Chapter 5
Biomes and Biodiversity
In the end, we conserve only what we love. We will love only what we understand. We will understand only what we are taught.

–Baba Dioum
Predators Help Restore Biodiversity in Yellowstone
5.1 Terrestrial Biomes

• **Biodiversity** - the number and variety of species.
• **Biomes** - broad types of biological communities with characteristic types of environments that occur in different conditions of temperature and precipitation.
• Biome type can be predicted based on the temperature and precipitation found in an area.
Map of Major World Biomes
Biomes Vary with Latitude

- Many temperature-controlled biomes occur in latitudinal bands.
- A band of boreal (northern) forest crosses Canada and Siberia.
- Tropical forests occur near the equator.
- Expansive grasslands lie near—or just beyond—the tropics.
- Many biomes are even named for their latitudes: like tropical rainforests or arctic tundra.
Vertical Zonation

• Temperature and precipitation change with elevation as well as with latitude. In mountainous regions, temperatures are cooler and precipitation is usually greater at high elevations. Mountains are cooler and often wetter, than low elevations.

• Vertical zonation is the term applied to vegetation zones which are defined by altitude.
Vertical Zonation

- Alpine (tundra)
- Spruce/fir (taiga)
- Pine/spruce/fir (boreal forest)
- Oak forest (temperate deciduous)
- Oak woodland (temperate savanna)
- Grassland (temperate grassland)
- Shrub desert (desert)

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.
Tropical Rainforests

- Tropical rainforests occur where rainfall is abundant—more than 200 cm (80 in.) per year—and temperatures are warm to hot year-round.
Tropical Savannas and Grasslands are Dry Most of the Year

- Where there is too little rainfall to support forests, we find open grasslands or grasslands with sparse tree cover, which we call savannas.
Deserts are Hot or Cold, but Always Dry

- **Deserts** occur where precipitation is uncommon and slight, usually with less than 30 cm of rain per year.
Temperate Grasslands have Rich Soils

- As in tropical latitudes, temperate (midlatitude) grasslands occur where there is enough rain to support abundant grass but not enough for forests.
Temperate Forests can be Evergreen or Deciduous

• These forests are grouped by tree type, broad-leaved **deciduous** (losing leaves seasonally) or evergreen **coniferous** (cone-bearing).
Temperate Rainforests

- The coniferous forests of the Pacific coast grow in extremely wet conditions. The wettest coastal forests are known as **temperate rainforest**, a cool, rainy forest often is enshrouded in fog.
Boreal Forests Lie North of the Temperate Zone

- Because conifers can survive winter cold, they tend to dominate the **boreal forest**.
- Dominant trees are pines, hemlocks, spruce, cedar, and fir.
- Boreal forests are found in Siberia, Canada, and the western United States.
Tundra Can Freeze in Any Month

- Compared to other biomes, tundra has relatively low diversity.
- Temperatures are below freezing most of the year, making water unavailable to plants.
Florida’s Terrestrial Habitats

• Imperceptible elevation changes

• Pine Flatwoods
  – Acidic soil
  – Clay hardpan
    • Stores water
    • Lessens root penetration
  – Fire dependent
  – Species
    • Saw palmetto
    • Slash pine
    • Deer, fox, raccoon, possum, panther, snakes, burrowing owl

Image and Habitat information from the South Florida Water Management District www.sfwmd.gov

09/22/10
Florida’s Terrestrial Habitats

- **Scrub**
  - Highest elevation
  - Sandy, well drained soil
  - Species
    - Sand Pine
    - Scrub oak
    - Deer, fox, raccoon, possum, panther, snakes, gopher tortoise, bobcat

Image and Habitat information from the South Florida Water Management District www.sfwmd.gov
Florida’s Terrestrial Habitats

• Hardwood Hammock
  – Lowest elevation
  – Cooler
  – Species
    • Gumbo Limbo
    • Oaks
    • Cabbage Palm (state tree)
    • Deer, fox, raccoon, possum, panther, snakes,
5.2 Marine Ecosystems

• Most marine communities depend on photosynthetic organisms.

• **Phytoplankton**: tiny, free-floating photosynthetic algae that often support a marine food web.

• In oceans, photosynthetic activity tends to be greatest near coastlines.
Satellite Measurements of Primary Productivity in the Oceans

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.
Open Ocean Communities Vary from Surface to Hadal Zone

• Ocean systems can be described by depth and proximity to shore:
  – **Benthic** communities occur on the bottom.
  – **Pelagic** zones are the water column.

• The **epipelagic zone** has photosynthetic organisms.

• Below are the **mesopelagic** and **bathypelagic zones**.

• The deepest layers are the **abyssal zone** (to 4,000 m) and **hadal zone** (deeper than 6,000 m).

