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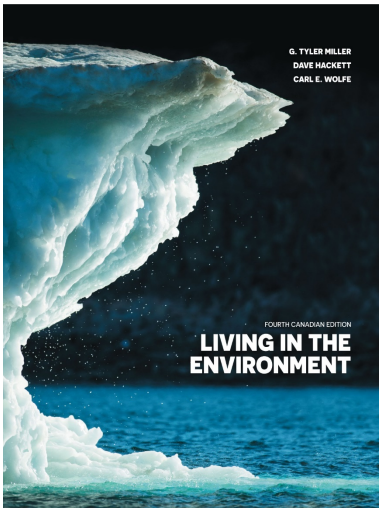


prepared by

Ian Dawe

Chapter 6

Climate and Terrestrial Biodiversity

Key Concepts

Factors influencing weather

Factors influencing climate

Relationship between climate and biomes

Biome characteristics

– Desert
– Grassland
– Forest
– Mountain

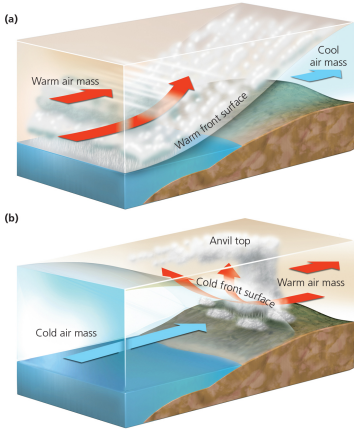
What Is Weather?

