Introduction to Ecology

19-1 p. 359-365

Essential Question

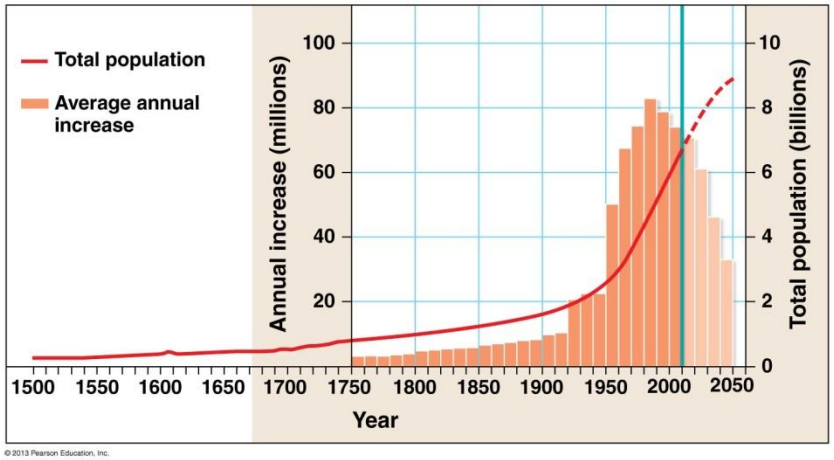
1. Identify three ways in which the expanding human population impacts the environment.
2. Describe the hierarchical levels of organization in living systems from organisms to the biosphere.
3. Give an example of how organisms are interconnected and how a disturbance can affect an entire ecosystem.

Ecology

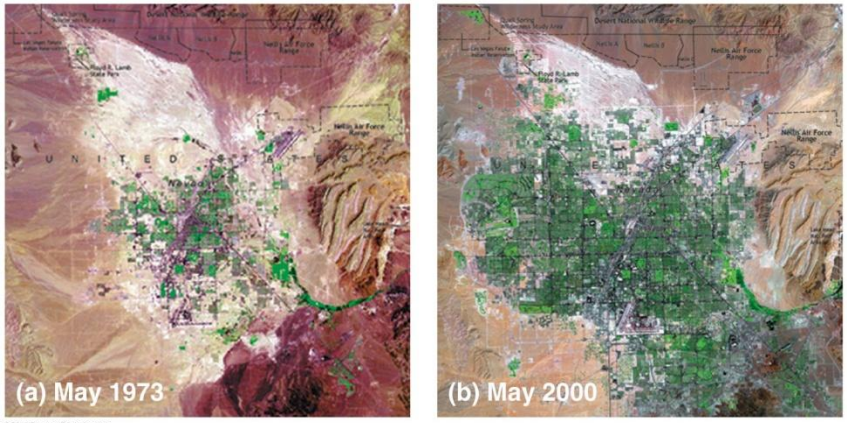
- Ecology is the study of the interactions between organisms and the living & nonliving components of their environment


© 2013 Pearson Education, Inc.

Today's Environment – The Exploding Human Population



© 2013 Pearson Education, Inc.



© 2013 Pearson Education, Inc.

- The human population has been & continues to grow exponentially
  - It has more than tripled in the last 30 years!
  - The current human population is 7.2 billion
- The amount of resources on Earth is limited
  - Providing for the human population will be more and more difficult as our numbers increase
- Like all organisms, human alter the environment, but on a much greater scale

The Sixth Mass Extinction

- As the human population increases, many other species have declined or gone extinct
- These species are eliminated by:
  - Habitat destruction
  - Overhunting
  - Introduction of predators or disease
  - Other human activities

