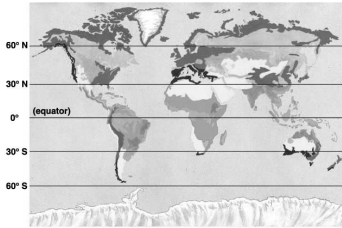


## Chapter 29: Earth's Diverse Ecosystems



"We must consider our planet to be on loan from our children,  
rather than being a gift from our ancestors."

Gro Harlem Brundtland, former Prime Minister of Norway

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### Factors Affecting Distribution of Life on Earth:

- 1) Weather: *Short-term* fluctuations in temperature, humidity, cloud cover, wind, and precipitation in a region
  - ❖ Affects individual organisms (days / weeks)
- 2) Climate: *Long-term* patterns of weather that prevail in a region
  - ❖ Affects distributions of species (years / centuries)

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### What Drives Weather / Climate?

#### • The Sun!

- ❖ Influences wind,
- ❖ ocean currents,
- ❖ global water cycles




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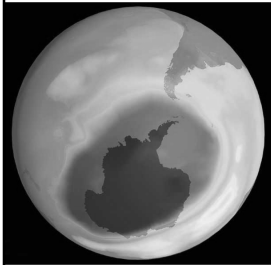
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### Factors Affecting Distribution of Life on Earth:

Ozone Layer: Protective layer of atmosphere which blocks UV radiation from sun

- UV radiation damages biological molecules



- ❖ Ozone layer ↓ due to chlorofluorocarbons (CFCs)
- ❖ Other factors in ozone depletion:
  - Carbon tetrachloride
  - trichloroethane

Earth Watch - Pg. 850

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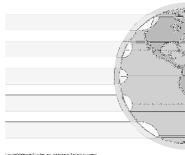
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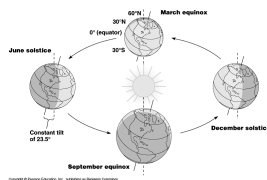
### Physical Factors Influencing Climate:

- 1) Latitude influences the angle at which the sunlight strikes earth

Latitude: The distance (in degrees) a location is away from the equator (north or south)



- Curvature affects temperature
  - ↑ temperatures at equator
  - ↓ temperatures closer to poles



- Tilt affects season
    - NH towards sun = summer
    - NH away from sun = winter
- NH = Northern Hemisphere

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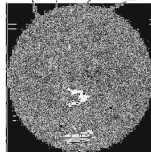
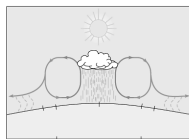
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### Physical Factors Influencing Climate:

- 2) Air currents produce broad climatic regions



- Generated by:
  - 1)  $\Delta$  temperature
    - ❖ Warm air rises (rain)
    - ❖ Cool air falls (dry)
  - 2) rotation of earth (wind)

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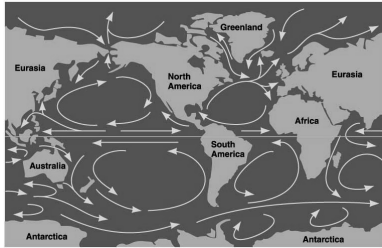
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### Physical Factors Influencing Climate:

#### 3) Ocean Currents Moderate Near-Shore Climates

- Water cools / warms slower than air / land



Currents driven by:

- 1) Earth's rotation
- 2) Wind
- 3) Solar energy

Gyres:  
Circular current patterns

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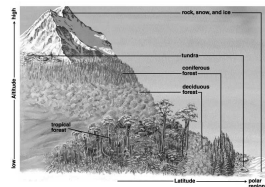
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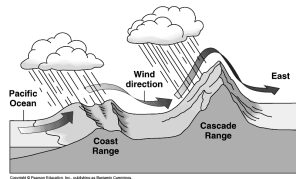
### Physical Factors Influencing Climate:

#### 4) Geological structures alter temperature & flow of wind / water



↑ Elevation = ↓ Temperature

Local dry areas  
Mountains create rain shadows:




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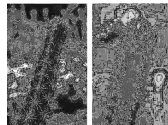
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### Fundamental Requirements of Life:

- 1) Nutrients to construct living tissue
- 2) Energy to power construction of tissue
- 3) Liquid water = medium for chemical reactions to occur
- 4) Appropriate temperature to carry out reactions



### Resources unevenly distributed around globe

- Regions with similar resources tend to have similar types of organisms organized into similar types of communities
- **Biome:** Large land areas with similar environmental communities and plant communities
  - ❖ Influenced primarily by precipitation & temperature

