Terrestrial biomes: the forests

A biome is a broad ecological region with characteristic communities adapted to its climate. Similar climates can support similar vegetation on different continents.

1. CLIMATE SETS MAJOR CONSTRAINTS

Temperature	Precipitation	Seasonality
Growing season	Water supply	Timing of stress

2. COMPARE FOUR FOREST BIOMES

Tropical rainforest	Amazon, Congo, SE Asia	Warm and wet; mainly near the equator. Layered evergreen vegetation supports high diversity. Rapid nutrient uptake and heavy leaching mean many soils are nutrient-poor despite abundant biomass.
Temperate rainforest	Pacific NW; southern Chile	Mild coastal temperatures and abundant moisture support large trees, mosses and ferns. Ocean influence limits temperature extremes. These forests are wet, but not tropical.
Temperate seasonal forest	Eastern N. America; Europe; East Asia	Warm summers, cold winters and sufficient rainfall. Many broadleaf trees shed leaves in autumn, reducing winter water loss. Leaf litter replenishes soil organic matter and nutrients.
Taiga / boreal forest	Canada, Scandinavia, Russia	Long cold winters and short growing seasons. Conifers dominate; persistent needles conserve nutrients. Slow decomposition often leaves acidic soils with limited available nutrients.

Forest climate and soil patterns: OpenStax, Biology 2e 44.3.
Tropical rainforest distribution and structure: NASA, Mission: Biomes.
Coastal temperate rainforest: National Park Service, Olympic.

Scope: College Board AP Environmental Science CED (2025), Topic 1.2, p. 37.

Grasslands, shrublands and extremes

Water shortage, seasonal drought, cold and disturbance can limit tree cover. Identify a biome using climate and vegetation together, not a single animal or place name.

1. COMPARE FIVE MORE BIOMES

Temperate grassland Prairies, pampas, steppes	Warm summers and cold winters; seasonal water limits. Grasses dominate, with deep roots that add organic matter to often fertile soils. Fire and grazing can restrict trees.
Savanna East Africa; Brazil; N. Australia	Warm year-round, with wet and dry seasons. Grasses grow among scattered trees. Drought, fire and herbivory influence tree cover; grazing animals may track seasonal food and water.
Shrubland / chaparral Mediterranean; California	Hot, dry summers and mild, wetter winters in Mediterranean-type shrublands. Small, tough leaves reduce water loss. Many species resprout or germinate after fire; excessively frequent fire can damage recovery.
Desert Sahara; Atacama; Gobi	Very low precipitation; deserts can be hot or cold. Sparse plants conserve or store water. Some animals burrow or are nocturnal, avoiding daytime heat and reducing water loss.
Tundra Arctic; high mountains	Cold, short growing season with low vegetation: mosses, lichens and dwarf shrubs. Arctic permafrost restricts roots and drainage; seasonal surface thaw supports summer growth. Alpine tundra occurs above treeline.

Desert means dry, not necessarily hot. Tundra is not permanently ice-covered land. These broad categories contain local variation and gradual transition zones.

Grasslands: NASA, Mission: Biomes.
Shrublands: NASA, Mission: Biomes.
Tundra climate and vegetation: NASA, Mission: Biomes.
Desert and savanna characteristics: OpenStax, Biology 2e 44.3.

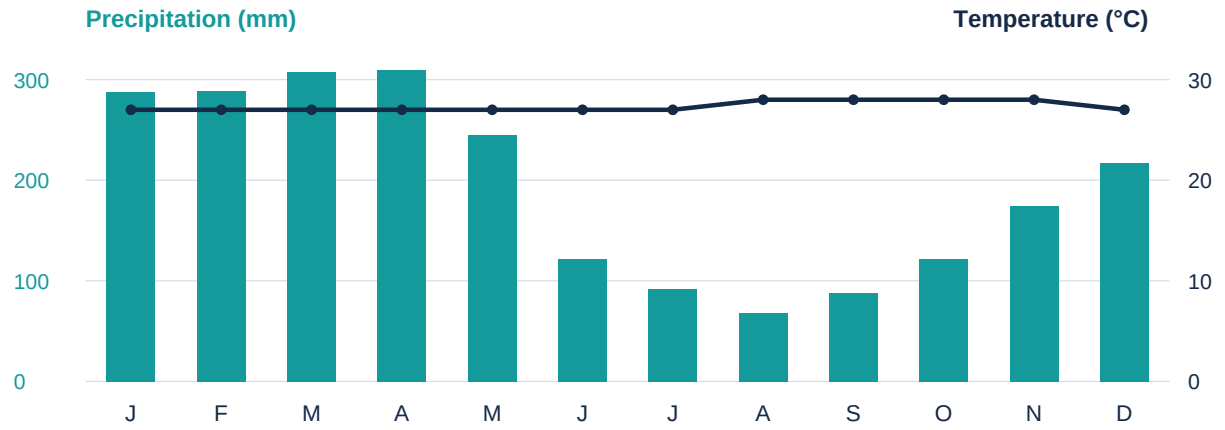
Scope: College Board AP Environmental Science CED (2025), Topic 1.2, p. 37.

Read climate, explain distribution

Monthly patterns matter: an annual average can hide a dry season or freezing winter. Read both temperature and precipitation before linking climate to vegetation.

1. A REAL CLIMOGRAPH: MANAUS, BRAZIL

NASA monthly averages, 1970-2000



Bars: rain. Line: temperature. Annual rain = 2,323 mm; temperature stays at 27-28°C. Rain varies seasonally, but warmth and substantial rainfall support tropical rainforest.

2. RESOURCES ARE UNEVENLY DISTRIBUTED

Water and timber availability reflect climate, geography, latitude, altitude, soil and nutrients. Wet forest regions can support extensive tree biomass; dry regions face water limits. Fertile grassland soils can support crops, but cultivation changes the original biome.

3. BIOME BOUNDARIES CAN MOVE

Climate has shifted biome distributions in the past and can do so again. Changing temperature and rainfall alter suitable conditions. Species respond at different rates, so an entire biome does not simply move intact. Mountains, soils and barriers affect where communities can establish.

Climate is a major control, not the only one: fire, grazing and human land use also shape the vegetation observed at a location.

Climograph data: NASA, Rainforest / Manaus (1970-2000).
Resource distribution and shifting biomes: College Board, ERT-1.B.3-4.

Scope: College Board AP Environmental Science CED (2025), Topic 1.2, p. 37.