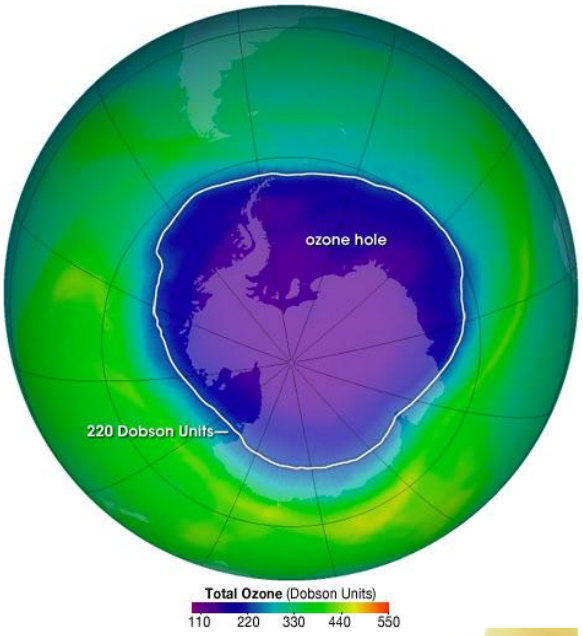
A Chinese river dolphin

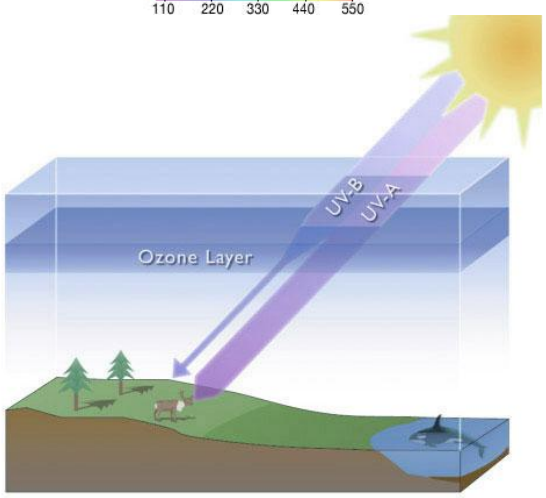
© 2013 Pearson Education, Inc.

Golden toads

© 2013 Pearson Education, Inc.

The Thinning Ozone Layer



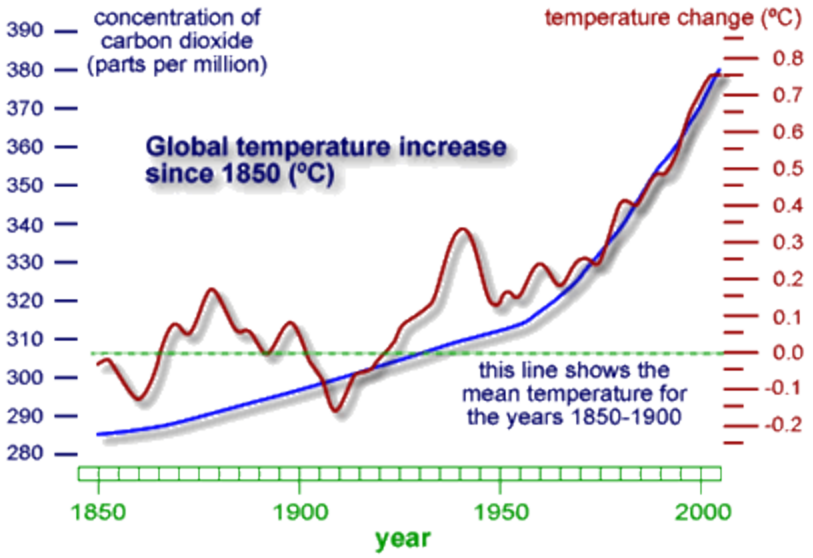


©2004, ACIA

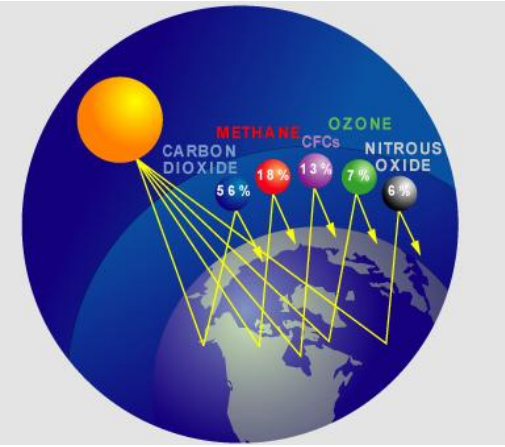
- The ozone layer in the upper atmosphere protects organisms by blocking out harmful UV radiation
- Air pollutants (mainly CFCs) react with ozone and destroy the ozone layer
  - These chemicals have been banned world-wide
  - If countries continue to ban the use of ozone depleting chemicals, this is reversible!

