

STAGE 5: SUSTAINABLE BIOMES



SNAPSHOT: Biomes and their productivity

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Sahara Desert, Morocco. Photo: L. Chaffer

GLOSSARY

Biomes – Earth’s major vegetation (plant) communities

Climatic zones – areas of the Earth that have similar temperatures. Climate zones are linked latitude and altitude

Spatial distribution – The location and arrangement of biomes across the surface of the Earth.

Arable– land cultivated to grow crops

Biome productivity – refers to the amount of biomass or living plant material produced through photosynthesis.

Tropical – refers to places that are between the tropics and have warm winters and hot summers

Temperate – refers to places with mild to warm summers and cool to cold winters

Polar – refers to places with cool summers and very cold winters.

Characteristics that differentiate the world’s biomes

Earth’s major biomes have distinctly different features of vegetation and animal life due to differences in climate (temperature and precipitation). Earth’s biomes generally correspond to the different climate zones. The same biome can occur in different places with similar climates, for example tundra can occur in areas near the Arctic Circle as well as high up mountain ranges where the climate is too cold for trees to grow and precipitation occurs as snow in winter.

Other factors such as relief, gradient, aspect and soil quality also influence the features of different biomes.

Comparing biomes

Comparing biomes is one way to understand reasons for differences between them.

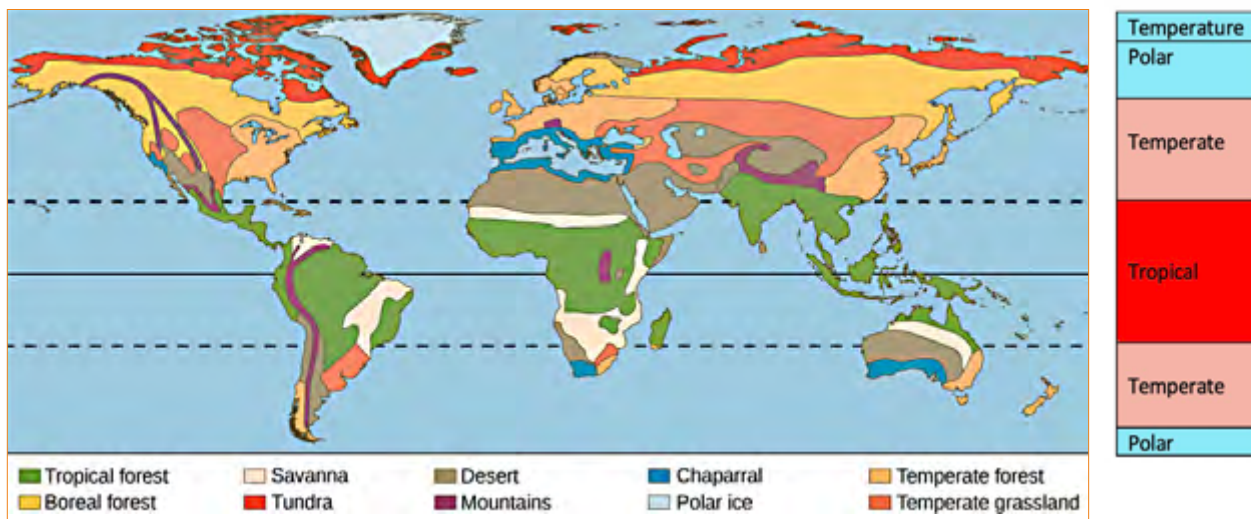
Examining the **climatic graphs** of places located in different biomes will reveal key characteristics such as temperature, temperature range, annual precipitation, types of precipitation and seasonal variations in temperatures and precipitation.

