



Core units: Exemplar – Year 9
Illustration 1: Biomes and ecosystems

World biomes

Major types of biome across the world include:

- forest and woodland
- grassland
- desert
- tundra
- alpine.

Forest and woodland biomes

Forest and woodland biomes are dominated by trees. Forests have very tall trees that are spaced relatively close together forming a closed canopy. Woodlands have smaller trees that are separated by some distance so there is an open canopy. The height and spacing of trees in a biome is generally influenced by the amount of rainfall received by the region. The higher the rainfall, the taller the trees and the more closely spaced they will be (increased productivity).

Tropical forests

Tropical forests are distributed in areas of the world near the equator and between the Tropic of Capricorn and the Tropic of Cancer. They are characterised by very hot temperatures and high average annual rainfall (greater than 1500 mm per annum). Regions which receive heavy rainfall all year round, with no distinct dry season, are referred to as tropical rainforests. Here the trees grow to over 40 metres high and their branches interlock to form a continuous canopy. They have higher productivity than any other biome. Regions which receive seasonal rainfall, influenced by changing monsoon winds, are referred to as monsoon forests. They are also characterised by trees more than 40 metres high forming an almost continuous canopy.

One of the most distinctive features of the tropical forest is the multi-storey arrangement, with each layer having its own particular characteristics which have adapted to both the climate and the microclimate within the forest. Examples of trees which grow to form the canopy include the African mahogany, the south-eastern Asian teak and the South American balsa. Some taller trees emerge above the canopy as they compete for sunlight. Smaller plants such as epiphytes and orchids also grow on the branches of the tall trees to gain access to light, while others (such as lianas) climb up the trees like vines to reach the light.

Beneath the canopy is the understorey. This layer contains the saplings of canopy trees and various species of palms and ferns which grow to approximately 15 metres high due to the restricted light. Nearer



to the forest floor plants are usually quite sparse. There may be a layer of palms, bamboo, ferns, orchids and mosses. The forest floor is also covered with the litter of leaves and branches which decompose relatively quickly due to the warm, moist conditions. This is turned into a shallow layer of humus. Despite the high productivity of tropical forests the soils are relatively infertile due to the heavy rainfall and subsequent leaching of minerals deep within the soil profile.

Temperate forests

There are two types of temperate forests – warm temperate forests and cool temperate forests. Both receive high average annual rainfall (greater than 1500 mm per year).

The warm temperate forest biome occurs in mid-latitude regions experiencing hot summers, cool to mild winters and moist conditions all year round. Examples of these areas include south-eastern USA, central-eastern China, southern Japan, southern Brazil and south-eastern Australia. Warm temperate forest plants have adapted into broad-leafed evergreen trees in response to the plentiful and evenly distributed rainfall. Forests in the northern hemisphere are dominated by oaks, laurels and camphor, while species of southern beech and eucalypts dominate the south.

The cool temperate forest biomes occur mainly in the mid to high latitude regions of the northern hemisphere. They are typical of areas including north-west Europe, north-east China and north-east USA. These regions have high rainfall with very cold winters. The trees have therefore adapted to losing their leaves and lying dormant during this time. Deciduous species include oak, maple, elm, ash, birch and chestnut.

Taiga forests

Also known as boreal or coniferous forest, the taiga biome occurs between 50 and 60 degrees latitude in the northern hemisphere. Taiga forests can be found in Eurasia, North America, Siberia, Scandinavia, Alaska, and Canada. Summers are moderately warm and wet with around 400 to 1000 mm of precipitation per year (including snow). Winters are long, cold, and dry. The length of the growing season in the taiga is approximately 130 days. Vegetation consists mostly of cold-tolerant evergreen conifers with needle-like leaves, such as pine, fir and spruce. Soils are thin, nutrient-poor and acidic.

Woodlands

Open canopy woodlands have evolved in parts of the world characterised by moderate and often seasonal rainfall (700–1200 mm per annum). They often form the transitional zone between areas of forests and shrub lands or grasslands. Two types of woodland are referred to in this text. Savanna woodlands are found in tropical regions characterised by hot, wet summers and warm, dry winters. Mediterranean woodlands are found in regions between 30 and 40 degrees north and south of the equator, characterised by warm to hot dry summers and cool to mild wet winters. Areas with savanna woodland include east Africa and central America. Mediterranean woodlands include places bordering the Mediterranean Sea and all places with similar latitudes, such as southern California, central Chile, the cape of South Africa and the south-west of Western Australia.

Woodland plants are generally adapted to periods of seasonal drought. Most trees have evolved as evergreen species such as oaks, olives and eucalypts. They have developed waxy, leathery leaves to reduce water loss through transpiration and have thick, rough barks to insulate themselves against the heat and protect them from fires. Laterisation appears to be the main soil-forming process, and soils tend



to have a hard, gravelly upper horizon which plants have also adapted to. Some species have wide-spreading roots to gather as much water as possible when rain falls, while others have thick, strong tap roots which enable them to penetrate through the rock and access the water table.

Grassland biomes

Grassland areas are found in the moderately drier parts of the world. The two main divisions of grasslands include savanna grasslands and temperate grasslands.

Savanna grasslands

Savanna grasslands cover almost half the surface of Africa and large areas of Australia, South America and India. They are always found in climates with relatively hot, wet summers and warm, dry winters where the annual rainfall ranges from approximately 500 to 1000 mm per year.

Different savannas support different grasses depending on the amount of rainfall received and soil conditions. For example, in drier areas such as the Serengeti plains or Kenya's Laikipia plateau, the dominant grasses are Rhodes grass and red oat grass. Throughout the East African region, star grasses are dominant. The soil of the savannah grasslands is porous, with rapid drainage of water. It has only a thin layer of humus (the organic portion of the soil created by partial decomposition of plant or animal matter) which provides vegetation with nutrients.

Temperate grasslands

Major temperate grassland areas occur in the veldts of South Africa, the puszta of Hungary, the pampas of Argentina and Uruguay, the steppes of Russia, and the plains and prairies of central North America. They are characterised by hot summers and cold winters with moderate seasonal rainfall. The amount of rainfall received influences the height of grassland vegetation, with taller grasses (prairies) in wetter regions and short grasses (steppes) in the drier regions. Examples of grass species include purple needlegrass, blue grama, buffalo grass, and galleta.

The soil of the temperate grasslands is deep and dark, with fertile upper layers. It is nutrient-rich from the growth and decay of deep, multi-branched grass roots. The rotted roots hold the soil together and provide a food source for living plants.