• Shorelines are known as **littoral zones**, and the area exposed by low tides is known as the **intertidal zone**.
Vertical Stratification is a Key Feature of Aquatic Ecosystems
Deep-sea Thermal Vent Communities

- Deep-sea thermal vent communities are based on microbes that capture sulfur compounds released from thermal vents on the ocean floor.
Coral reefs are among the best-known marine systems, because of their extraordinary biological productivity and their diverse and beautiful organisms.
Mangroves are a diverse group of salt-tolerant trees that grow along warm, calm marine coasts around the world.
Three Species of Florida Mangroves

• Red Mangroves usually grow near the shore of the water. It has red roots and is often referred to as the “walking mangrove” because its roots raise over the water.

• Black Mangroves grow in higher areas. Their roots spread near the trunk in shapes of fingers or pencils pointing up, exposing the roots to needed oxygen.

• White Mangroves grow even higher than the black mangrove, and its roots aren’t visible. These trees tend to get rid of salt on the backs of the leaves.
Estuaries are bays where rivers empty into the sea, mixing fresh water with salt water. Salt marshes, shallow wetlands flooded regularly or occasionally with seawater, occur on shallow coastlines, including estuaries.
5.3 Freshwater Ecosystems

- Freshwater environments are far less extensive than marine environments, but they are centers of biodiversity.
- Most terrestrial communities rely, to some extent, on freshwater environments.
Lakes Have Extensive Open Water
Wetlands are Shallow and Productive

• Wetlands are shallow ecosystems in which the land surface is saturated or submerged at least part of the year.

• Wetlands have vegetation that is adapted to grow under saturated conditions.

• These relatively small systems support rich biodiversity, and they are essential for both breeding and migrating birds.

• As water stands in wetlands, it also seeps into the ground, replenishing groundwater supplies.
Wetlands are Described by Their Vegetation

- **Swamps** are wetlands with trees.
- **Marshes** are wetlands without trees.
- **Bogs** are areas of water-saturated ground usually composed of deep layers of undecayed vegetation known as peat.
5.4 Biodiversity
How many species are there?

- To date: 1.5 million have been named
- Estimates are between 3-50 million
Map of Biodiversity Hot Spots
5.5 Benefits of Biodiversity

• We benefit from other organisms in many ways, some of which we don’t appreciate until a particular species or community disappears.
  • They play irreplaceable roles in ecological systems.
  • They could be the source of genes or drugs that someday may be indispensable.
Aesthetic and Existence Values are Important

• Nature appreciation is economically important. The U.S. Fish and Wildlife Service estimates that Americans spend $104 billion every year on wildlife-related recreation. This is 25 percent more than the $81 billion spent each year on new automobiles.

• For many people, just the idea that wildlife exists has value. This idea is termed "existence value." Even if they will never see a tiger or a blue whale, many find it gratifying to know they exist.
Biodiversity Provides Food and Medicines

• Wild plant species could make important contributions to human food supplies. Genetic material from wild plants has been used to improve domestic crops.

• Wild bees, moths, bats, and other organisms provide pollination for most of the world's agricultural crops.

• Pharmaceutical products derived from developing world plants, animals, and microbes bring in more than $30 billion per year.
5.6 What Threatens Biodiversity?

- **Extinction**, the elimination of a species, is a normal process of the natural world. However, human impacts have accelerated that rate recently.

- **Current Threats to Biodiversity Include:**
  - Habitat destruction is the main threat
    - Fragmentation reduces habitat to small, isolated patches
  - Invasive species are a growing threat
  - Overharvesting & commercial collection
  - Predator and pest control
  - Pollution poses many different types of risk
  - Human population growth
5.7 Endangered Species Protection

• Hunting and fishing laws protect some species. The general idea behind these laws was to conserve the resource for the future.

• In 1973, Congress passed The Endangered Species Act (ESA). This law established the idea that protecting biodiversity was in the public interest because even species we don't use directly can have economic and cultural value.

• Recovery plans are developed to help rebuild the populations.
The Bald Eagle is one of the ESA Success Stories
Endangered Species Act Terminology

• The ESA identifies three levels of risk:
  – **Endangered species** are those considered in imminent danger of extinction.
  – **Threatened species** are likely to become endangered, at least locally within the foreseeable future.
  – **Vulnerable species** are naturally rare or have been locally depleted by human activities to a level that puts them at risk.
  – **Species of Special concern** is a Florida rank and it puts the organism on a watch list.
IUCN Lists Species Internationally

- Worldwide, the International Union for Conservation of Nature and Natural Resources (IUCN) lists 17,586 endangered and threatened species.
- IUCN has no direct jurisdiction for slowing the loss of those species. Within the United States, the ESA provides mechanisms for reducing species losses.
CITES

- The Convention on International Trade in Endangered Species (CITES) of 1975

Parts from Rare and Endangered Species for Sale in China
Habitat Protection May Be Better than Species Protection

• Growing numbers of scientists, land managers, policymakers, and developers are arguing that we need a rational, continent-wide preservation of ecosystems that supports maximum biological diversity.

• They argue that this would be more effective than species-by-species battles for desperate cases.
Sometimes Protected Lands Do Not Contain the Highest Species Diversity