

CHAPTER 6

CLIMATE AND TERRESTRIAL BIODIVERSITY

Summary

1. Weather describes the short-term state of the atmosphere. Key factors that determine the Earth's weather are short-term atmospheric conditions such as temperature, pressure, moisture content, sunshine, cloud cover, precipitation, wind direction, and wind speed. Climate is a region's long-term atmospheric conditions over decades. The two main factors in determining climate are average temperature and average precipitation.
2. Warm air fronts lead to cloudy, rainy weather. Approaching cold air fronts produce thunderheads, followed by winds and thunderstorms, and then cooler temperatures with clear skies. High pressures are associated with clear, sunny conditions, and lows with clouds and precipitation. Tornadoes form over land, and tropical cyclones form over warm oceans. Both are weather extremes and can be very damaging.
3. Differences in temperature and in water density create warm or cold ocean currents, affecting the climate of many countries.
4. The uneven heating of the Earth's surface, seasonal changes in temperature and precipitation, the rotation of the Earth, and the properties of air, water, and land all contribute to global air-circulation patterns.
5. Surface waters are pushed away from land on some steep western continental coasts, and an upwelling of cold, nutrient-rich bottom water replaces the outgoing surface water. The El Niño–Southern Oscillation disrupts this pattern; the tropical winds change direction and suppress the upwellings.
6. The greenhouse effect is the process where incoming shortwave radiation from the sun passes through the atmosphere and is largely absorbed by the Earth's surface. Some of the solar energy is re-radiated as longwave energy, is trapped by gases, and heats the atmosphere. Greenhouse gases include water vapour, carbon dioxide, methane, and nitrous oxide. Without the greenhouse effect, Earth would be cold, and almost lifeless. Human activities have increased greenhouse gases, and global warming could result.
7. Precipitation is heavier on the windward side of mountains as moist oceanic air rises, cools, and loses its moisture. The leeward side of mountains is much drier, and this is called the rain shadow effect.
8. The average climate (annual precipitation and temperature) determines terrestrial regions with characteristic types of natural ecological communities. According to these two factors, biomes form.
9. The major types of desert biomes are tropical, temperate, and cold. Biodiversity is low, plant growth and nutrient cycling is slow, and water is scarce. Desert animals are small,

Climate and Terrestrial Biodiversity

and both desert plants and animals have many adaptations that allow them to conserve water.

10. Most grasslands are in the interiors of continents, and the three major types of grasslands are tropical (savannas), temperate, and polar (tundra). Savannas have warm year-round temperatures, two long dry seasons, and are home to large herbivores. Savannas have been destroyed by grazing cattle. Temperate grasslands have cold winters, hot, dry summers, fertile soils, and many herbivores. They have been used to grow crops and graze animals, and as a result, many of these grasslands have disappeared. The arctic tundra has a short summer, is very cold for most of the year, and has a permafrost layer. It has been compromised by oil drilling, mines, and military bases. A chaparral ecosystem, a temperate shrubland with a good climate, borders deserts that are near oceans, and is subject to periodic fires, flooding, and mudslides.
11. The three main types of forest biomes are tropical, temperate, and boreal. Tropical forests are high in biodiversity, have many broadleaf evergreens, exhibit a stratification of plant and animal niches in the canopy, and have poor soils. Human activities have destroyed much of the native trees; grazing has compromised the vegetation and eliminated food sources for native animals; and deforestation has changed the tropical forest's ecosystem, leading to the death of plants and animals. The temperate forest has less biodiversity, fewer tree species, and a rich forest soil. Fires, logging, and hunting have undermined this type of forest. Polar regions support a variety of wildlife, but oil drilling and oil spills have compromised the water, wildlife, and vegetation in the Arctic.
12. Mountain and arctic biomes play important ecological roles; they help regulate climate and affect sea levels. Mountain biome degradation arises from timber and mining extraction, hydroelectric dams and reservoirs, air pollution, increased tourism, and radiation from ozone depletion.