Useful resources for comparing biomes include:

Biome Viewer https://media.hhmi.org/biointeractive/biomeviewer_web/index.html

Earth Observatory Mission Biome at: <https://earthobservatory.nasa.gov/experiments/biome>

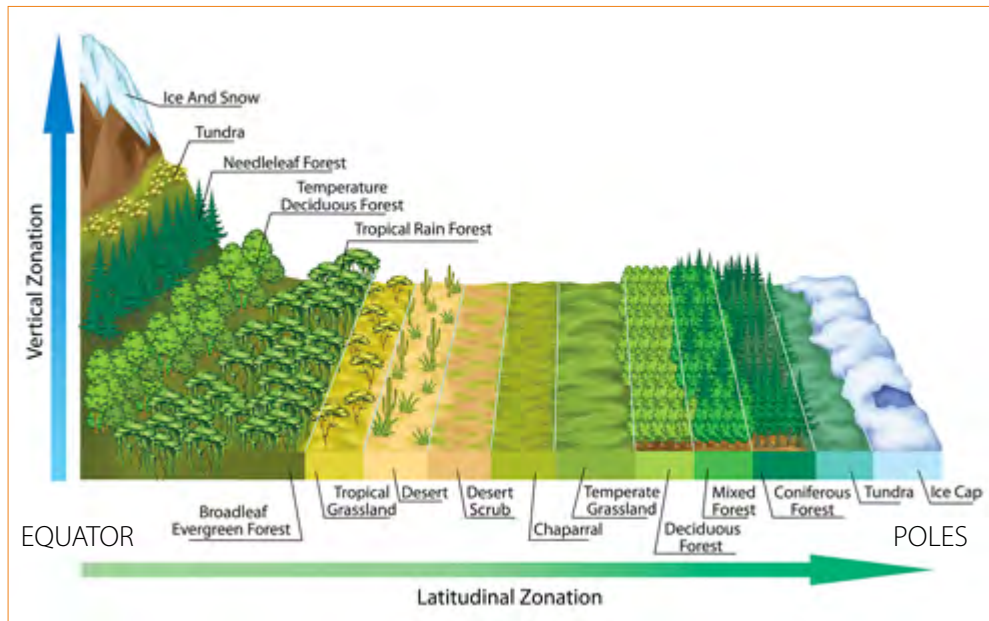
SOURCE A: Distribution of Earth’s biomes



Source: <https://openoregon.pressbooks.pub/envirobiology/chapter/3-3-terrestrial-biomes>

SUSTAINABLE BIOMES: SNAPSHOT

SOURCE B: Earth's biomes by latitude and altitude



Source: Shutterstock

See the Bulletin Supplement activity for "Biomes and their productivity" to demonstrate your understanding of the links between biomes and climate

Biome productivity

Primary productivity refers to the amount of biomass or living plant material produced through photosynthesis. High productivity can support large numbers of consumer species through food chains and food webs and can be understood by examining **food pyramids** and **food webs**.

The least productive biomes are those with extreme climates like deserts and tundra where temperatures are hot or cold and precipitation low, resulting in limited plant growth. The most productive biomes typically have higher temperatures, plenty of water and lots of available soil nitrogen.

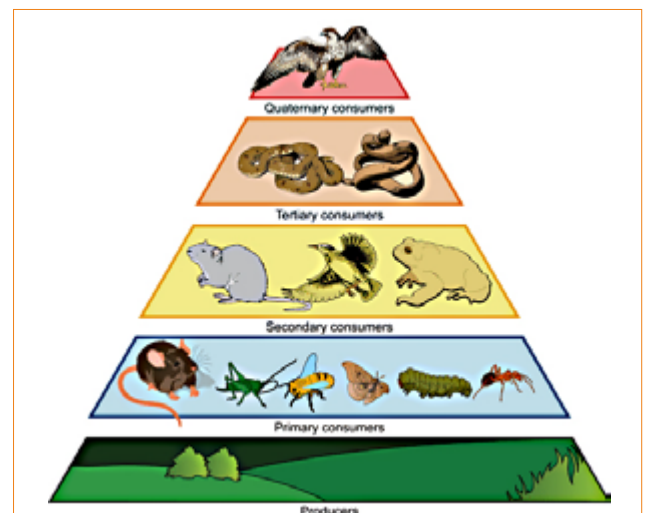
Biome productivity and capacity to produce food

The most productive biomes generally have the best capacity to produce food, because they have the climatic conditions that plants need to grow ... and can produce crops for human consumption or pasture and feed for livestock.