Short-term atmospheric conditions

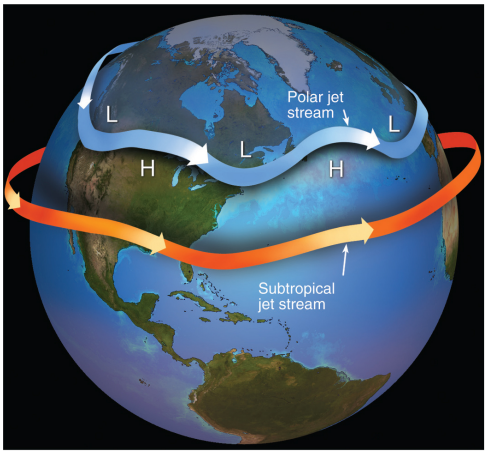
Primarily due to interacting air masses

Warm or cold fronts

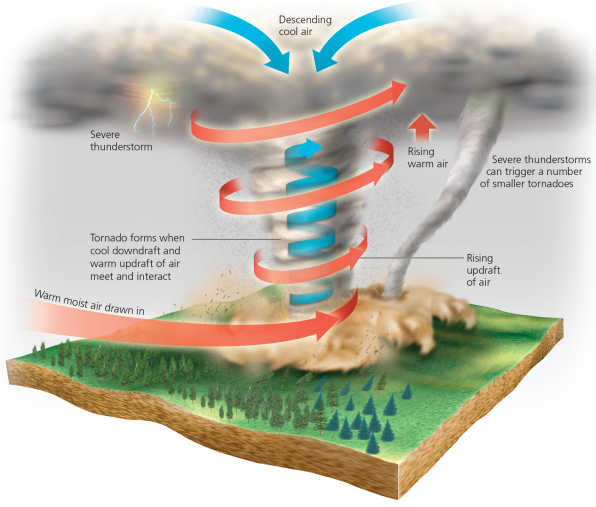
High or low pressures



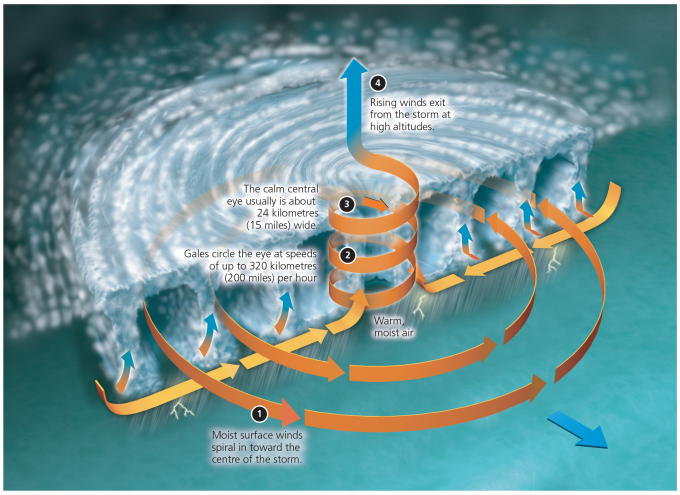
Weather: Jet Streams



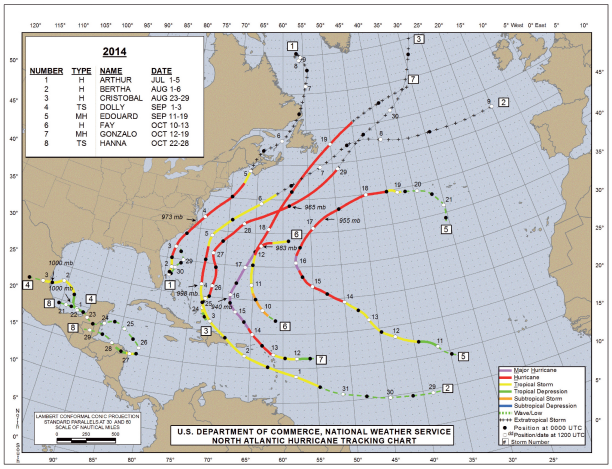
Weather Extremes: Formation of a Tornado



Weather Extremes: Formation of a Tropical Cyclone



Weather Extremes: Hurricane Mapping



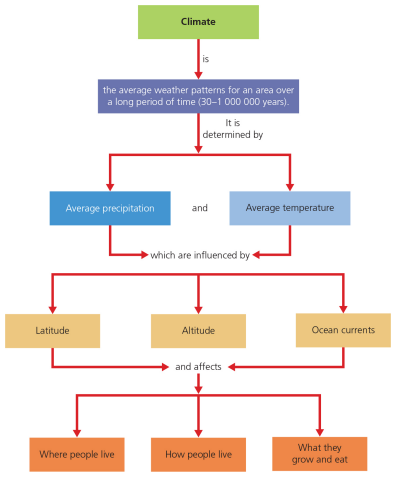
What Is Climate?

Long-term atmospheric patterns of **temperature** and **precipitation**

Typically measured in decades, in contrast with weather

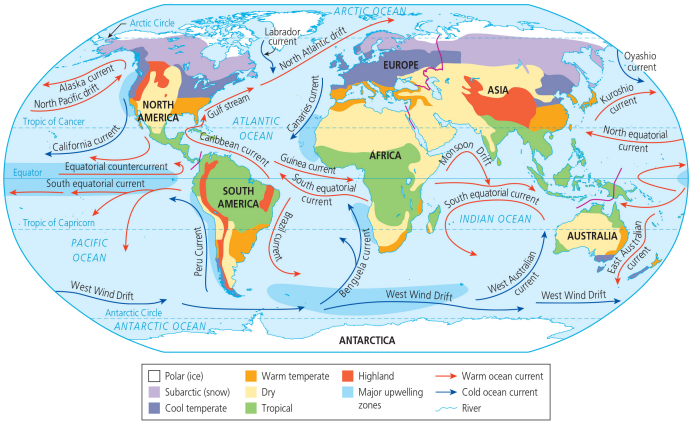
Earth has several defined "climate zones," each with their own distinctive patterns of environmental conditions.

