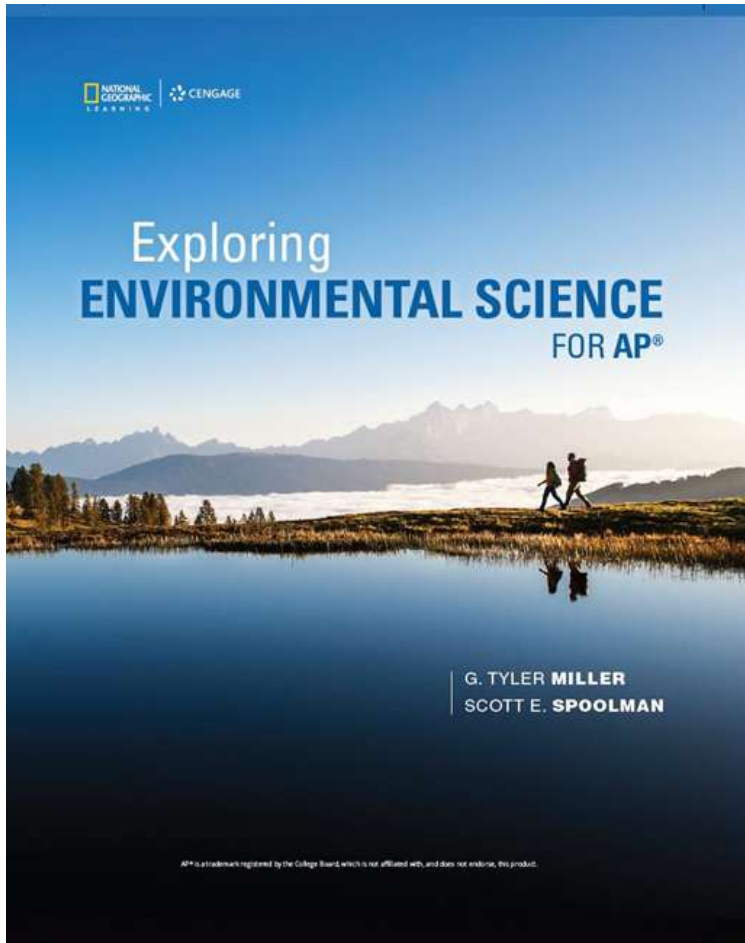


Exploring Environmental Science for AP[®]

1st Edition



Chapter 5 Climate and Terrestrial Biodiversity

Core Case Study: African Savanna (1 of 2)

- Why do grasslands grow in some areas while forests and deserts form in others?
 - Climate
 - Tropical
 - Polar
 - Temperate
- Savanna
 - Scattered trees and warm temperatures
 - Loss of habitat threatens native animals

Core Case Study: African Savanna (2 of 2)



Amy Nichole Harris/Fotolia LLC

7.1 What Factors Influence Weather?

- Weather
 - Set of physical conditions of the lower atmosphere in an area over a period of hours to days
 - Atmospheric temperature and precipitation
- Weather affected by:
 - Moving masses of warm or cold air
 - Atmospheric pressure changes
 - Occasional shifts in major winds

Weather is Affected by Moving Masses of Warm or Cold Air (1 of 2)

- Front
 - Boundary between two air masses with different temperatures and densities
- Warm front
 - Advancing warm air mass rises up over cooler air
 - Moisture begins to condense
 - Forms layers of clouds at different altitudes

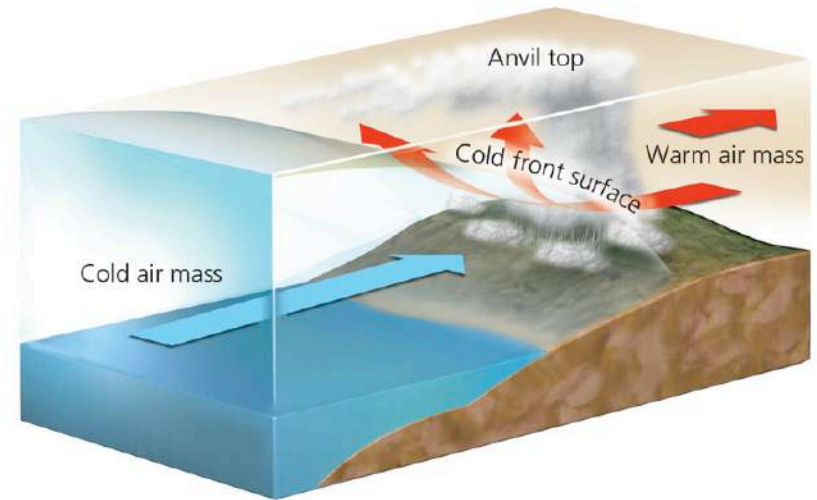
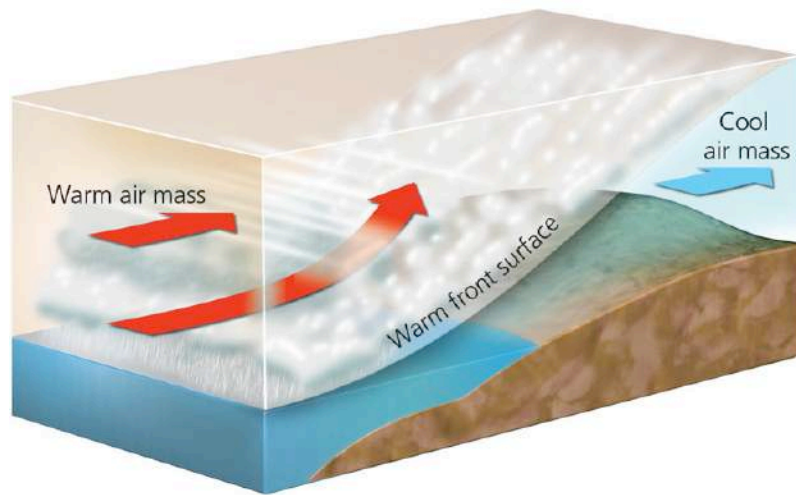
Weather is Affected by Moving Masses of Warm or Cold Air (2 of 2)

- Cold front
 - Advancing cold air mass stays close to the ground, wedging below warmer air
 - Produces rapidly moving, towering clouds called thunderheads
 - Can cause high surface winds and thunderstorms as it passes through

Weather is Affected by Atmospheric Pressure and Wind Patterns (1 of 5)

- Atmospheric pressure
 - Greater near the earth's surface
- High pressure air mass contains cool, dense air
- Low pressure air mass contains low-density, warm air
 - Air rises, expands, and cools
 - Condenses when temperature drops below dew point

Weather is Affected by Atmospheric Pressure and Wind Patterns (2 of 5)