Climatic Change

- Human activities are changing the composition of the atmosphere
- This influences the global climate
- Currently, the average global temperature is increasing because of heat trapped by excess greenhouse gases



Greenhouse Gases



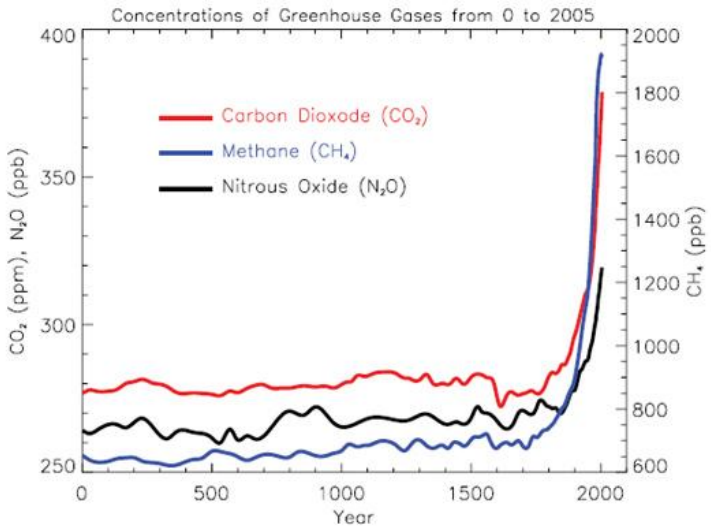


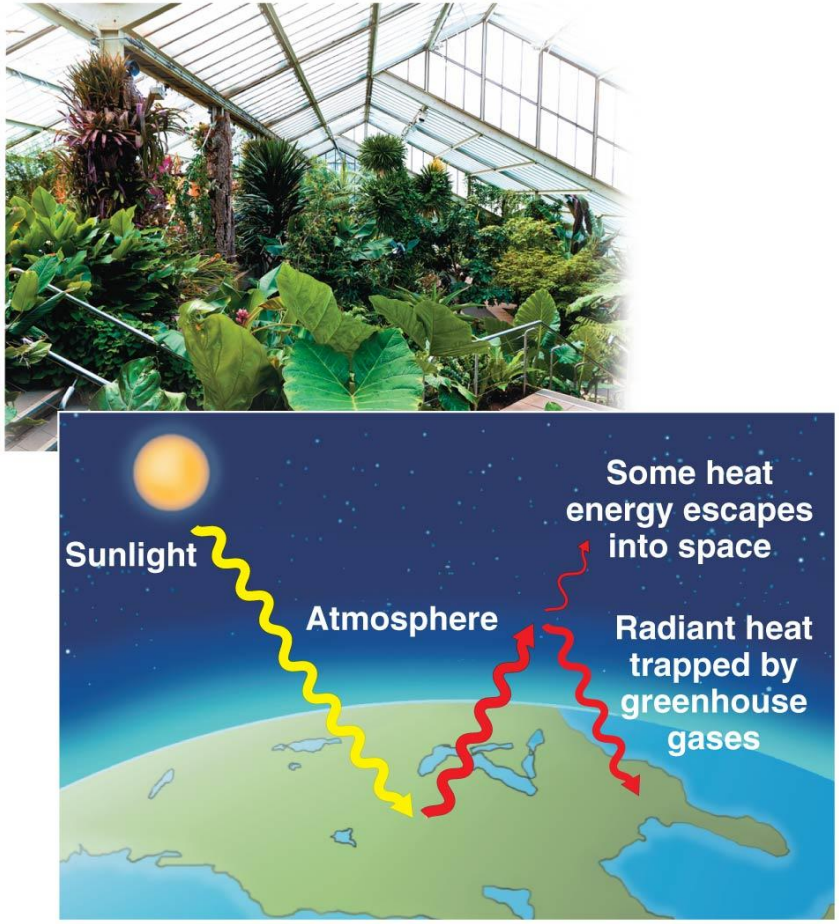
Figure 1. Atmospheric concentrations of important long-lived greenhouse gases over the last 2,000 years. Increases since about 1750 are attributed to human activities in the industrial era. Concentration units are parts per million (ppm) or parts per billion (ppb), indicating the number of molecules of the greenhouse gas per million or billion air molecules, respectively, in an atmospheric sample.