Biomes are used for food, fibre and industrial products production in many ways:

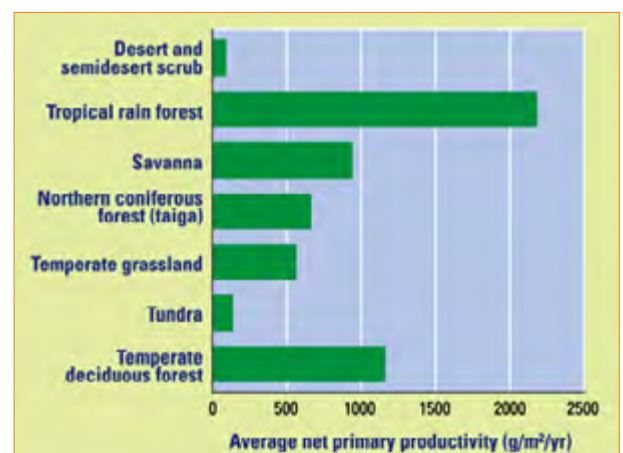
- harvesting biome resources such as nuts, fruits, seeds, wildlife and timber in forest biomes
- managing the natural resources of the biome for food production such as grazing animals on native pastures in grassland and tundra biomes.
- replacing the natural biome with introduced species of plants and animals such as rice, wheat and cotton and improving pastures with exotic species.
- modifying the characteristics of natural biomes such as using irrigation to supplement natural rainfall, terracing land to grow crops, fertilising soils and building wind breaks.

SOURCE C: Food pyramid



Primary producers create biomass (plant material) used as food by consumers. Plants are the base of food pyramids.

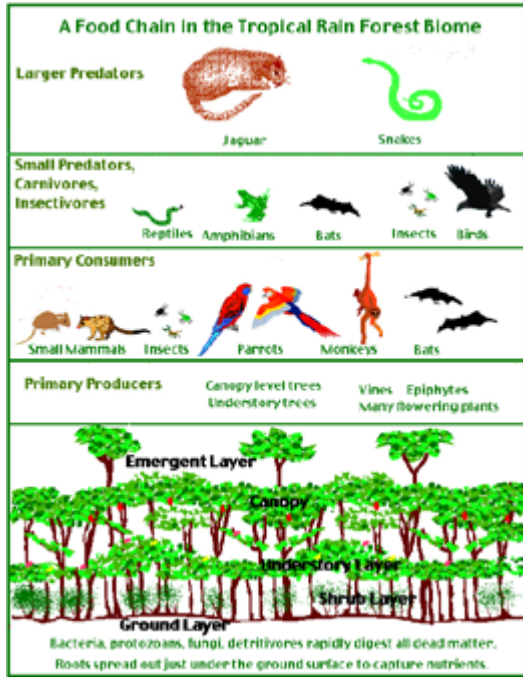
SOURCE D: Biomes productivity



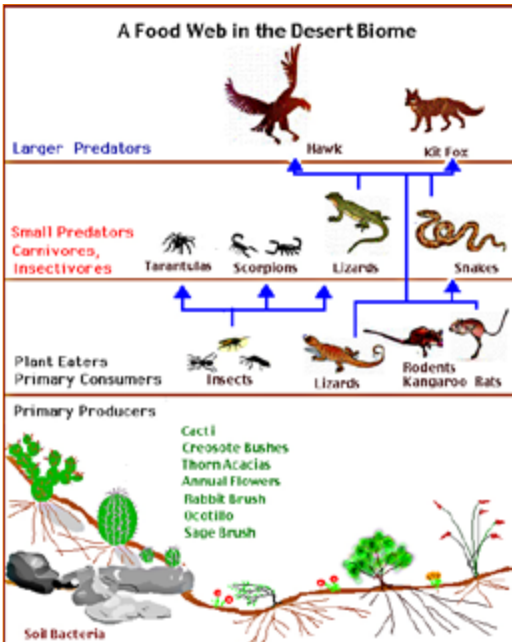
Net primary productivity is the biomass left after producers meet their survival needs. It is available for plant growth.