Climate and Its Effects



Source: Data from National Oceanic and Atmospheric Administration

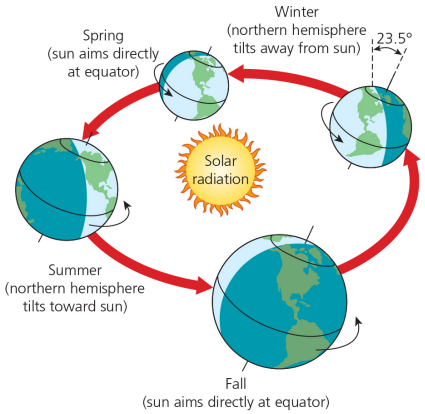
Earth's Climate Zones



Factors Affecting Global Air Circulation

1. Uneven heating of Earth's surface
2. Seasonal changes
3. Rotation of Earth on axis
4. Properties of air, water, land

Seasonal Changes



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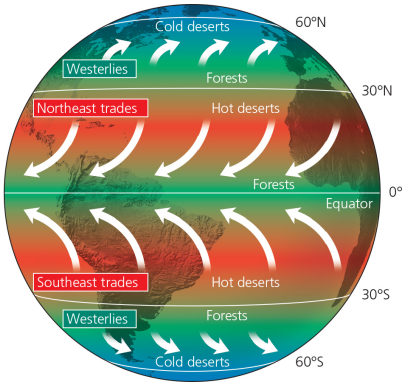
Air Circulation

Prevailing winds result from the Earth's rotation



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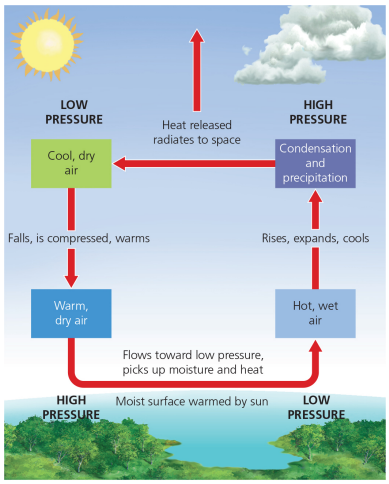
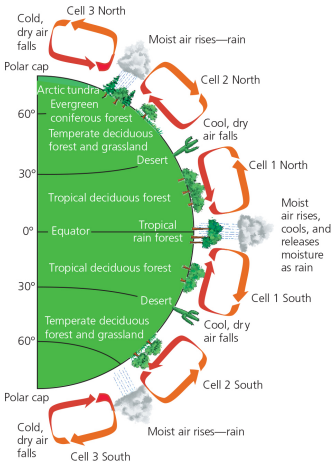
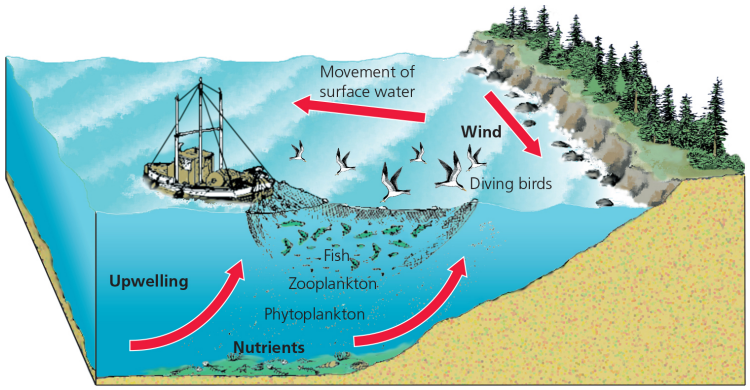
Transfer of Energy by Convection