IPCC AR4 FAQ

- Gases in the Earth's atmosphere that allow solar radiation to pass through, but trap heat near Earth's surface by absorbing or reflecting heat
  - This increases the global temperature, much like the glass or plastic walls of a greenhouse
- Greenhouse gases include:
  - **Water vapor** (H_2O)
  - **Carbon dioxide** (CO_2)
  - **Methane** (CH_4)
  - **Nitrous oxide** (N_2O)
  - **Chlorofluorocarbons** (CFCs) – synthetic chemicals used in refrigeration & aerosols

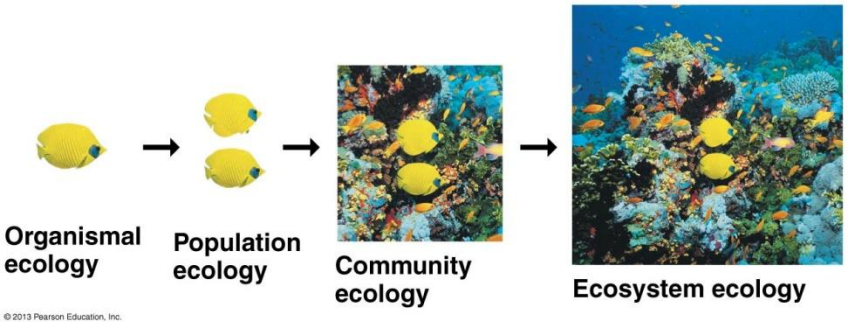
The Greenhouse Effect

- The **greenhouse effect is a natural process that warms the earth's lower atmosphere & surface**
  - **Solar energy absorbed by the earth's surface radiates into the atmosphere as heat**
  - This heat causes the **molecules of certain gases to vibrate & release infrared radiation(of longer wavelengths)**
  - The infrared radiation interacts with **other molecules in the atmosphere, increasing their kinetic energy**
  - This increase in kinetic energy **warms the lower atmosphere & the earth's surface**
- Without this natural process, the earth would be too cold to support life



© 2013 Pearson Education, Inc.

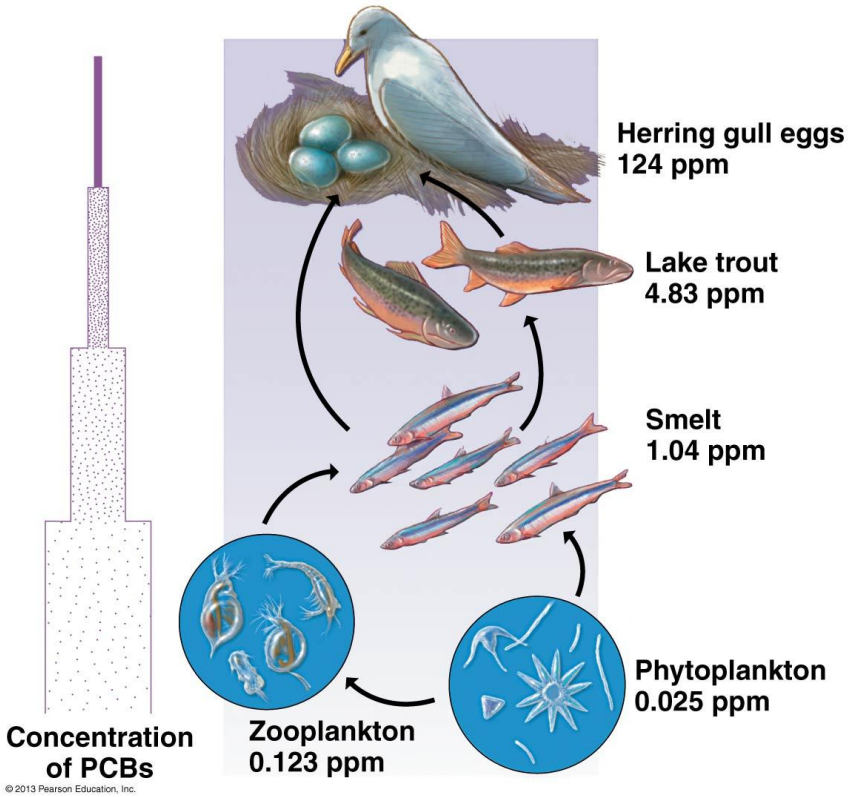
Levels of Organization



- Life is organized in a hierarchical system:
  - Biosphere – the whole Earth
  - Ecosystems – all of the living & non-living things in a particular area
  - Communities – all of the living organisms in an area
  - Population – all of the organisms in an area of the same species
  - Organisms – individual living things

