

Climate Zones and Biomes

Dana Desonie, Ph.D.

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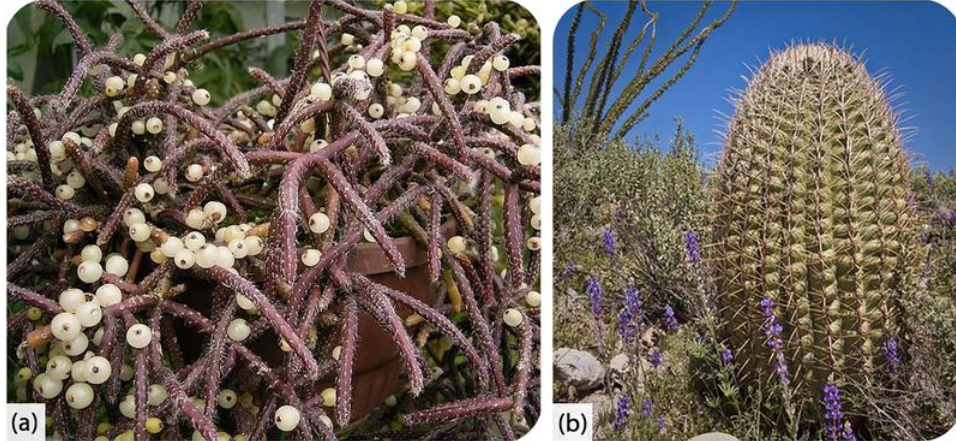
Dana Desonie, Ph.D.

CONCEPT

1

Climate Zones and Biomes

- Define biome and microclimate.
- Describe the major climate zones and explain how they relate to biomes.



How do plants that evolved without any genetic interaction end up being so similar?

Organisms evolve to fit the conditions they are in. There are only so many ways to minimize the use of water, so plants in arid climates evolve very similar structures for that purpose. There are many instances of parallel evolution in widely separated organisms.

Climate Zones and Biomes

The major factors that influence climate determine the different climate zones. In general, the same type of climate zone will be found at similar latitudes and in similar positions on nearly all continents, both in the Northern and Southern Hemispheres. The exceptions to this pattern are the climate zones called the continental climates, which are not found at higher latitudes in the Southern Hemisphere. This is because the Southern Hemisphere land masses are not wide enough to produce a continental climate.

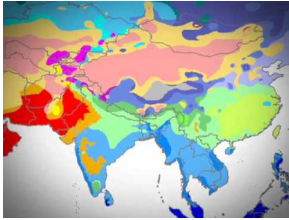
Classification

Climate zones are classified by the Köppen classification system. This system is based on the temperature, the amount of precipitation, and the times of year when precipitation occurs. Since climate determines the type of vegetation that grows in an area, vegetation is used as an indicator of climate type.

Biomes

A climate type and its plants and animals make up a **biome**. The organisms of a biome share certain characteristics around the world, because their environment has similar advantages and challenges. The organisms have adapted to that environment in similar ways over time. For example, different species of cactus live on different continents, but they have adapted to the harsh desert in similar ways.

The similarities between climate zones and biome types are displayed in this video: http://www.youtube.com/watch?v=Z_THTbynoRA (1:01).



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Major Climate Groups

The Köppen classification system recognizes five major climate groups. Each group is divided into subcategories. Some of these subcategories are forest, monsoon, and wet/dry types, based on the amount of precipitation and season when that precipitation occurs (**Figure 1.1**).