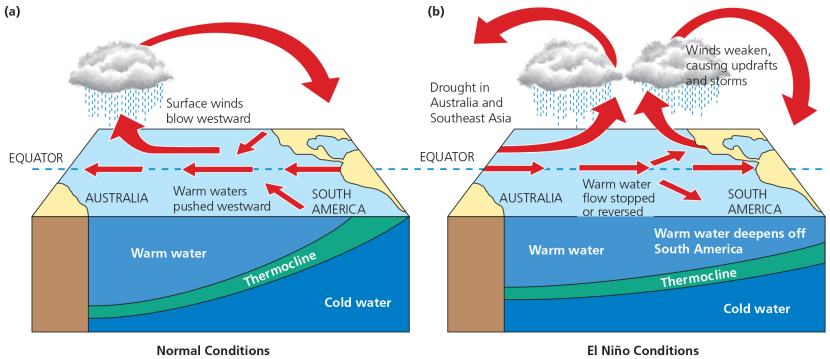
Global Air Circulation and Biomes



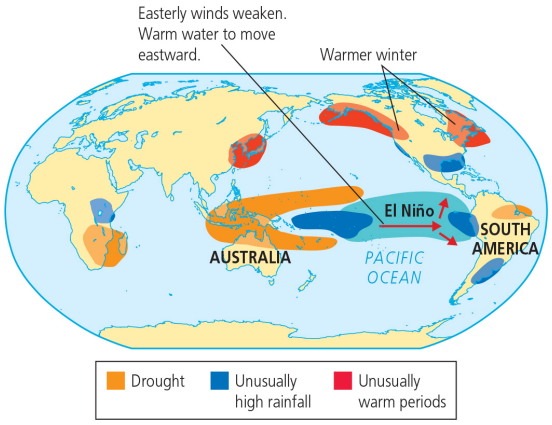
A Shore Upwelling



What Are El Niño and La Niña?



Climatic Effects of El Niño

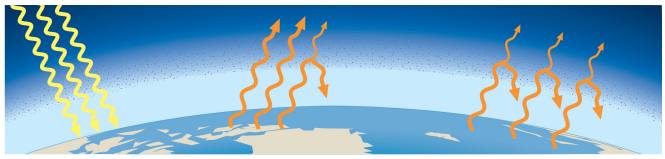


Source: Data from National Oceanic and Atmospheric Administration

How Do Gases in the Atmosphere Affect Climate?

Natural greenhouse effect (normal)

The concern is over the *anthropogenic* greenhouse effect.



(a) Rays of sunlight penetrate the lower atmosphere and warm the Earth's surface.

(b) The Earth's surface absorbs much of the incoming solar radiation and degrades it to longer-wavelength infrared (IR) radiation, which rises into the lower atmosphere. Some of this IR radiation escapes into space as heat and some is absorbed by molecules of greenhouse gases and emitted as even longer-wavelength IR radiation, which warms the lower atmosphere.

(c) As concentrations of greenhouse gases rise, their molecules absorb and emit more infrared radiation, which adds more heat to the lower atmosphere.

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Other Anthropogenic Gasses Affect Climate

It's not just CO_2.

Methane (CH_4) also gives rise to warming.

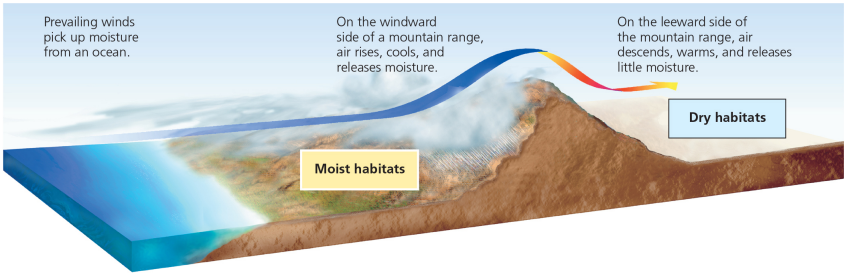
As does ozone (O_3)

Halocarbons and chlorofluorocarbons deplete the ozone layer, but are also greenhouse gasses.

Nitrous oxide (N_2O) is another example.

How Does Topography Create Microclimates?