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SOURCE E: Food Pyramids

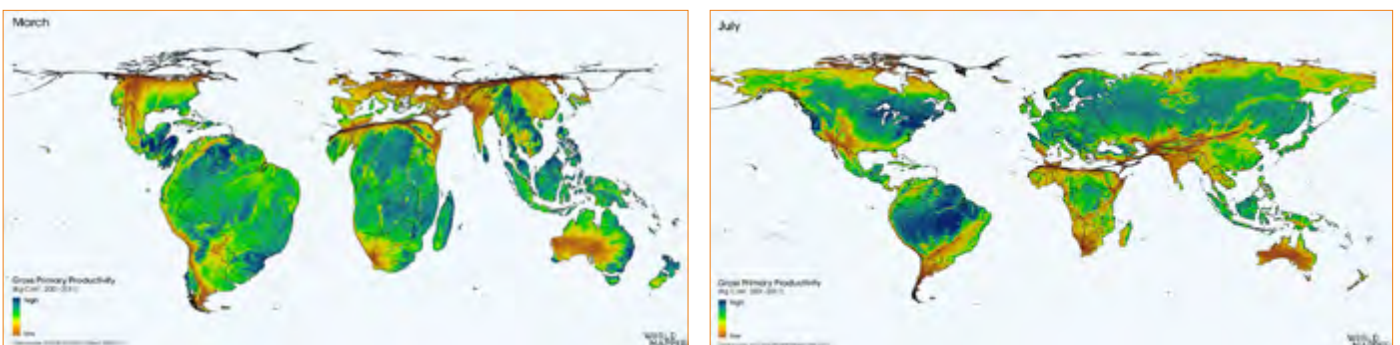


Source: https://www.world-builders.org/lessons/less/biomes/rainforest/tropi_rain/rainweb.html



Source: <https://www.world-builders.org/lessons/less/biomes/desert/hot-desert-chain.html>

SOURCE G: Earth's Heartbeat



Source: WORLDMAPPER 'Heartbeat of nature's productivity' at <https://www.visualcapitalist.com/animation-the-heartbeat-of-natures-productivity/>

Global satellite monitoring

Satellites are used to monitor biome productivity by showing how "green" different parts of the planet are and how that greenness changes over time. These observations help scientists understand the influence of natural cycles, seasons and drought on vegetation.

On this global map dark greens show land areas with plenty of leafy green vegetation, such as the Amazon Rainforest. Beige to white areas have little or no vegetation, including deserts and Arctic tundra areas. Areas with moderate amounts vegetation such as grasslands are pale green. Water appears blue and 'no data' areas appear as grey.

SOURCE F: Seasonal biome productivity



Productivity changes with the seasons

Visualisations showing changing productivity through the seasons can be found at these locations:

- A NASA visualisation shows 20 years of continuous observations of plant life on land and at the ocean's surface, from 1997 to 2017 at <https://www.nasa.gov/feature/goddard/2017/thechanging-colors-of-our-living-planet>
- Worldmapper 'Heartbeat of nature's productivity' is a fascinating cartogram visualisation in which countries are resized by their productivity. Watch the visualisation and read more at <https://www.visualcapitalist.com/animation-the-heartbeat-of-natures-productivity>

Climate change and biome productivity

Potential impacts of climate change on biomes include:

