Exploring Terrestrial & Aquatic Biomes

Overview: Discovering Ecology

- **Ecology** is the scientific study of the interactions between organisms and the environment
- These interactions determine distribution of organisms and their abundance
- Modern ecology includes observation and experimentation

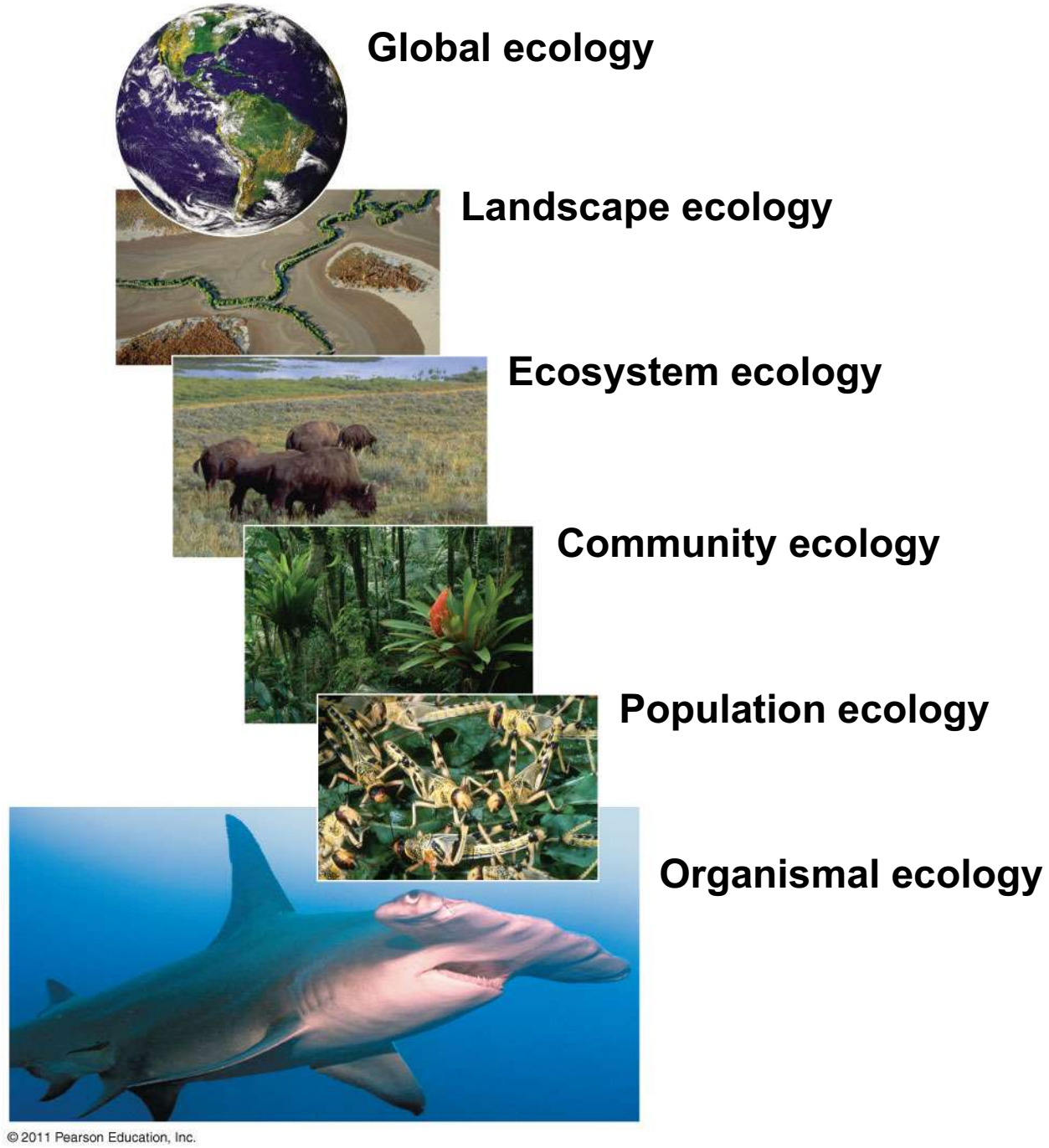
High Georgia Performance Standards

- SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.
- a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.
- b. Explain the flow of matter and energy through ecosystems by Arranging components of a food chain according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major nutrients (C, O, H, N, P).
- c. Relate environmental conditions to successional changes in ecosystems.
- d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.
- e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.
- f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