For example, **Rain shadow effect**

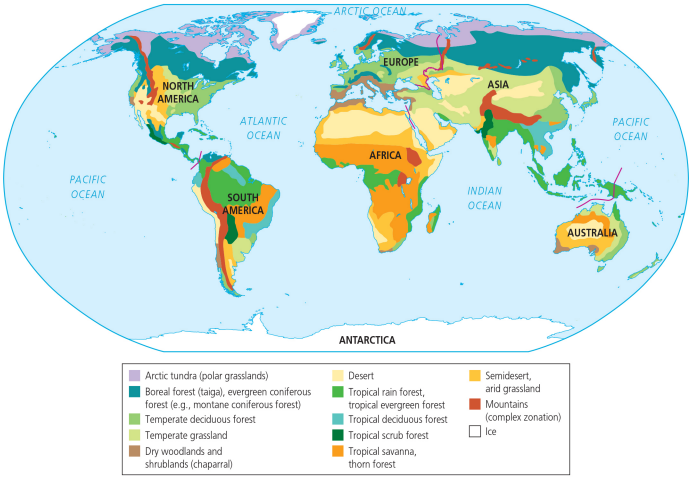


Biomes: Why Do Different Organisms Live in Different Places?

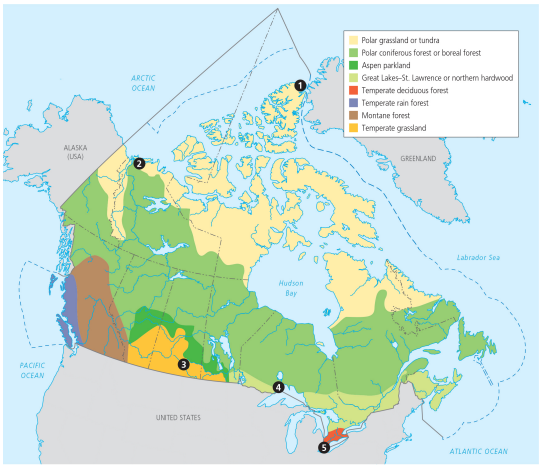
Different climates result in different organisms that are best suited.

Biomes are patchy, not uniform, communities.

The Earth's Major Biomes

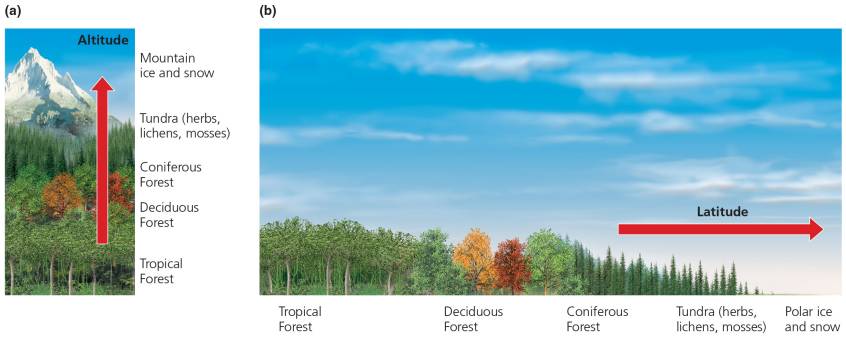


Canada's Major Biomes

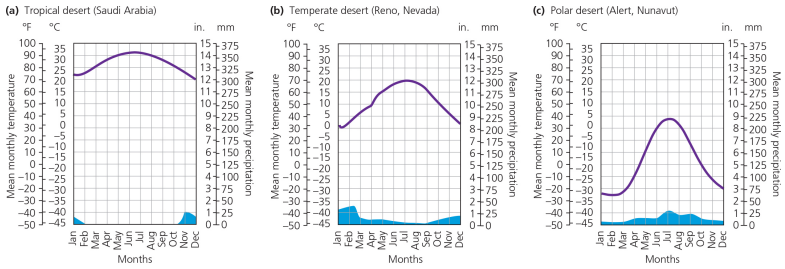


Source: Global Forest Watch Canada and Environment Canada

Biomes: Latitude and Altitude



Desert Biomes



How Do Desert Plants and Animals Survive?