A Key Theme in Ecology - Interconnectedness

- All organisms interact with other organisms & with the non-living things in their environment
- Each organism's survival depends on these interactions



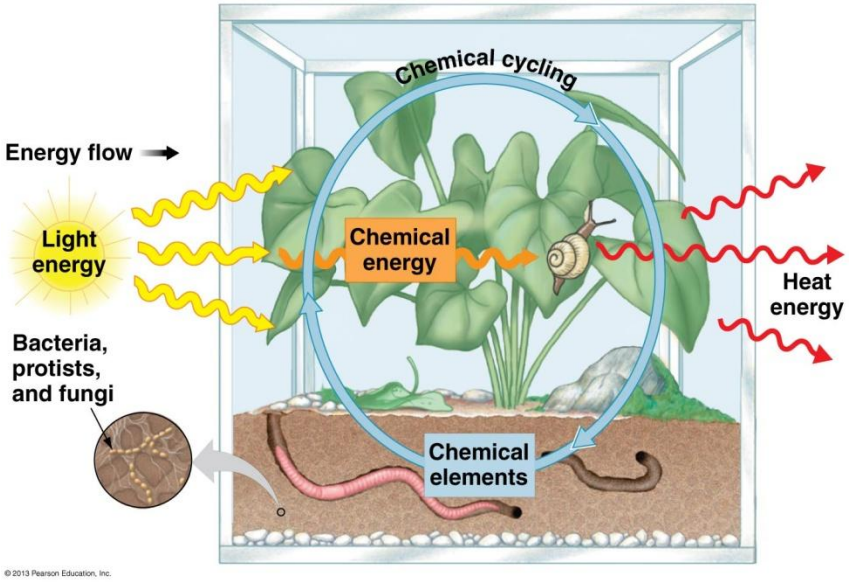
Disturbances in Ecosystems


© 2013 Pearson Education, Inc.

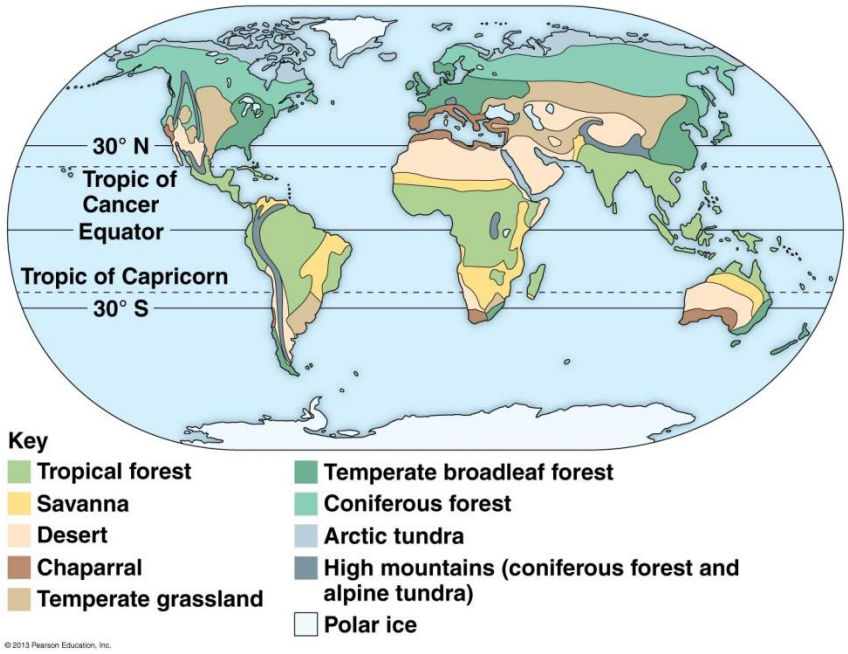
- A disturbance is anything that can alter the organisms in an ecosystem and their interactions
  - Examples: forest fire, drought, human activity, etc
- A consequence of interconnectedness is that any disturbance can affect the entire ecosystem