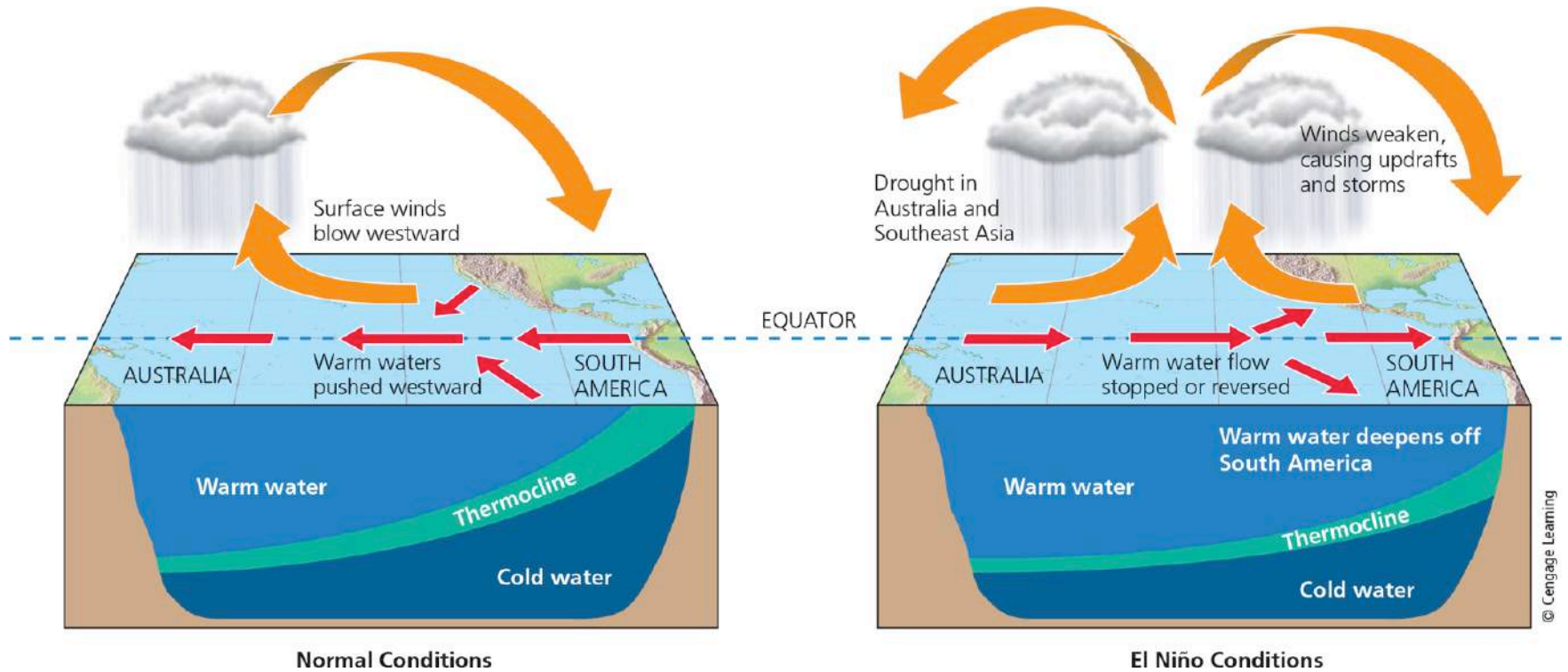


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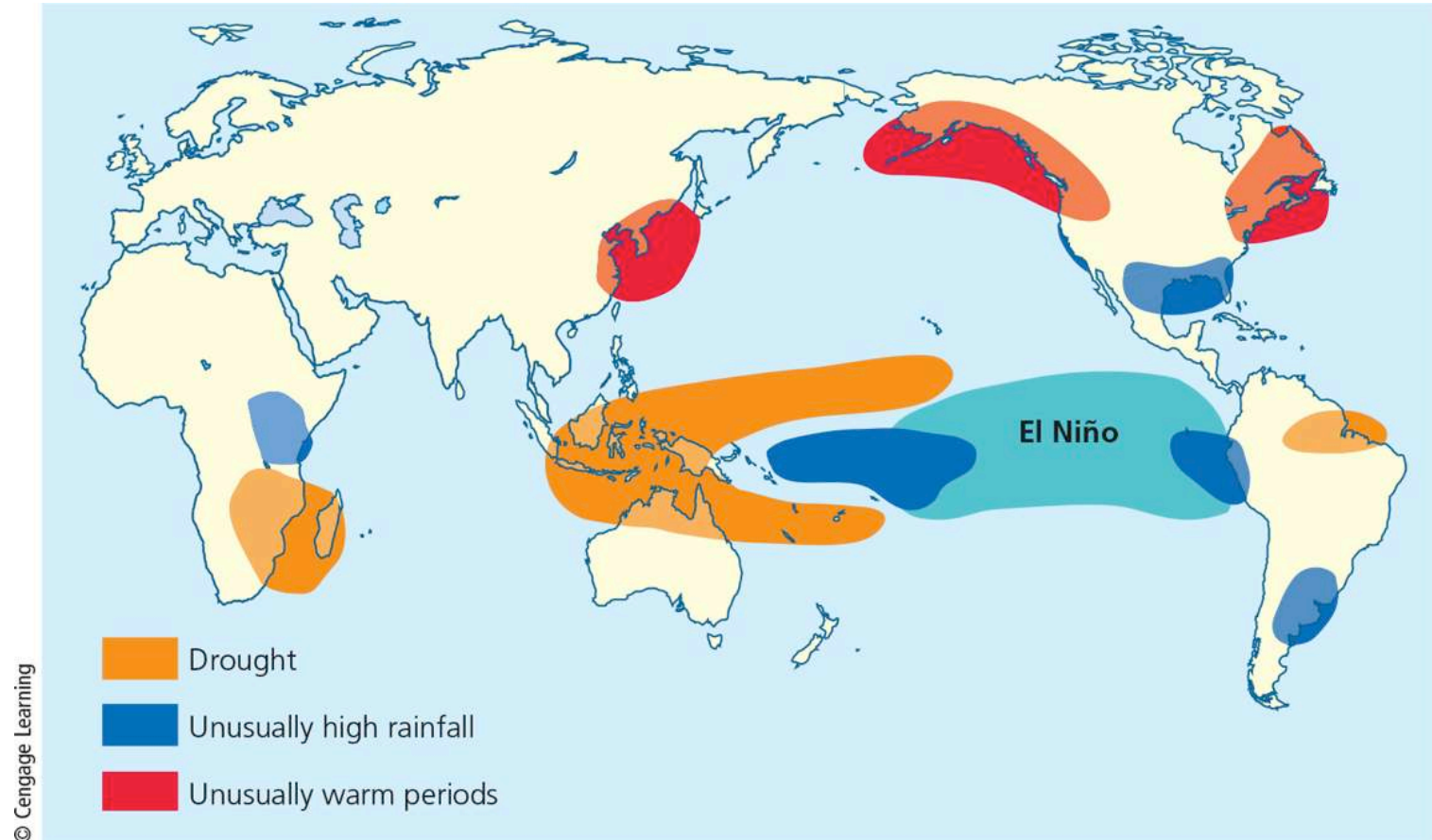
Weather is Affected by Atmospheric Pressure and Wind Patterns (3 of 5)

- Jet streams
 - Powerful winds that circle the globe
- El Niño-Southern Oscillation (ENSO)
 - Periodic change in wind patterns in the Pacific Ocean
 - Results in drier weather in some areas and wetter in others
 - Can alter conditions over two-thirds of the world

Weather is Affected by Atmospheric Pressure and Wind Patterns (4 of 5)



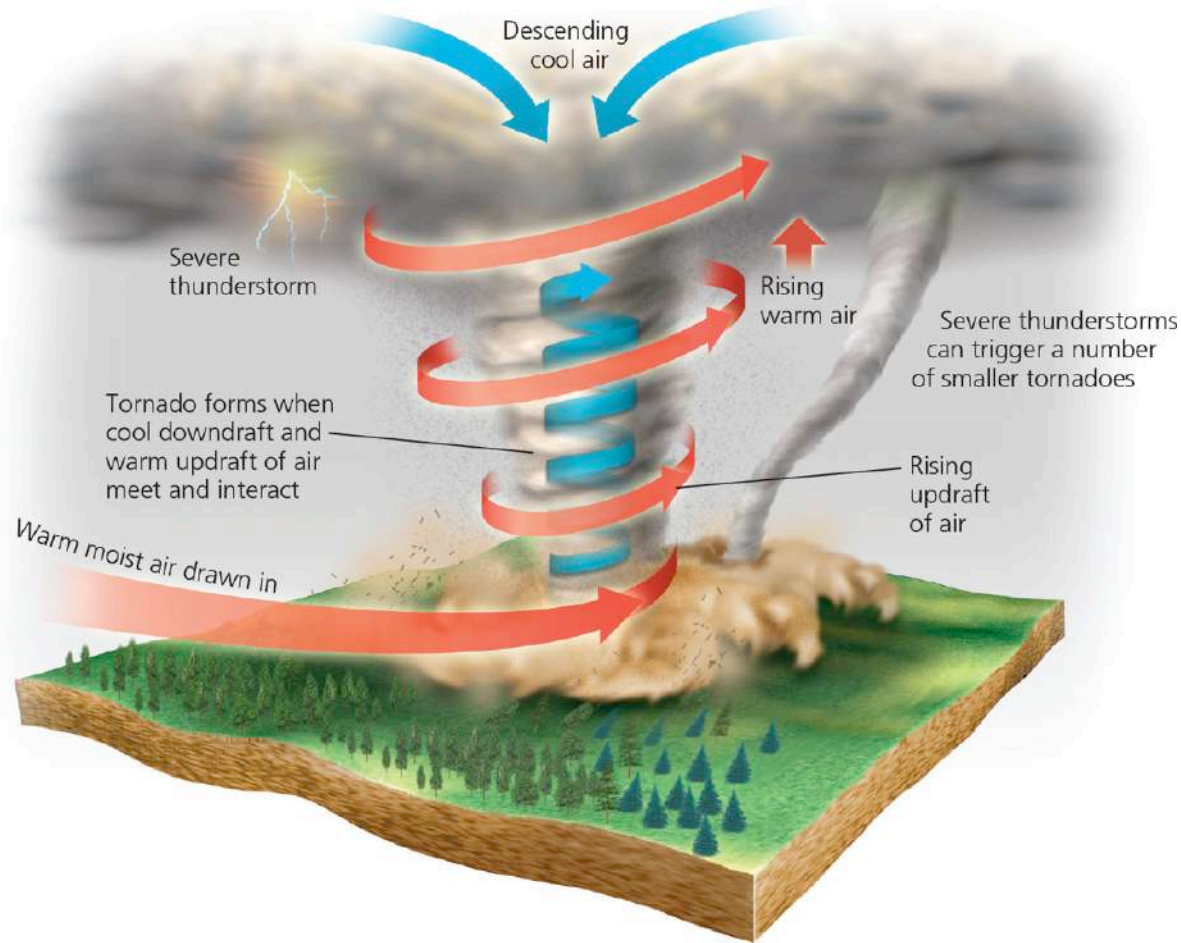
Weather is Affected by Atmospheric Pressure and Wind Patterns (5 of 5)



Tornados and Tropical Cyclones Are Violent Weather Extremes (1 of 3)