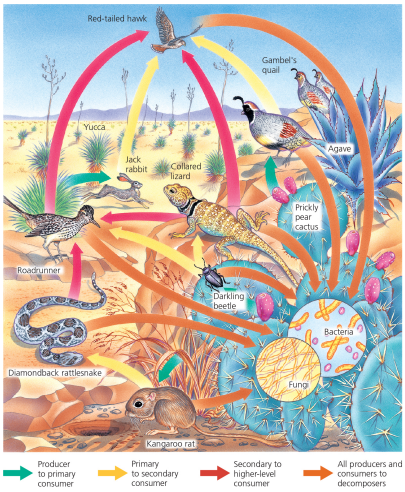
Avoid water losses

- Minimize evapotranspiration
- Substantial water storage systems
- CO_2 uptake only at night in plants

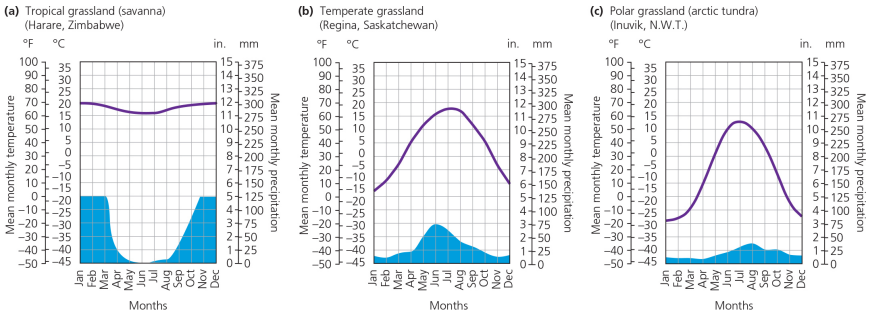
Protect from extreme temperatures

- Heat: Minimize daytime animal activity
- Cold: Plants stay low to ground, animals hibernate

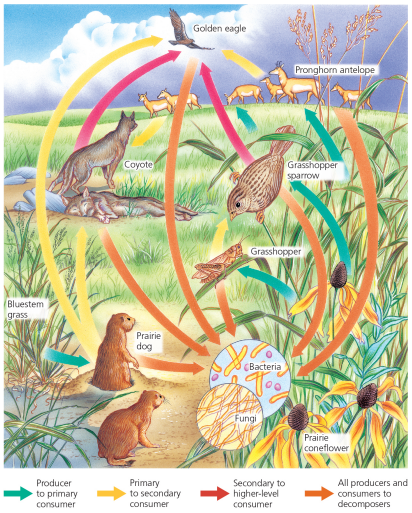
Temperate Desert Ecosystem



Grassland and Tundra Biomes



Temperate Prairie Ecosystem



Climate Characteristics of Polar Grasslands (Tundra)

Arctic Tundra

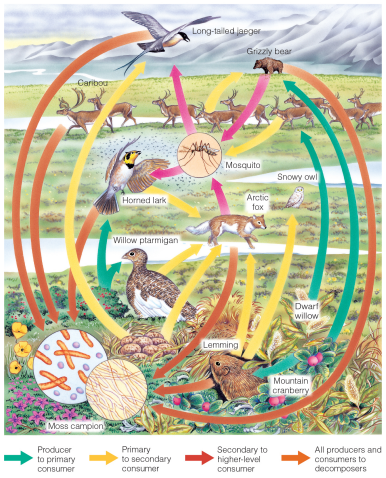
– Extreme winds

– Permafrost

Alpine Tundra

– Above treeline but below snow line

Polar Grassland (Tundra) Ecosystem



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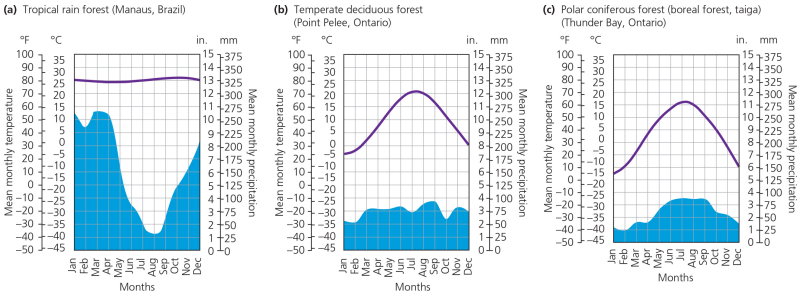
Forest Biomes