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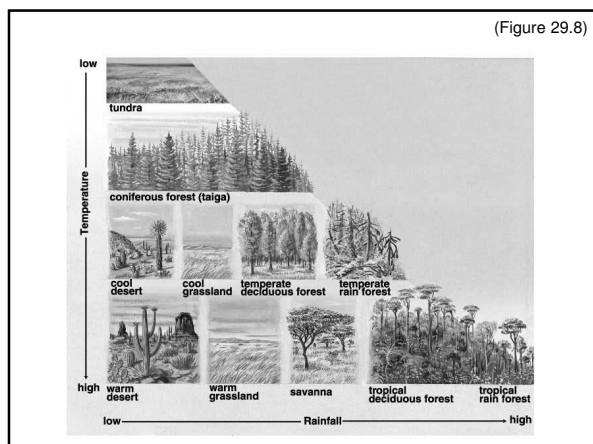
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(Figure 29.8)




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## Terrestrial Biomes of Earth:

### 1) Tropical Rain Forest



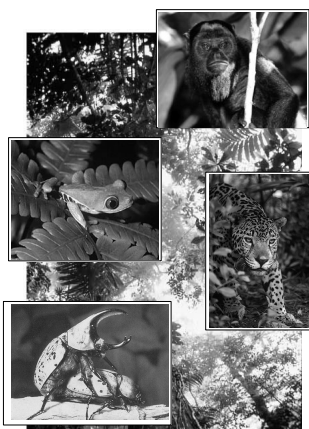
Temperature = High (Constant)  
Precipitation = High (Constant)

Dominant Plant:

Broadleaf Evergreen Trees

- Highest biodiversity of earth's ecosystems
- Majority of nutrients tied up in vegetation

Human Impact: Deforestation




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## Terrestrial Biomes of Earth:

### 2) Savanna



Temperature = High (Constant)  
Precipitation = Low (Seasonal)

Dominant Plant:

Grasslands

- More large mammals than other ecosystems

Human Impact: Poaching  
Grazing  
Fencing




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Terrestrial Biomes of Earth:

3) Deserts



Temperature = High / Low (Seasonal)  
Precipitation = Low (< 10 in. / yr.)

Dominant Plant:  
Shallow-rooted, waxy-coated plants

- Low productivity (slow growing)
- Animals adapted to live on very little water & hot temperatures

Human Impact: Vehicular destruction



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Terrestrial Biomes of Earth:

4) Chaparral



Temperature = High / Low (Seasonal)  
Precipitation = Medium (Seasonal)

- Frequent fogs (close to sea)

Dominant Plant:  
Small trees / large bushes

- Maintained by frequent lightning fires

Human Impact: Grazing



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Terrestrial Biomes of Earth:

5) Grasslands (Prairies)



Temperature = Moderate (seasonal)  
Precipitation = Moderate (seasonal)

Dominant Plant:  
Grasses (trees by rivers)

- Maintained by frequent fires and droughts
- Most fertile soil of all ecosystems

Human Impact: Agriculture / grazing



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Terrestrial Biomes of Earth:

6) **Temperate Deciduous Forest**

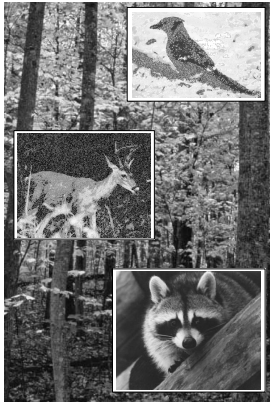


Temperature = Moderate (seasonal)  
Precipitation = Moderate (constant)

Dominant Plant:  
Broadleaf Deciduous Trees

- Decaying leaf litter offers vibrant forest floor flora / fauna

Human Impact: Decreased predators  
Habitat destruction



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Terrestrial Biomes of Earth:

6a) **Temperate Rain Forests**



Temperature = Moderate (constant)  
Precipitation = High (constant)

Dominant Plant:  
Conifer Evergreen Trees



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Terrestrial Biomes of Earth:

7) **Taiga (Northern Coniferous Forest)**



Temperature = Low (seasonal)  
Precipitation = Low / Moderate

Dominant Plant:  
Conifer Evergreen Trees

- Short growing season
- Low biodiversity

Human Impact: Clear-cutting (low lat.)  
Undisturbed (high lat.)