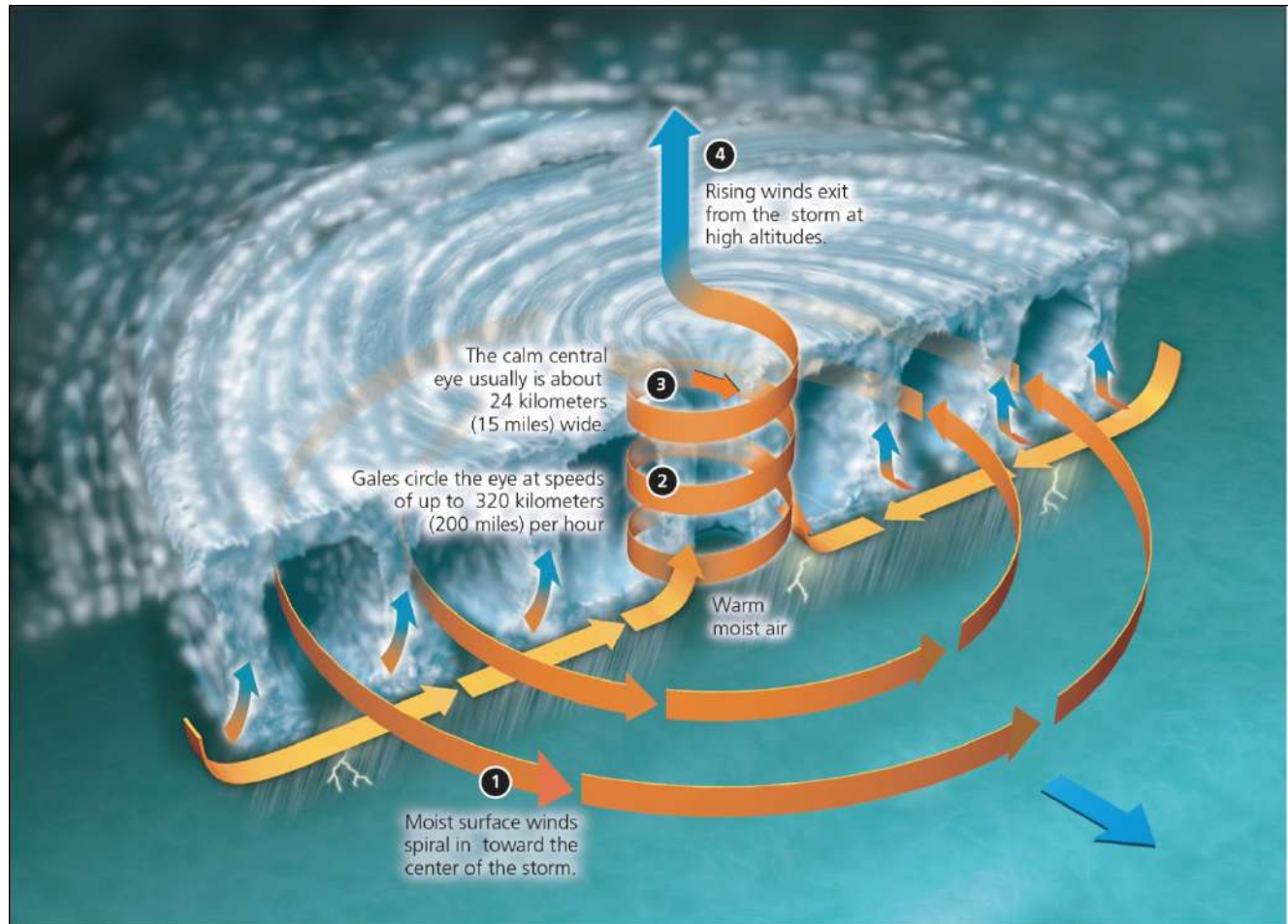
- Tornados
 - Violent weather event that forms over land
 - Vertical convection currents suck air upward
 - Most occur in American Midwest in spring
- Tropical cyclones
 - Form over warm ocean waters
 - Take a long time to form and gain strength
 - Intensities rated based on wind speeds

Tornados and Tropical Cyclones Are Violent Weather Extremes (2 of 3)



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Tornados and Tropical Cyclones Are Violent Weather Extremes (3 of 3)



7.2 What Factors Influence Climate?

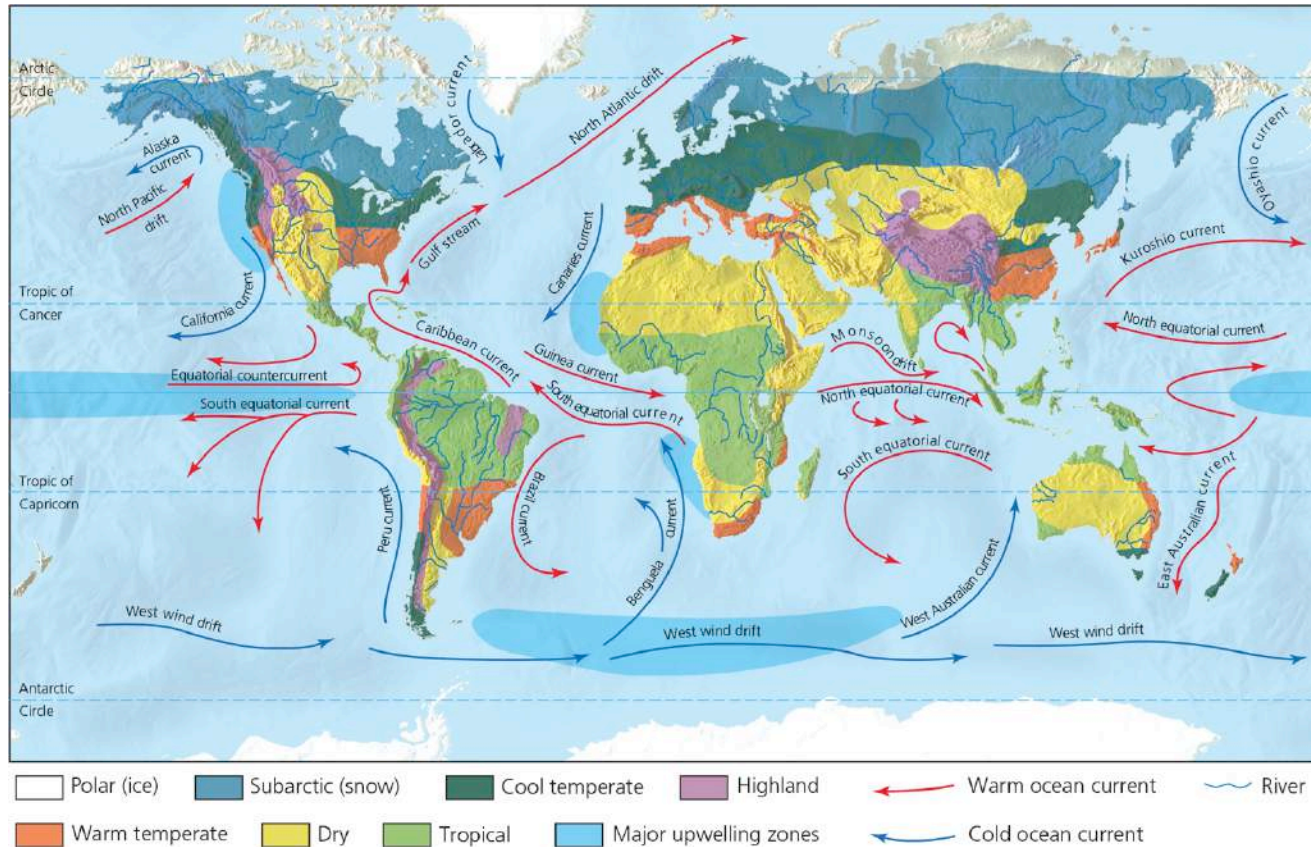
- Key factors that determine an area's climate
 - Incoming solar energy
 - The earth's rotation
 - Global patterns of air and water movement
 - Atmospheric gases
 - The earth's surface features

Several Factors Affect Regional Climates

(1 of 7)

- Weather
 - Temperature, precipitation, wind speed, and cloud cover
 - Hours to days
- Climate
 - Area's general pattern of atmospheric conditions over three decades and longer
 - Varies among the earth's different regions

Several Factors Affect Regional Climates (2 of 7)