Ecological Models

- Ecosystems are extremely complex and difficult to study
- Ecologists use model to simplify the study of ecosystems
- Models may be:
  - Visual (diagrams)
  - Verbal (descriptions)
  - Mathematical (graphs & equations)



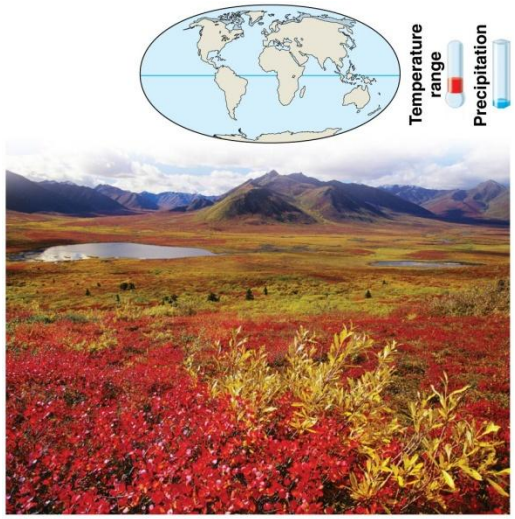
Types of Ecosystems



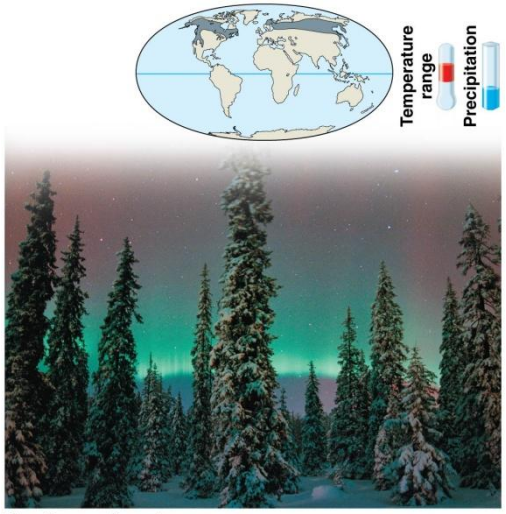
- Biomes – large terrestrial ecosystems that contain many smaller ecosystems
- Biomes are characterized by:
  - Average yearly temperature
  - Average yearly precipitation
  - Types of soil
  - Types of organisms that live there

Terrestrial Biomes

- Tundra – cold & mostly treeless biome
  - Permafrost – permanently frozen layer of soil
- Taiga – forested biome dominated by ever-green trees
  - Aka “Coniferous forest” or “Boreal forest” in many areas

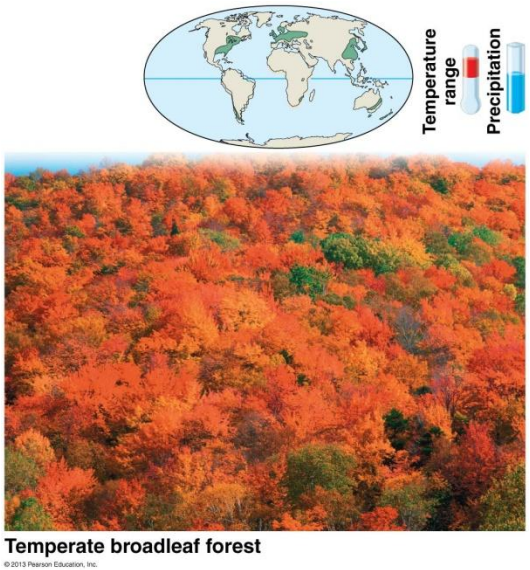


Tundra
© 2013 Pearson Education, Inc.