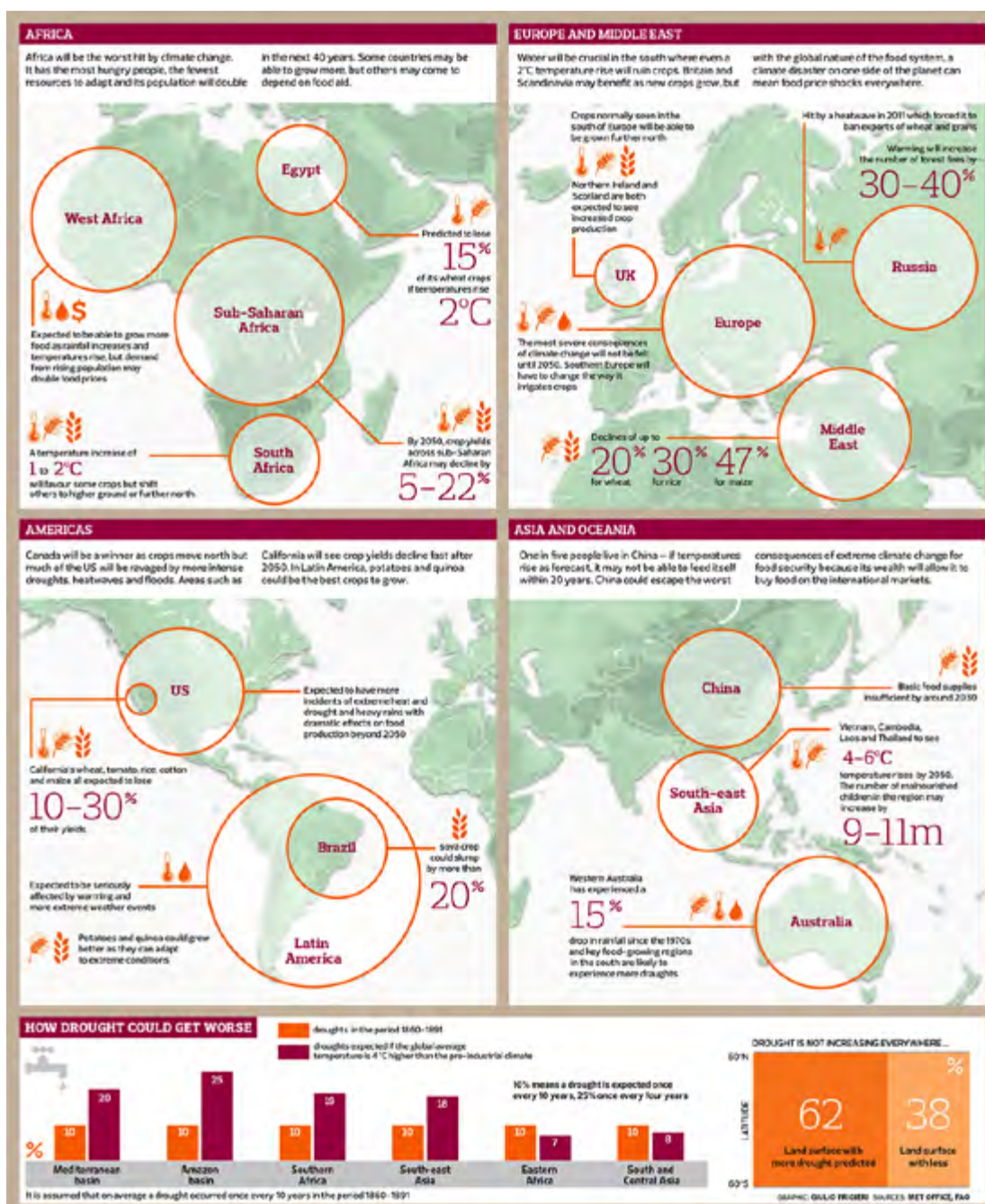
- higher temperatures favouring some plant species. Trees may grow in areas where it is now too cold.
- increasing rainfall increasing biome productivity
- decreasing rainfall reducing productivity and may turn grasslands into deserts
- more extreme weather events such as drought, flood, bushfire and storm by stressing the capacity of ecosystems such as forests to survive
- sea level rise submerging coastal biomes or reducing plant growth because of salinity
- species migration and changing food webs

Climate change and food production

Hotter, wetter, drier climates will impact on the suitability of some biomes to produce food.

- desertification will reduce the capacity of farmers to graze cattle on grasslands
- grain growing regions may become too wet for wheat but more suited to rice.
- grazing land could be used to grow crops without irrigation.
- irrigation may be needed to keep crops growing where the climate becomes dryer
- crop losses from pests and diseases may increase

SOURCE G: Climate change and food production



The GUARDIAN: Climate change: how a warming world is a threat to our food supplies (2013) <https://www.theguardian.com/environment/2013/apr/13/climate-change-threat-food-supplies>