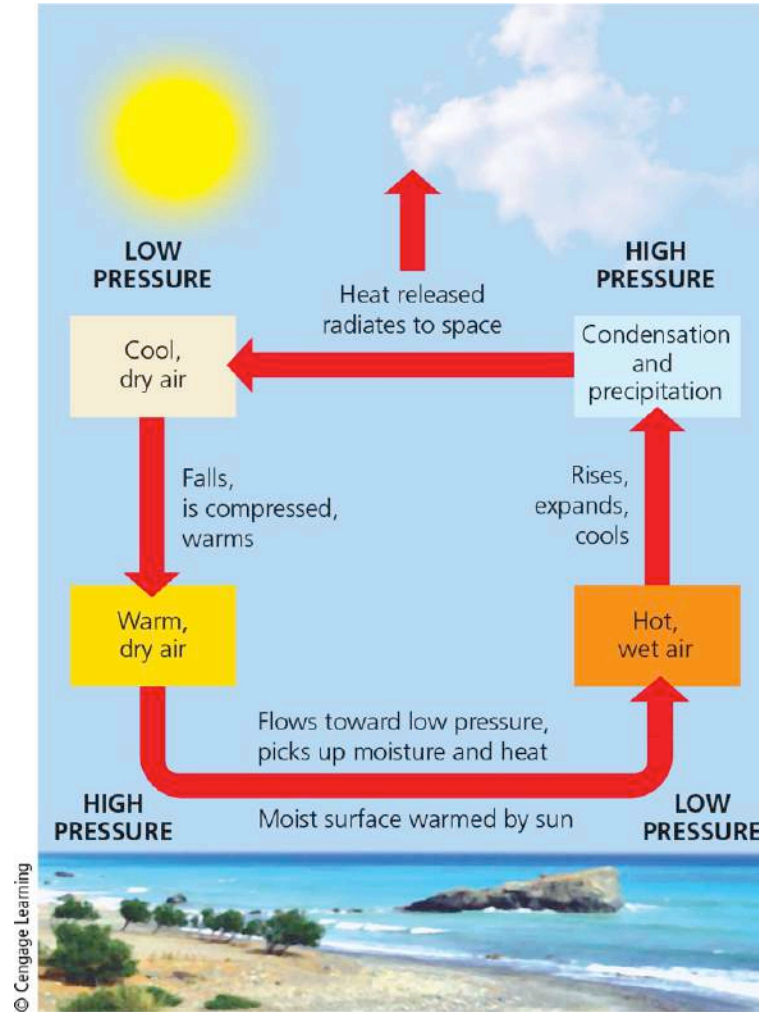


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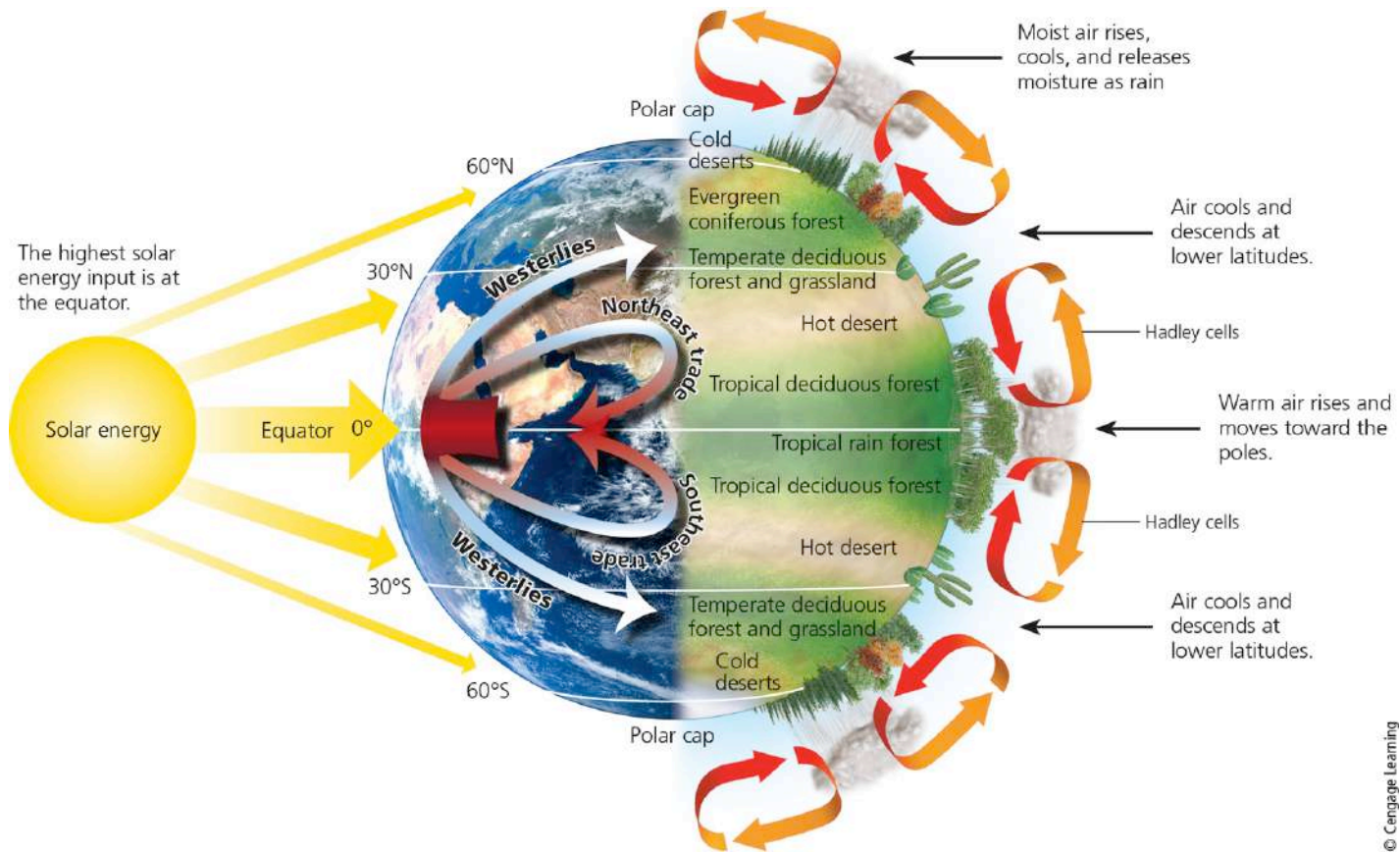
Several Factors Affect Regional Climates (3 of 7)

- Factors that determine regional climates
 - Cyclical air movement driven by solar energy
 - Uneven heating of the earth's surface by the sun
 - Varies with latitude
 - Tilt of earth's axis and resulting seasonal changes
 - Rotation of the earth on its axis
 - Ocean currents help redistribute sun's heat

Several Factors Affect Regional Climates (4 of 7)

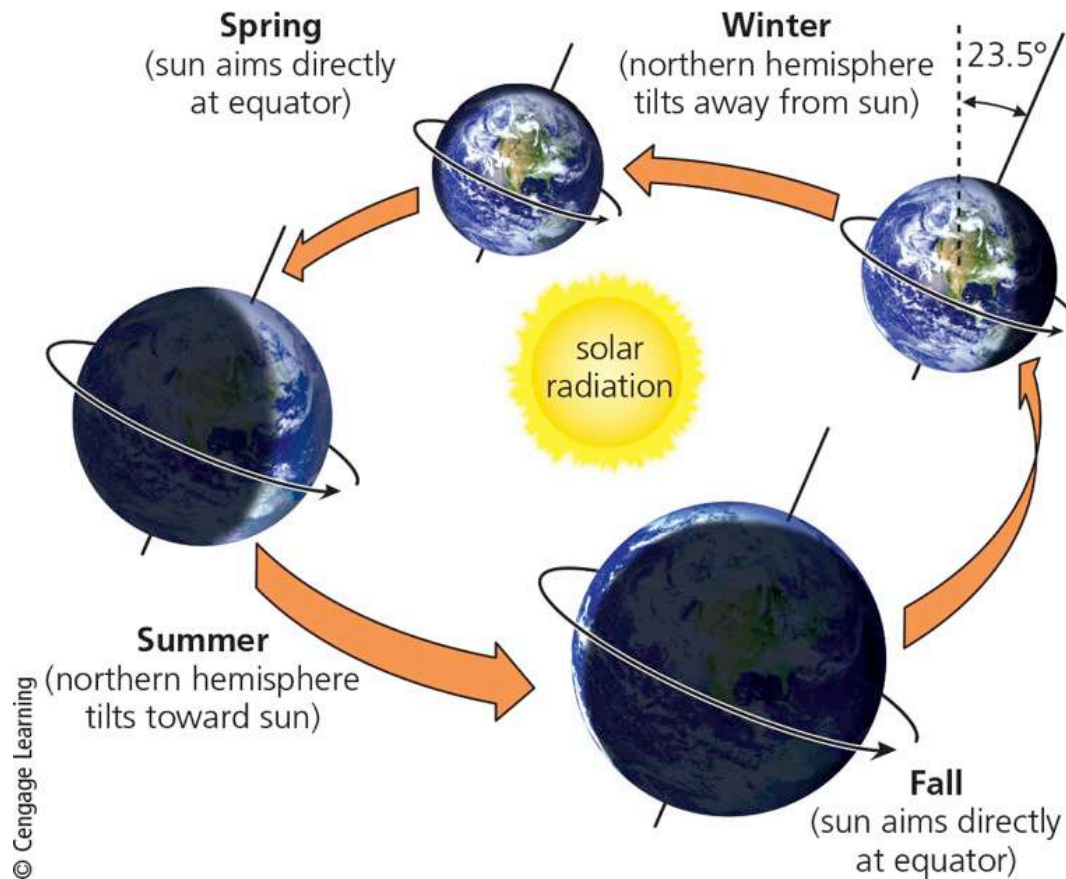


Several Factors Affect Regional Climates (5 of 7)