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## Terrestrial Biomes of Earth:

### 8) Tundra



Temperature = Low (seasonal)  
Precipitation = Low ("freezing" desert)

Dominant Plant:  
Mosses & small plants

- Permafrost: Permanently frozen soil ~ 1.5 feet below surface
- 24 hour day / night

Human Impact: Construction (localized)




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## Fundamental Requirements of Life:

- 1) Nutrients to construct living tissue
  - 2) Energy to power construction of tissue
  - 3) Liquid water = medium for chemical reactions to occur
  - 4) Appropriate temperature to carry out reactions
- Strongly Influence Aquatic Environments
- Strongly Influence Biomes

What about Aquatic Environments (71% of earth)?

- Plenty of liquid water
- Temperature relatively stable (slower to heat / cool than air)
- Energy concentrated near surface (water absorbs energy)
- Nutrients concentrated near bottom (sedimentation)

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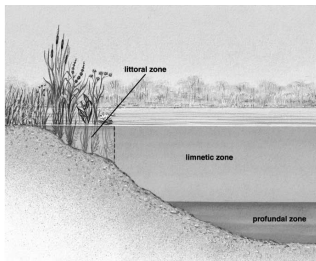
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## Aquatic Ecosystems of Earth:

### 1) Freshwater (e.g. lakes)

- Life zones in lake determined by light / nutrient availability



(Figure 29.24)

- 1) Littoral Zone:
  - Near shore (shallow)
  - Adequate nutrients / light
  - Diverse communities
- 2) Limnetic Zone:
  - Open-water region
  - Free-floating autotrophs
- 3) Profundal Zone:
  - Bottom of lake (deep)
  - Decomposers / detritus feeders (no autotrophs)

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## Freshwater systems “burp”

- Because of the high amount of decomposition and volcanic origins, a few lakes can “burp” deadly gasses
  - ❖ Carbon Dioxide (CO<sub>2</sub>)
  - ❖ Methane
- Two lakes recently “burped”
  - ❖ 1700 people died when Lake Nyos outgassed CO<sub>2</sub> in 1986
  - ❖ 34 died when Lake Monoun outgassed CO<sub>2</sub> in 1984



This ox died when Lake Nyos outgassed CO<sub>2</sub>

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## Water fountains

- Prevent decomposition gasses from building under stagnant, usually man made, lakes.
  - ❖ Though not dangerous, these lakes can “burp” very smelly methane gasses.




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## Aquatic Ecosystems of Earth:

### 1) Freshwater (e.g. lakes)

- Lakes classified on basis of nutrient content



#### 1) Oligotrophic (“poorly fed”) Lake

- Low sediment (clear / deep)
- ↑ light = ↑ photosynthesis = ↑ oxygen



#### 2) Eutrophic (“well fed”) Lake

- High sediment (cloudy / shallow)
- ↑ algae = ↑ decomposition = ↓ oxygen

Human Impact: Eutrophication  
Acid rain

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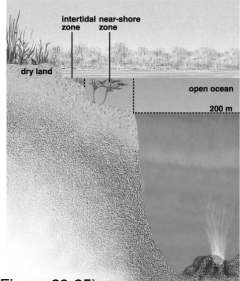
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## Aquatic Ecosystems of Earth:

### 2) Marine

- Zones determined by light availability



(Figure 29.25)

#### 1) Photic Zone:

- Upper layer
- Energy = photosynthesis

#### 2) Aphotic Zone:

- Lower layer
- Energy = Detritus / Predation

- Photic zone nutrient sources:

- Land run-off
- Upwelling (from aphotic zone)

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## Aquatic Ecosystems of Earth:

### 2) Marine

- Marine Biomes:

#### A) Coastal Waters



- Support most abundant marine life
- Consist of: 1) Intertidal zone  
2) Near-shore zone (e.g. estuaries)

#### Human Impact:

- Coastal wetlands destroyed
- Erosion / pollution / overfishing

#### B) Coral Reefs



- Found in warm, shallow waters
- High biodiversity
- Algae / coral in mutualistic relationship
- Reef = calcium carbonate

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## Aquatic Ecosystems of Earth:

### 2) Marine

- Marine Biomes:

#### C) Open Ocean

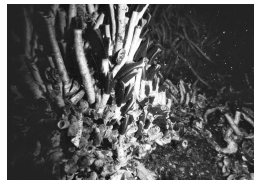


- Pelagic: Free-swimming / floating organisms
- Phytoplankton ("floating plants")
- Zooplankton ("floating animals")

#### Human Impact:

- Overfishing
- Pollution

#### D) Hydrothermal Vents



- Energy source = hydrogen sulfide
- Chemosynthesis (bacteria)
- Organisms withstand extremely high temperatures

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