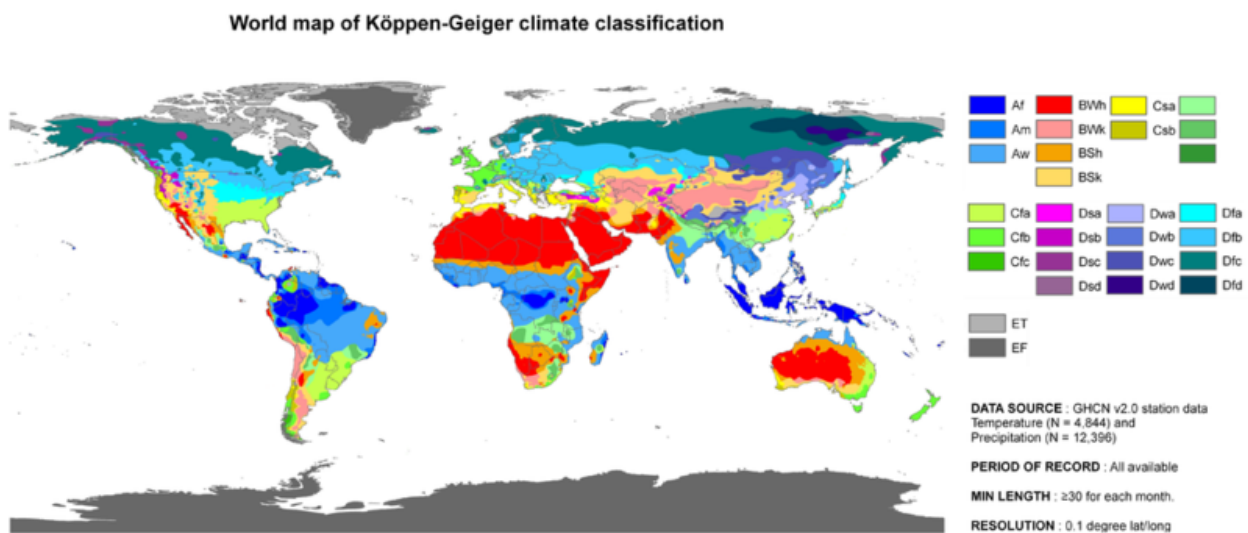


FIGURE 1.1

This world map of the Köppen classification system indicates where the climate zones and major biomes are located.

Tropical Moist Climates

Tropical moist climates are found in a band about 15° to 25° N and S of the equator (**Figure 1.1**).

- Temperature: Intense sunshine. Each month has an average temperature of at least 18°C (64°F).
- Rainfall: Abundant, at least 150 cm (59 inches) per year.

The main vegetation for this climate is the tropical rainforest.

Dry Climates

Dry climates have less precipitation than evaporation.

- Temperature: Abundant sunshine. Summer temperatures are high; winters are cooler and longer than in tropical moist climates.
- Rainfall: Irregular; several years of drought are often followed by a single year of abundant rainfall. Dry climates cover about 26% of the world's land area.

Low latitude deserts are found at the Ferrell cell high pressure zone. Higher latitude deserts occur within continents or in rainshadows. Vegetation is sparse but well adapted to the dry conditions.

Moist Subtropical Mid-latitude

Moist subtropical mid-latitude climates are found along the coastal areas in the United States.

- Temperature: The coldest month ranges from just below freezing to almost balmy, between -3°C and 18°C (27° to 64°F). Summers are mild, with average temperatures above 10°C (50°F). Seasons are distinct.
- Rainfall: There is plentiful annual rainfall.

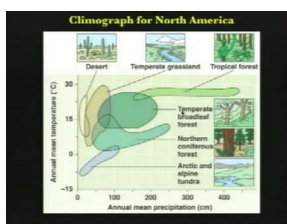
Continental Climates

Continental climates are found in most of the North American interior from about 40°N to 70°N .

- Temperature: The average temperature of the warmest month is higher than 10°C (50°F) and the coldest month is below -3°C (27°F).
- Precipitation: Winters are cold and stormy (look at the latitude of this zone and see if you can figure out why). Snowfall is common and snow stays on the ground for long periods of time.

Trees grow in continental climates, even though winters are extremely cold, because the average annual temperature is fairly mild. Continental climates are not found in the Southern Hemisphere because of the absence of a continent large enough to generate this effect.

This "Ecosystem Ecology" video lecture at U.C. Berkley outlines the factors that create climate zones and consequently the biomes: <http://www.youtube.com/watch?v=3tY3aXgX4AM> (46:46).



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Polar Climates

Polar climates are found across the continents that border the Arctic Ocean, Greenland, and Antarctica.

- Temperature: Winters are entirely dark and bitterly cold. Summer days are long, but the sun is low on the horizon so summers are cool. The average temperature of the warmest month is less than 10°C (50°F). The annual temperature range is large.
- Precipitation: The region is dry, with less than 25 cm (10 inches) of precipitation annually; most precipitation occurs during the summer.

Microclimates

When climate conditions in a small area are different from those of the surroundings, the climate of the small area is called a **microclimate**. The microclimate of a valley may be cool relative to its surroundings since cold air sinks. The ground surface may be hotter or colder than the air a few feet above it, because rock and soil gain and lose heat readily. Different sides of a mountain will have different microclimates. In the Northern Hemisphere, a south-facing slope receives more solar energy than a north-facing slope, so each side supports different amounts and types of vegetation.

Altitude mimics latitude in climate zones. Climates and biomes typical of higher latitudes may be found in other areas of the world at high altitudes.

Vocabulary

- **biome**: The living organisms that are found within a climate zone that make that zone distinct.
- **microclimate**: A local climate that is different from the regional climate.

Summary

- A biome is a climate zone and the plants and animals that live in it.
- The Koppen classification system divides climates into five major types and many subtypes based on temperature and humidity characteristics.
- A microclimate has different climate conditions from the surrounding regions.

Practice

Use this resource to answer the questions that follow.

<http://www.youtube.com/watch?v=ZouWWVyz9v8>



MEDIA

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1. What determines the characteristics of the Moab desert?
2. Where are deserts often found?
3. Why are the poles cold?
4. How can the ocean heat the land?
5. What is the mean temperature at Reykjavik?
6. What brings the warm temperatures to Iceland?
7. How do greenhouse gases effect climate?
8. What are the principal factors in determining climate?

Review

1. How does a biome relate to a climate zone?
2. How does a region develop its own microclimate?
3. Where do you think dry climates are located? Where are subtropical climates located?