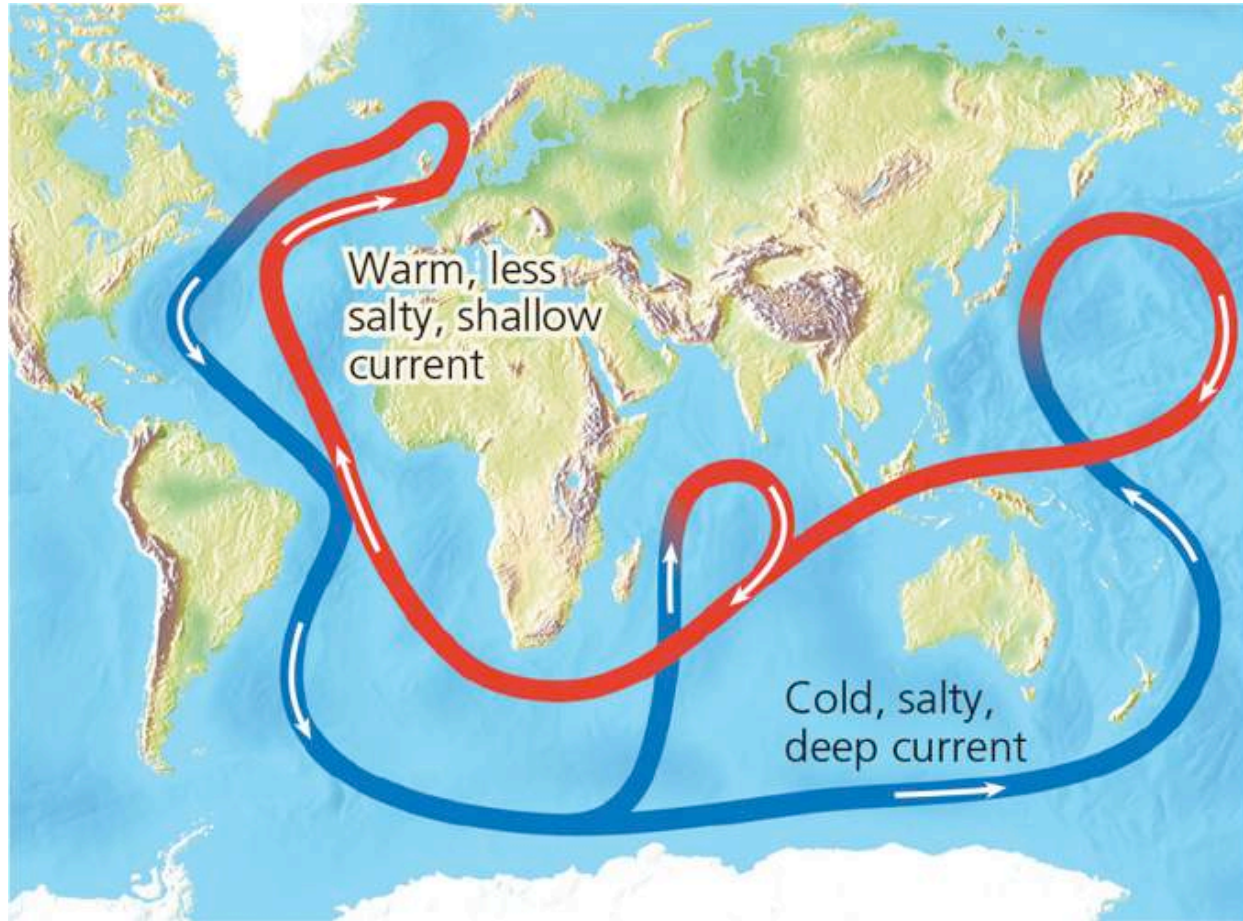


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Several Factors Affect Regional Climates (6 of 7)



Several Factors Affect Regional Climates (7 of 7)



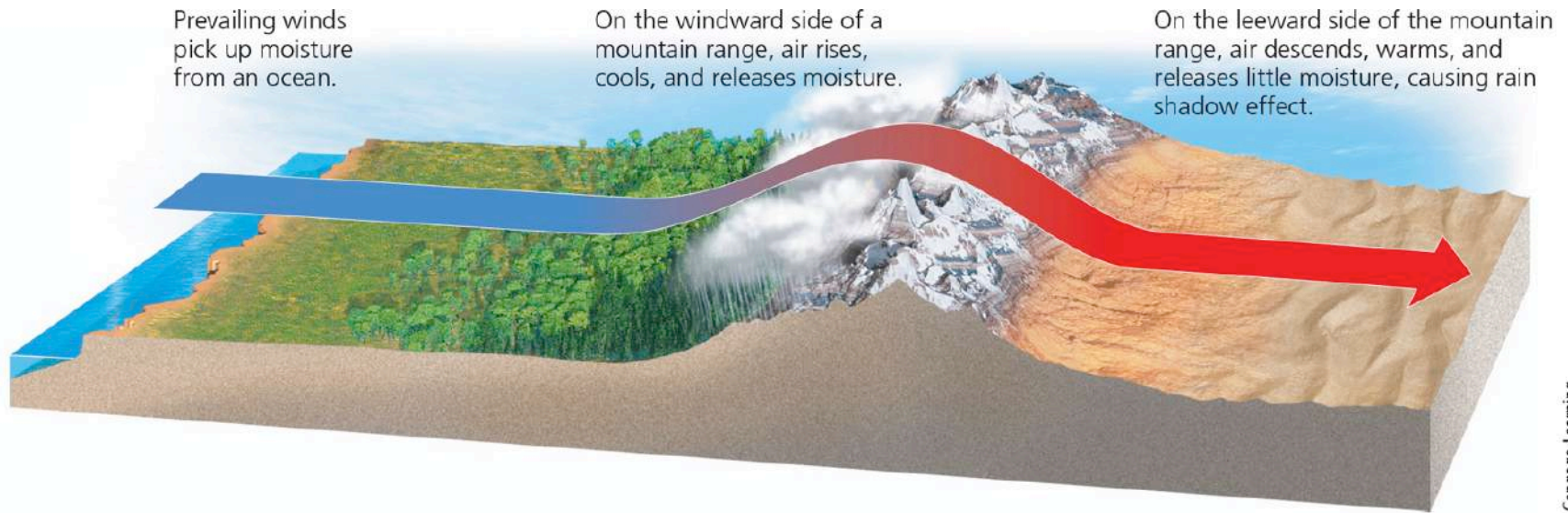
Greenhouse Gases Warm the Lower Atmosphere

- Greenhouse gases
 - H_2O
 - CO_2
 - CH_4
 - N_2O
- Natural greenhouse effect
 - Gases keep the earth habitable
- Human-enhanced global warming

The Earth's Surface Features Affect Local Climates (1 of 2)

- Mountains interrupt flow of prevailing winds
- Rain shadow effect
 - Most precipitation falls on the windward side of mountain ranges
 - Deserts leeward
- Cities create microclimates
 - Heat islands

The Earth's Surface Features Affect Local Climates (2 of 2)