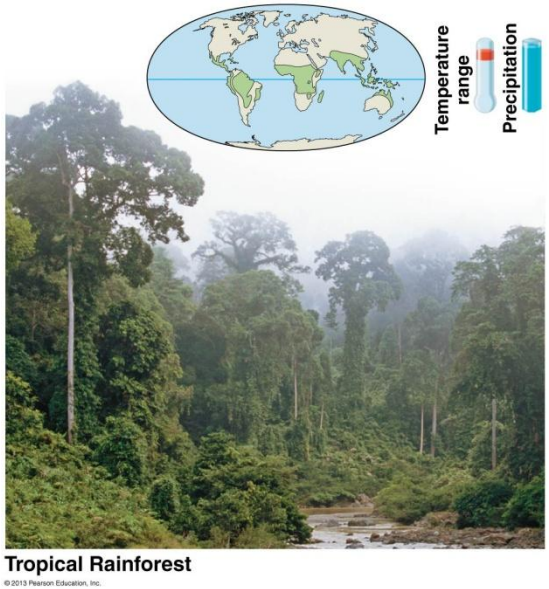
Coniferous forest
© 2013 Pearson Education, Inc.

Terrestrial Biomes



Temperate broadleaf forest

© 2013 Pearson Education, Inc.



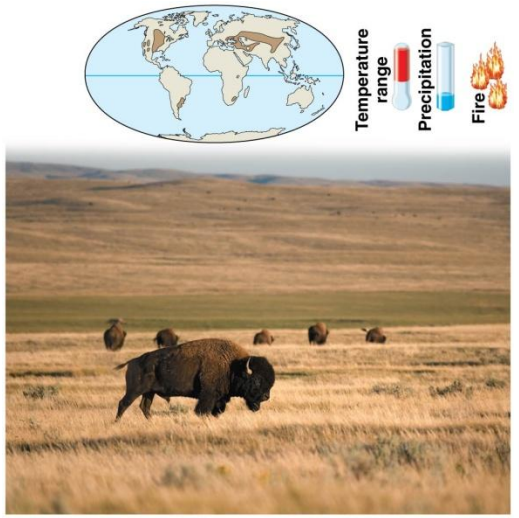
Tropical Rainforest

© 2013 Pearson Education, Inc.

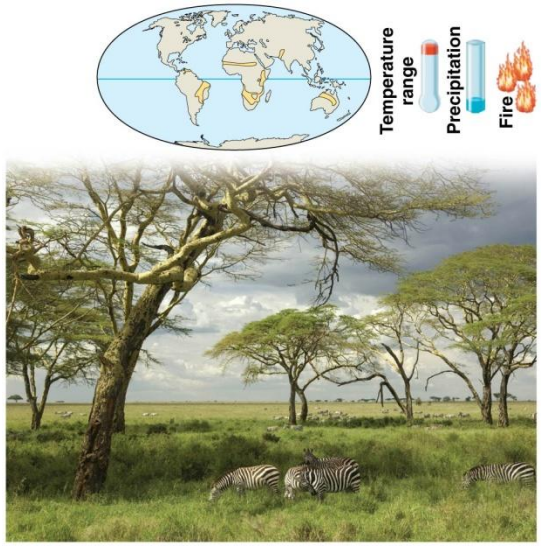
- Temperate Deciduous Forests – characterized by trees that lose their leaves in the fall
- Tropical Rain Forests – Characterized by tall trees & vast amounts of rainfall

Terrestrial Biomes

- Temperate Grasslands – dominated by grasses & sparse trees
- Savannas – tropical or subtropical grasslands



Temperate grassland



Savanna

© 2013 Pearson Education, Inc.