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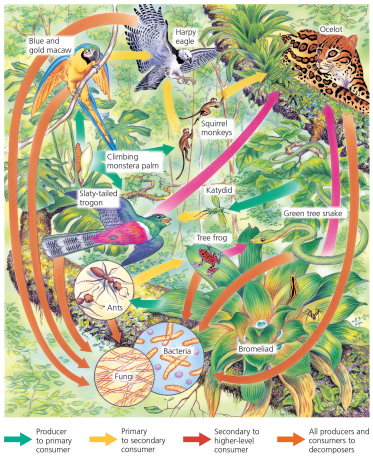
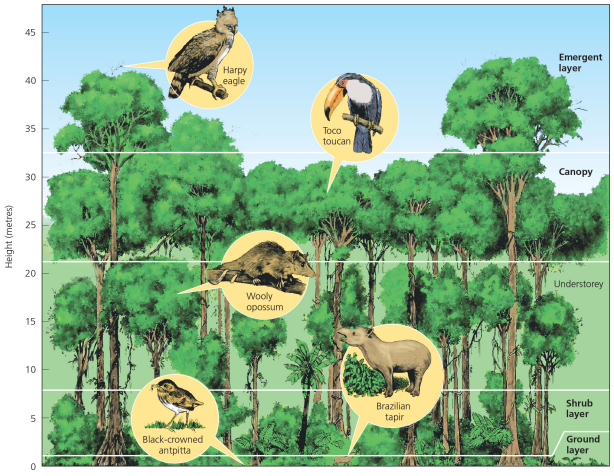
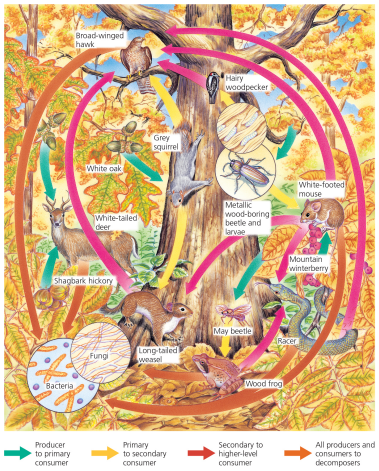
Tropical Rainforest Ecosystem



Forests Are Stratified in Layers



Temperate Deciduous Forest Ecosystem



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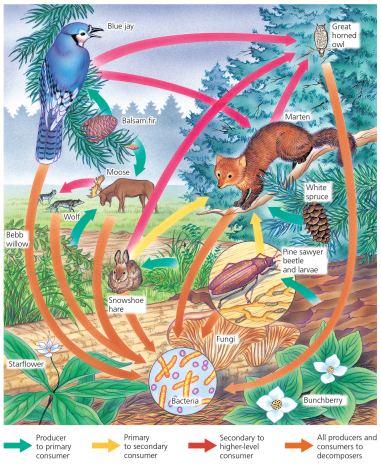
Evergreen Coniferous Forest Ecosystem



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What Are Temperate Rainforests?

Coastal coniferous forest

– Ample rainfall and moisture
– Temperature moderated by ocean
– Substantial mosses, ferns

Mountain Biomes

High-altitude biodiversity sanctuaries

Majority of world forests

Regulate climate

– Reflect solar radiation
– Glacial ice affects sea level
– Hydrologic cycle via meltwater

Human Impact on Mountain Biomes

FIGURE 6-36 **NATURAL CAPITAL DEGRADATION**

Mountains

Major human impacts on the world's mountains

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- Landless poor migrating uphill to survive
- Timber extraction
- Mineral resource extraction
- Hydroelectric dams and reservoirs
- Increasing tourism (such as hiking and skiing)
- Air pollution from industrial and urban centres
- Increased ultraviolet radiation from ozone depletion
- Soil damage from off-road vehicles

Conclusion

Weather is the interaction of air masses (short-term).

Climate is long-term patterns of temperature and precipitation.

Biomes are defined by their climate and topography.

Climate dictates habitat complexity and biodiversity.