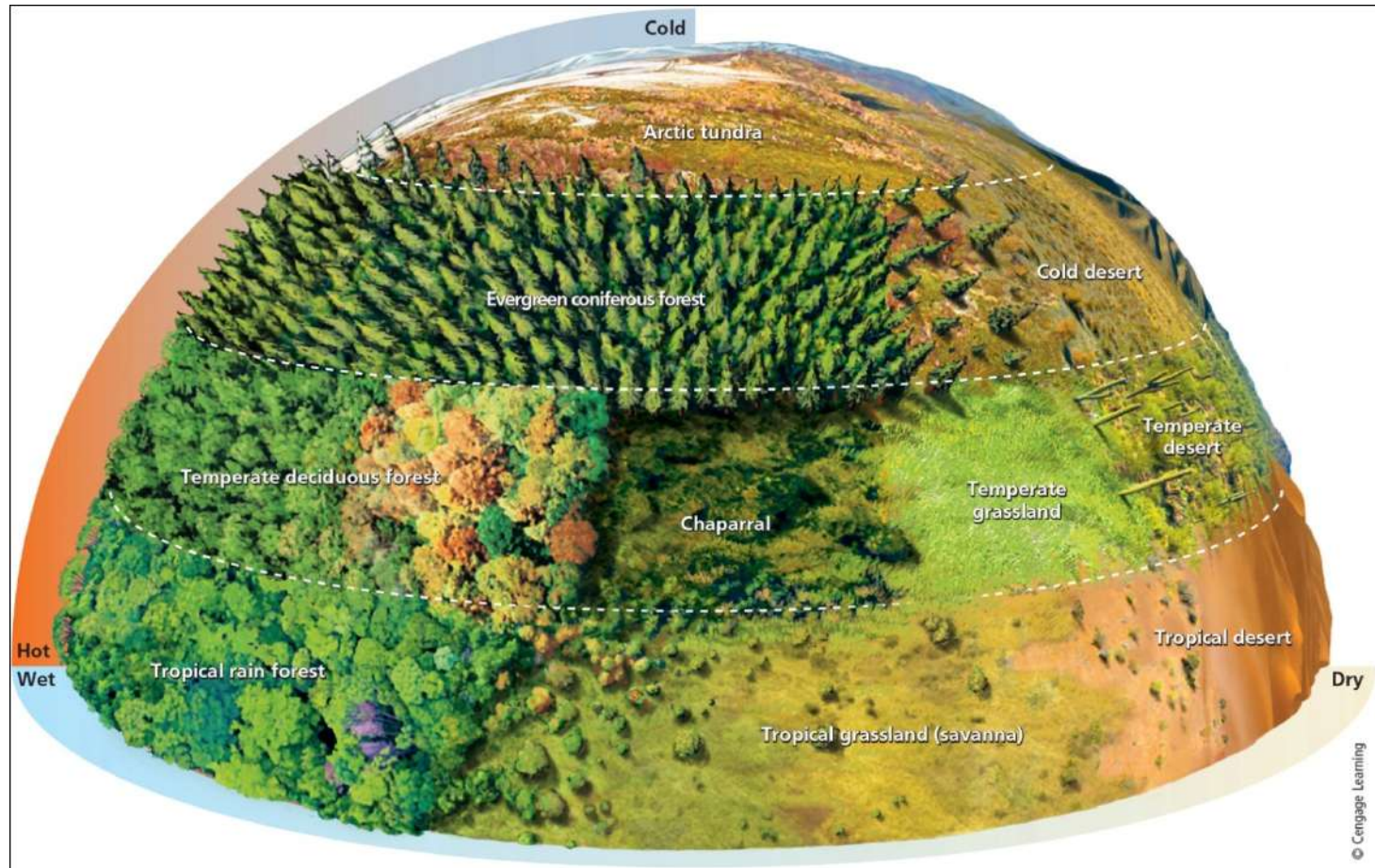


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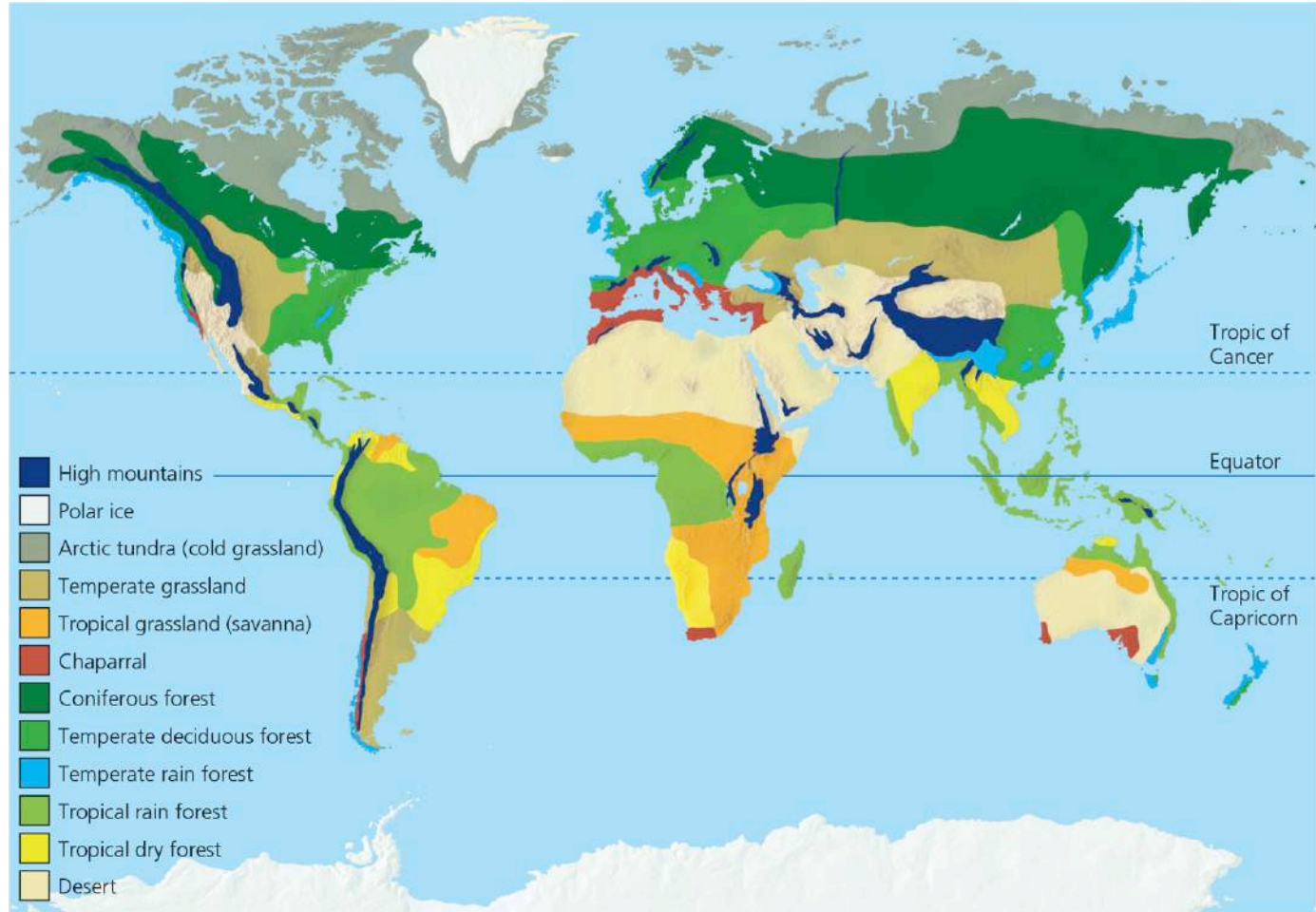
7.3 How Does Climate Affect the Nature and Locations of Biomes? (1 of 3)

- Biomes
 - Large terrestrial regions
 - Each characterized by different type of climate and plant life
 - Not uniform

7.3 How Does Climate Affect the Nature and Locations of Biomes? (2 of 3)



7.3 How Does Climate Affect the Nature and Locations of Biomes? (3 of 3)



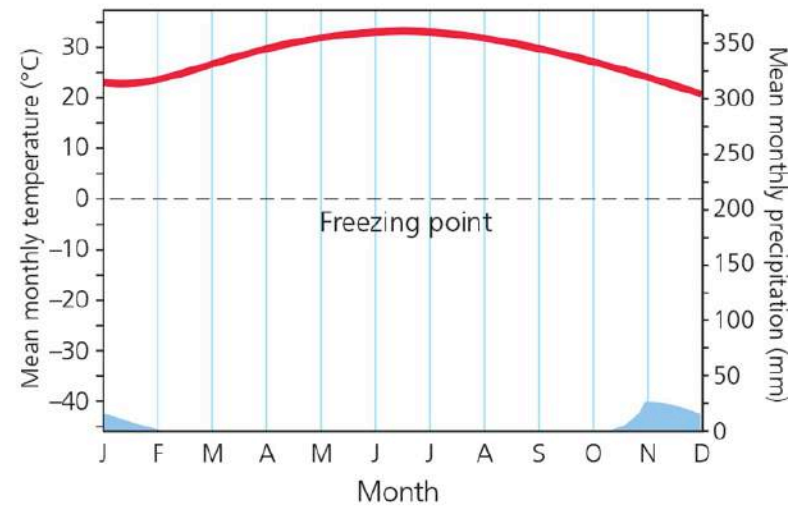
Three Types of Deserts (1 of 4)

- Desert – annual precipitation low and scattered unevenly throughout the year
 - Tropical deserts
 - Temperate deserts
 - Cold deserts
- Desert ecosystems vulnerable to disruption
 - Slow plant growth and low species diversity
 - Slow nutrient cycling

Three Types of Deserts (2 of 4)



Tropical desert

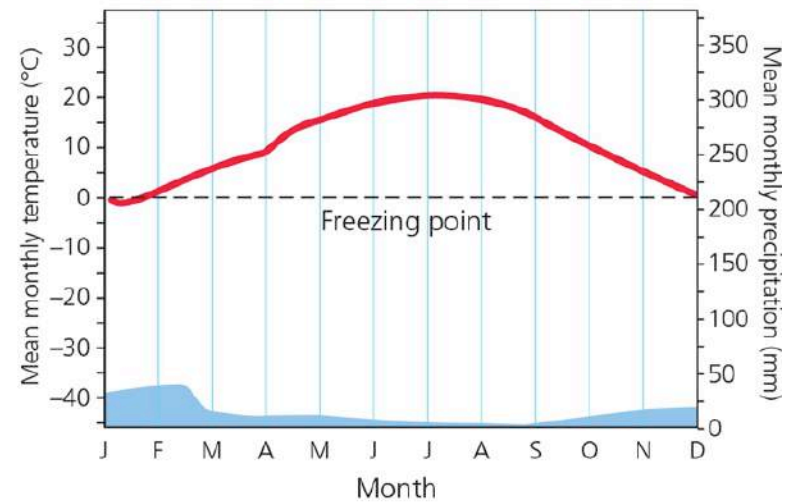


Three Types of Deserts (3 of 4)



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Temperate desert

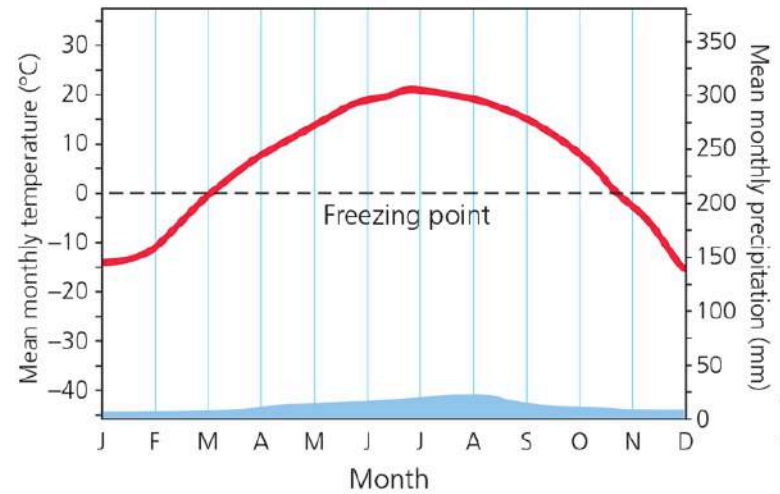


Three Types of Deserts (4 of 4)



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Cold desert



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Science Focus 7.1: Staying Alive in the Desert (1 of 2)

- Desert survival adaptations
 - Plant water conservation
 - Dormancy
 - Deep roots
 - Storing water in leaves
 - Waxy leaves reduce water loss
 - Open pores only at night

Science Focus 7.1: Staying Alive in the Desert (2 of 2)

- Desert animal adaptations
 - Hiding in cool burrows or rocky crevices by day
 - Dormancy
 - Camels drink massive amounts of water and store
 - Reptiles' thick outer coverings minimize water loss

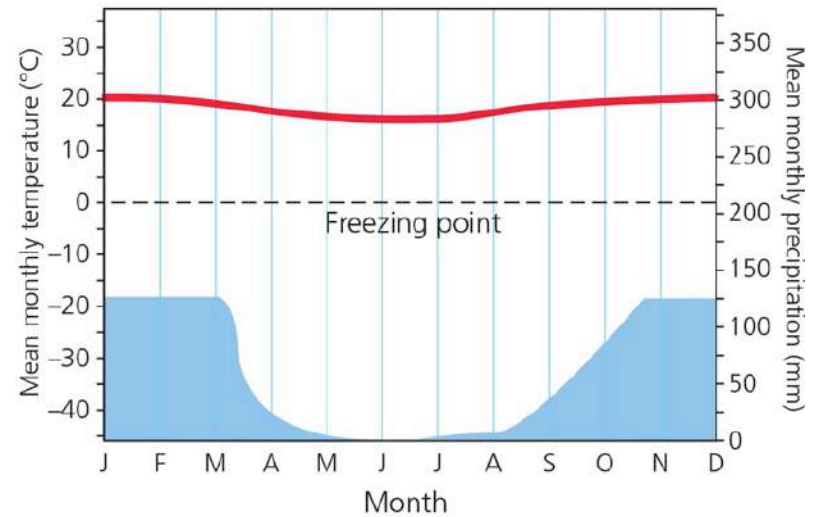
Three Types of Grasslands (1 of 7)

