vegetation belts and biomes are often referred to interchangeably, vegetation belts are more location-specific: they relate only to the plant-life found there. There are various classifications of vegetation belts, from broad to considerably more detailed. The classifications shown in Figure 5 give a good range that complements knowledge gained through work on climate zones and biomes.

Ice cap	Very cold all year with permanent ice and snow. No plant life
Tundra	Treeless plain with grasses, mosses, and shrubs adapted to the cold climate
Coniferous forest	Evergreen trees with needles and cones
Deciduous forest	Trees with broad flat leaves that shed before the winter
Broadleaf evergreen forest	Tall trees with large leaves that remain green all year
Mixed forest	A mix of coniferous and deciduous trees
Temperate grassland	Short and tall grasses adapted to cool climates
Tropical grassland	Grasses and scattered trees adapted to a tropical wet and dry climate
Mediterranean	Small trees and bushes adapted to a Mediterranean climate
Desert scrub	Small trees, bushes and other plants adapted to a dry climate
Desert	An arid region with very few plants
Highland	Vegetation varies with latitude and elevation

Figure 5: Earth's vegetation belts.
Source: www.quizlet.com

Glossary

Biome – a large region of the world with places that share a similar climate, and are home to similar vegetation and animals that have adapted to live in those conditions.

Canopy – The second highest layer of rainforest at around 30–45 metres. The crowns of trees form a dense canopy, blocking out sunlight from lower layers and intercepting rainfall. The canopy contains the most plant species and is home to the most animal species, including birds, monkeys, reptiles and many insects.

Climate – the long-term weather patterns of a region. Climate is measured in terms of average seasonal precipitation (rain- or snowfall), maximum and minimum temperatures, hours of sunshine, levels of humidity and the frequency of extreme weather events over a given period (the World Meteorological Organisation standard is a 30-year average).

Climate change – a large-scale and long-term change in the planet's climate, including weather patterns and average temperatures.

Coniferous forest – a large area of cone-bearing and needle- or scale-leaved evergreen trees are. Deciduous forest – a large area of broad-leaved trees that shed their leaves during autumn.

Emergent layer – the layer of rainforest above the canopy, where the tallest trees grow. These trees receive the most sunlight, but also need to weather high temperatures and strong winds. Animals living in this layer include butterflies, small monkeys and bats.

Forest clearance – felling trees to convert the land for agricultural or other development.

Forest floor – the lowest level of the rainforest. Very little light reaches the forest floor, so plants grow slowly. The ground is covered with fallen leaves and rotten branches. When a tree falls and a patch of light appears, young plants grow very fast to fill the gap. In different rainforests across the world, this layer is home to jaguars, leopards, gorillas and elephants.

Precipitation – any form of water (liquid or solid) falling from the sky. This includes rain, sleet, snow, hail, drizzle and freezing rain.

Understorey – This level is quite open; dense patches of vegetation only occur near rivers or under openings in the upper storeys. The upper storeys block out the sun, so light levels in the understorey are low. Plants that have adapted to these low light levels in order to grow include smaller trees, ferns and climbing plants. Animals that live in this layer include birds, butterflies, frogs, snakes and a wide variety of insect species.

Vegetation – plants associated with a particular area or habitat.

Weather – daily elements of the atmosphere, such as temperature, wind and rain, which can change hour by hour.

Further ideas, links and resources to support your teaching of climate and biomes can be found at:
www.geography.org.uk/investigating-climate-biomes-and-vegetation-belts-at-key-stage-1-2