Terrestrial Biomes

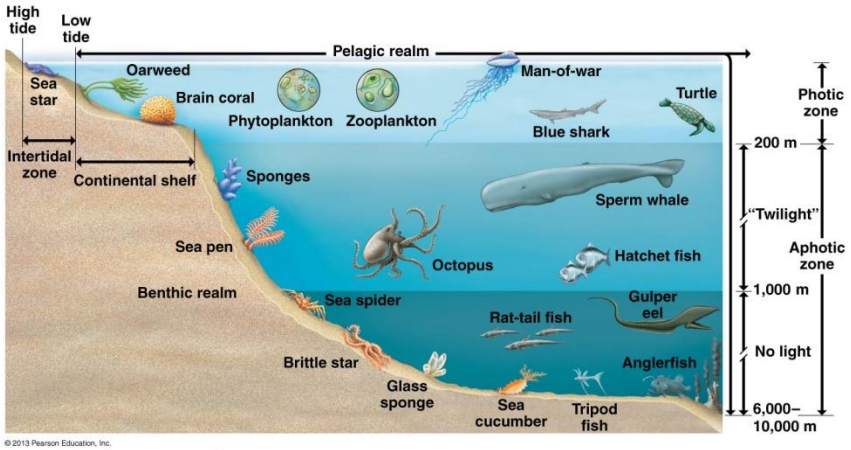
Desert

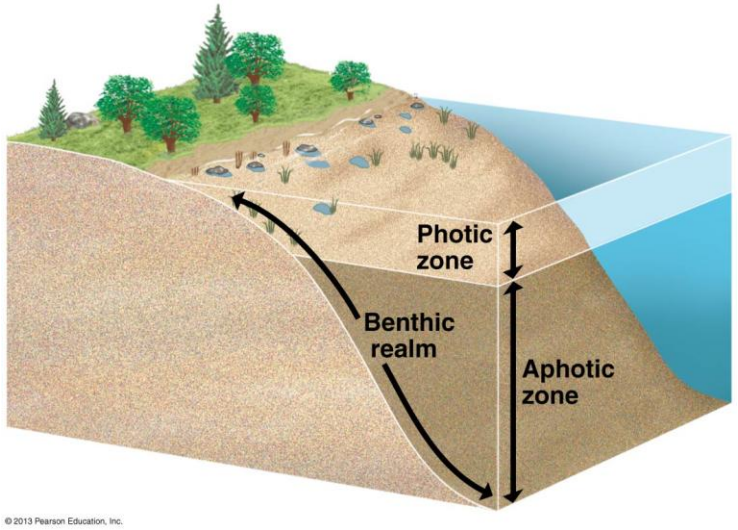
© 2013 Pearson Education, Inc.

- Deserts – receive less than 25 cm of rainfall a year
  - Sparse vegetation
  - Plants and animals adapted to low water conditions

Aquatic Ecosystems

- Aquatic ecosystems are characterized by:
  - Type of water (fresh or saltwater)
  - Amount of light
  - Amount of available nutrients





Saltwater Ecosystems

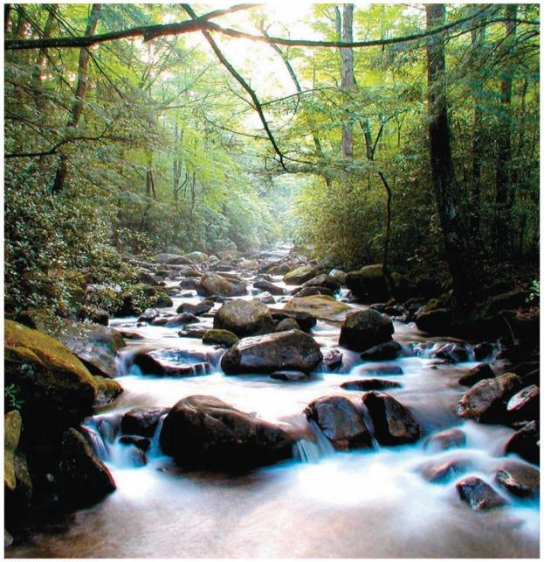

© 2013 Pearson Education, Inc.


© 2013 Pearson Education, Inc.

- Coral reefs – built by coral
  - Productive and rich in biodiversity
  - Typically in warm, shallow tropical water
- Estuaries – where freshwater rivers meet the ocean
  - Water is a mixture of salt & fresh water
  - Rich in biodiversity for both marine & terrestrial organisms

Freshwater Ecosystems

- These include:
  - Lakes
  - Rivers
  - Streams
  - Ponds
  - Wetlands – areas that are covered by water most of the year


© 2013 Pearson Education, Inc.


© 2013 Pearson Education, Inc.

Essential Question

1. Identify three ways in which the expanding human population impacts the environment.
2. Describe the hierarchical levels of organization in living systems from organisms to the biosphere.
3. Give an example of how organisms are interconnected and how a disturbance can affect an entire ecosystem.