- Grasslands exist in continent interiors
 - Areas too moist for deserts but too dry for forests
- Three main types
 - Tropical
 - Temperate
 - Cold (arctic tundra)

Three Types of Grasslands (2 of 7)



Tropical grassland (savanna)

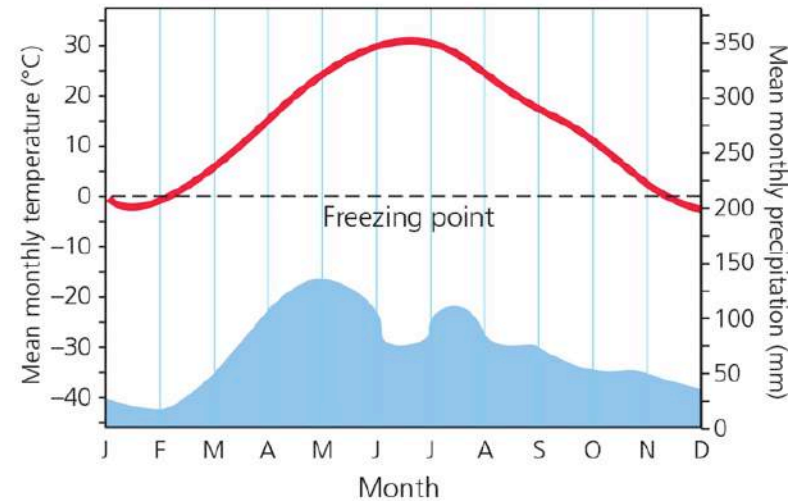


Three Types of Grasslands (3 of 7)



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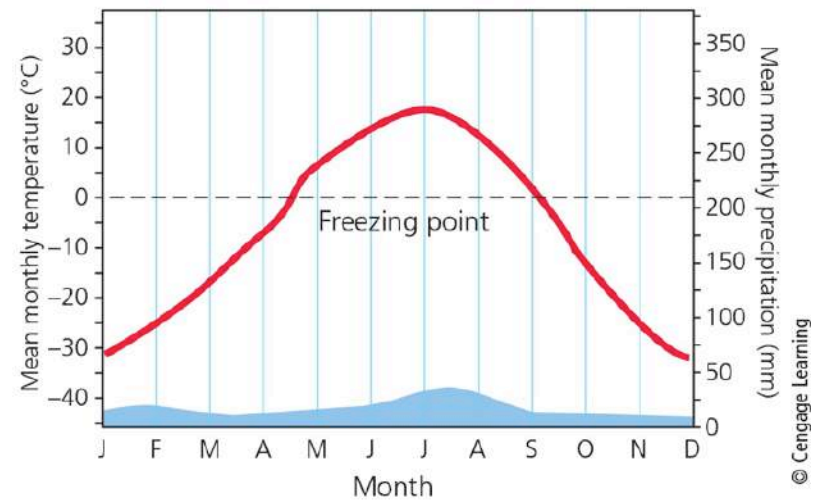
Temperate grassland (prairie)



Three Types of Grasslands (4 of 7)



Cold grassland (arctic tundra)



Three Types of Grasslands (5 of 7)

- Tropical
 - Savanna
 - Warm temperatures year-round
 - Grazing and browsing animals
- Temperate
 - Cold winters and hot, dry summers
 - Tallgrass prairies
 - Short-grass prairies
 - Often converted to farmland

Three Types of Grasslands (6 of 7)



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Three Types of Grasslands (7 of 7)

- Arctic tundra
 - Plants close to ground to conserve heat
 - Most growth in short summer
 - Animals have thick fur
 - Permafrost
 - Underground soil that stays frozen
- Alpine tundra
 - Above tree line in mountains

Chaparral: A Dry, Temperate Biome (1 of 2)

- Occur in coastal regions that border deserts
- Dense growths of low growing, evergreen shrubs
- Some small trees with leathery leaves
- Thin soil
- Adapted to and maintained by occasional fires

Chaparral: A Dry, Temperate Biome (2 of 2)



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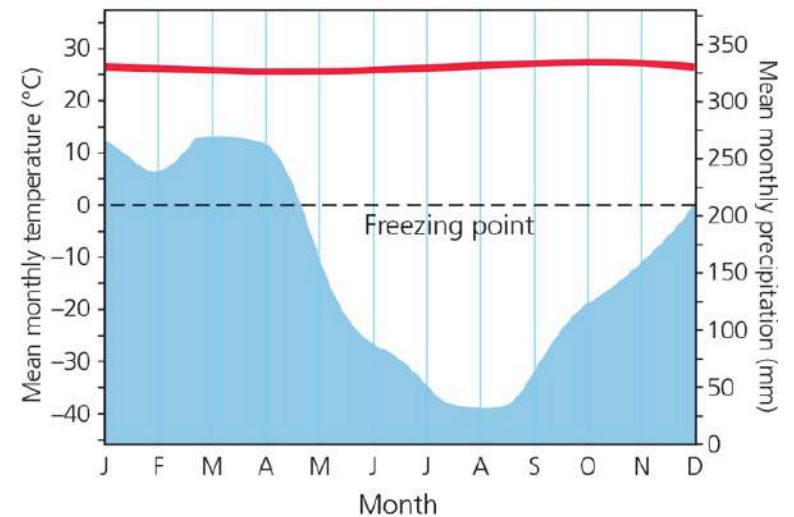
Three Types of Forests (1 of 9)

- Forests – lands dominated by trees
- Tropical
- Temperate
- Cold
 - Northern coniferous and boreal

Three Types of Forests (2 of 9)



Tropical rain forest

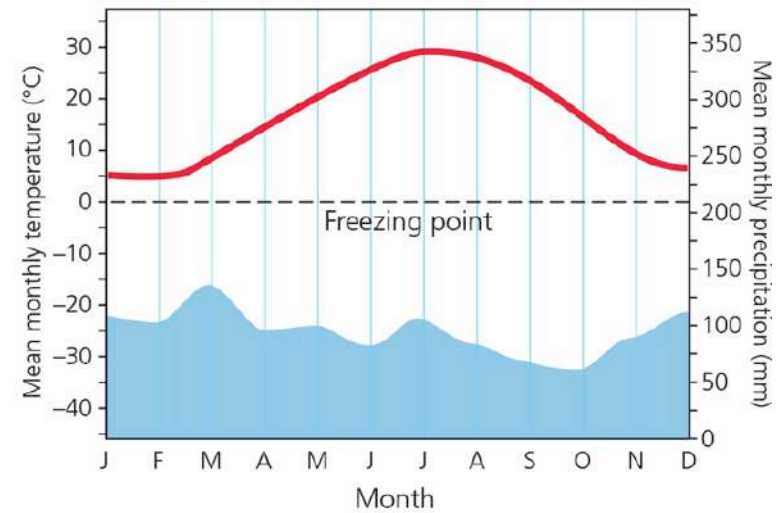


Three Types of Forests (3 of 9)



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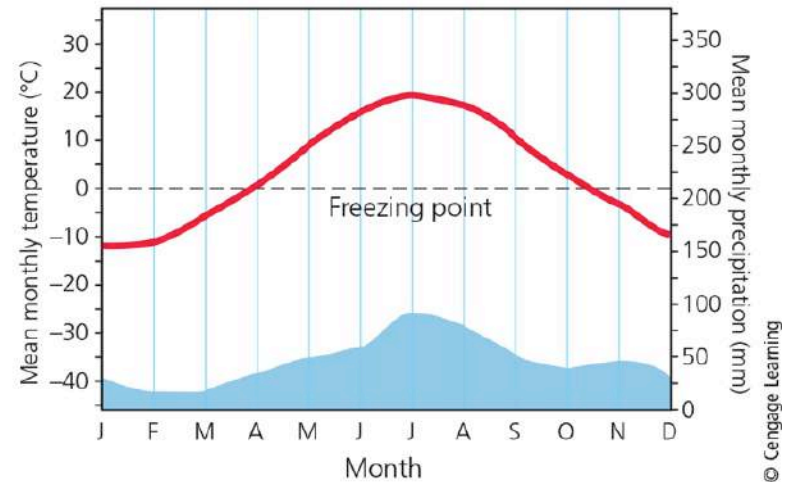
Temperate deciduous forest



Three Types of Forests (4 of 9)



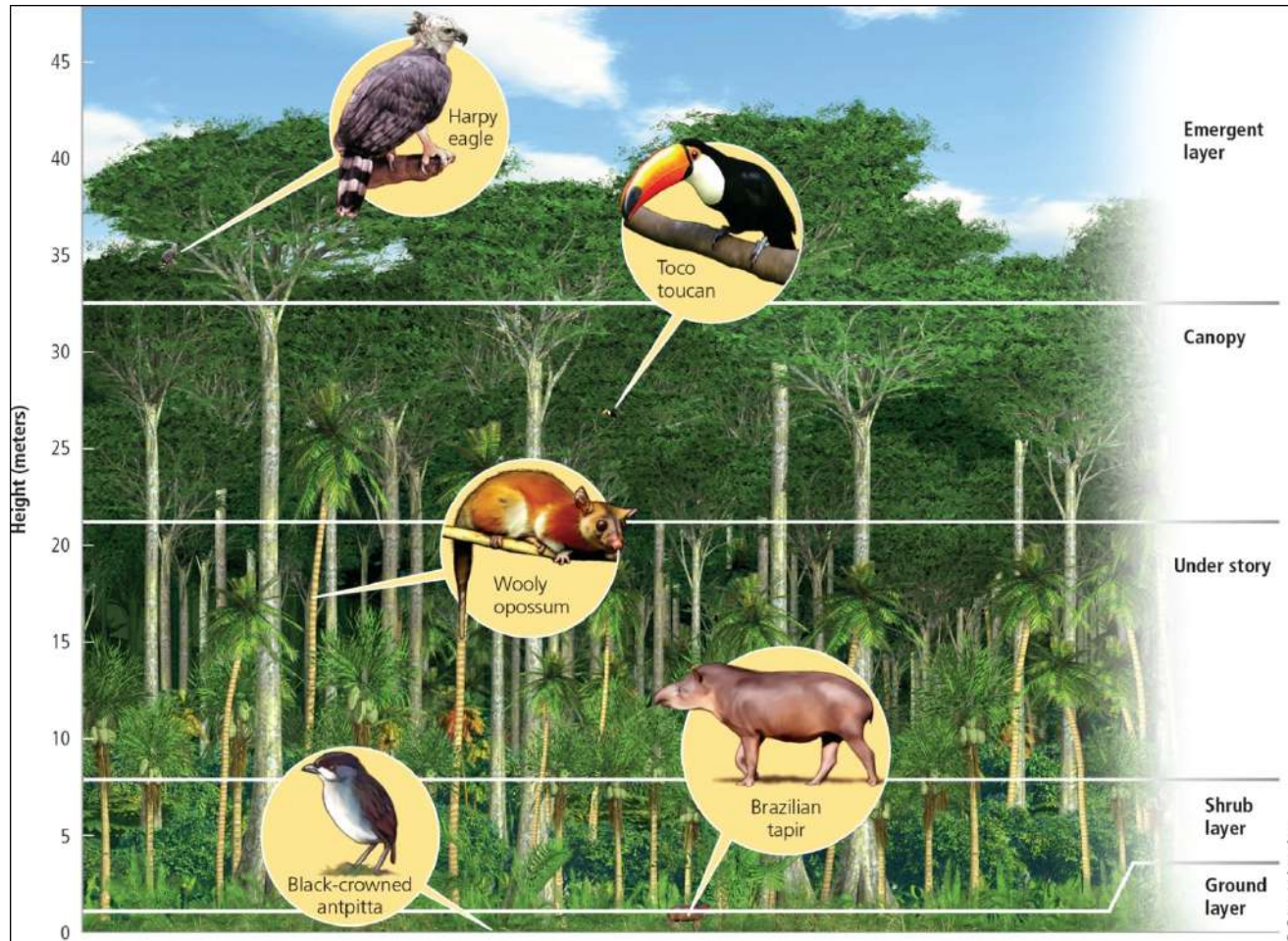
Northern coniferous forest (boreal forest, taiga)



Three Types of Forests (5 of 9)

- Tropical rain forests
 - Hot, high moisture air
 - Stratification of specialized plant and animal niches
 - Rapid recycling of scarce soil nutrients
 - What is the impact of human activities in the rain forest?

Three Types of Forests (6 of 9)



Three Types of Forests (7 of 9)

- Temperate deciduous forests
 - Cooler temperatures, abundant moisture
 - Broadleaf deciduous trees
 - Slow rate of decomposition
 - What is the impact of human activities on temperate forests?

Three Types of Forests (8 of 9)



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Three Types of Forests (9 of 9)

- Coastal coniferous forest
 - Also called temperate rain forests
 - Found in scattered coastal regions
 - Ample rainfall and moisture from fog
 - Evergreen coniferous trees
- Cold (northern) coniferous forest
 - Also called boreal forests or taigas
 - South of arctic tundra
 - Cold winters and short summers

Mountains Play Important Ecological Roles (1 of 2)

- Mountains – steep or high elevation lands
 - Large portion of world's forests
 - Islands of biodiversity
 - Habitats for endemic species
 - Help regulate the earth's climate
 - Major storehouses of water
 - Role in hydrologic cycle

Mountains Play Important Ecological Roles (2 of 2)



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Critical Concepts: Valuation of Natural Capital

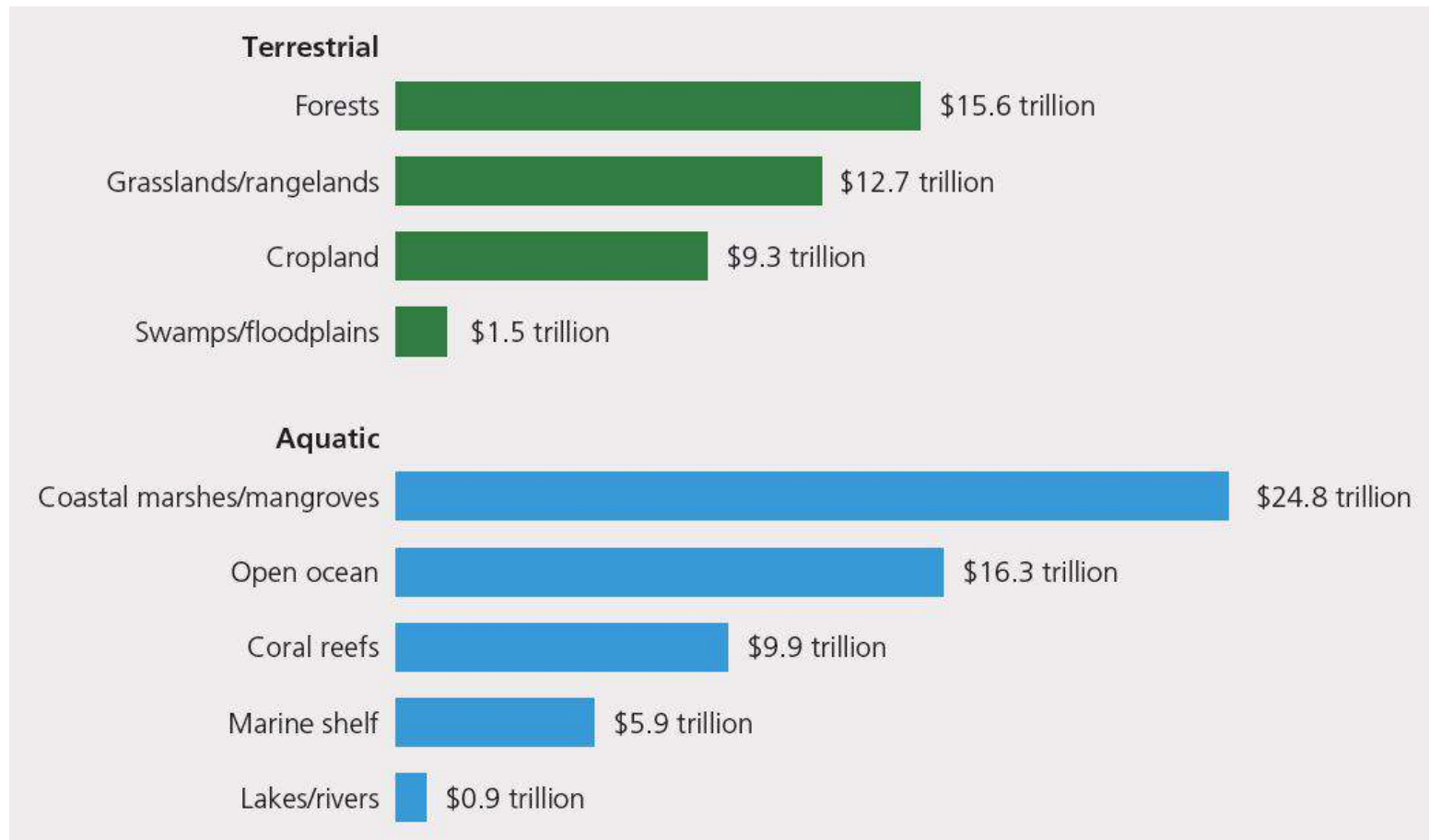
(1 of 3)

- Robert Costanza and his colleagues estimate the economic value of ecosystem services by the earth's forests to be \$15.6 trillion per year
- Far greater in value than the amount of money the felled timber would bring
- Underpricing of natural resources when not considering the services they provide leads to unsustainable management.

Critical Concepts: Valuation of Natural Capital (2 of 3)

- Important ecosystem services include
 - Pollination
 - Clean water
 - Seed dispersal
 - Soil fertility
 - Decomposition of organic waste
 - Pest control
 - Flood control
 - Climate regulation
 - Cycling of nutrients

Critical Concepts: Valuation of Natural Capital (3 of 3)



Humans Have Disturbed Much of the Earth's Land (1 of 2)

- About 60% of world's major terrestrial ecosystems being degraded or used unsustainably
- The human ecological footprint is spreading across the globe

Humans Have Disturbed Much of the Earth's Land (2 of 2)

Natural Capital Degradation

Major Human Impacts on Terrestrial Ecosystems

Deserts	Grasslands	Forests	Mountains
			
<p>Large desert cities</p> <p>Destruction of soil and underground habitat by off-road vehicles</p> <p>Depletion of groundwater</p> <p>Land disturbance and pollution from mineral extraction</p>	<p>Conversion to cropland</p> <p>Release of CO₂ to atmosphere from burning grassland</p> <p>Overgrazing by livestock</p> <p>Oil production and off-road vehicles in arctic tundra</p>	<p>Clearing for agriculture, livestock grazing, timber, and urban development</p> <p>Conversion of diverse forests to tree plantations</p> <p>Damage from off-road vehicles</p> <p>Pollution of forest streams</p>	<p>Agriculture</p> <p>Timber and mineral extraction</p> <p>Hydroelectric dams and reservoirs</p> <p>Air pollution blowing in from urban areas and power plants</p> <p>Soil damage from off-road vehicles</p>