Middle Georgia Performance Standards

- S7L4. Students will examine the dependence of organisms on one another and their environments.
- a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.
- b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
- c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.
- d. Categorize relationships between organisms that are competitive or mutually beneficial.
- e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

Figure 52.2



Global Ecology

- The **biosphere** is the global ecosystem, the sum of all the planet's ecosystems
- **Global ecology** examines the influence of energy and materials on organisms across the biosphere

Landscape Ecology

- A **landscape** or **seascape** is a mosaic of connected ecosystems
- **Landscape ecology** focuses on the exchanges of energy, materials, and organisms across multiple ecosystems

Ecosystem Ecology

- An **ecosystem** is the community of organisms in an area and the physical factors with which they interact
- **Ecosystem ecology** emphasizes energy flow and chemical cycling among the various biotic and abiotic components

Community Ecology

- A **community** is a group of populations of different species in an area
- **Community ecology** deals with the whole array of interacting species in a community

Population Ecology

- A **population** is a group of individuals of the same species living in an area
- **Population ecology** focuses on factors affecting population size over time

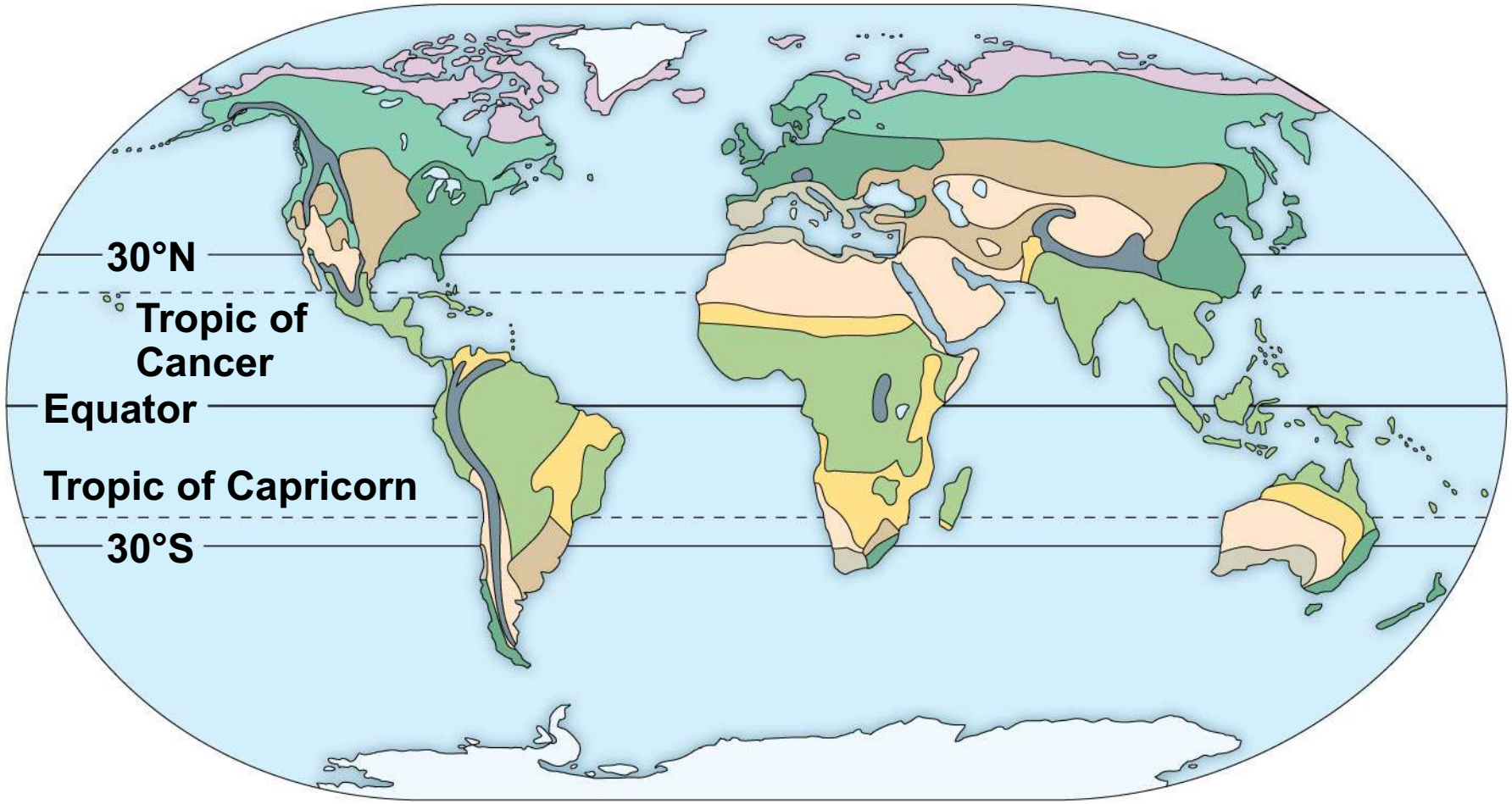
Organismal Ecology

- **Organismal ecology** studies how an organism's structure, physiology, and (for animals) behavior meet environmental challenges
- Organismal ecology includes physiological, evolutionary, and behavioral ecology

Microclimate

- Microclimate is determined by fine-scale differences in the environment that affect light and wind patterns
- Every environment is characterized by differences in
  - **Abiotic** factors, including nonliving attributes such as temperature, light, water, and nutrients
  - **Biotic** factors, including other organisms that are part of an individual's environment

Figure 52.9



General Features of Terrestrial Biomes

- Terrestrial biomes are often named for major physical or climatic factors and for vegetation
- Terrestrial biomes usually grade into each other, without sharp boundaries
- The area of intergradation, called an **ecotone**, may be wide or narrow

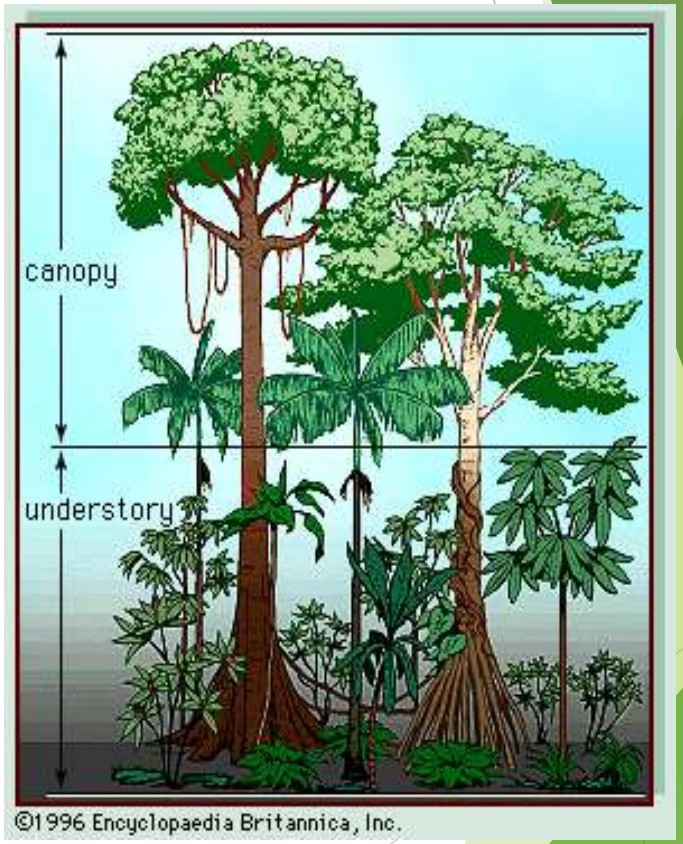
Tropical Forest

- Distribution is in equatorial and subequatorial regions
- In **tropical rain forests**, rainfall is relatively constant, while in **tropical dry forests** precipitation is highly seasonal
- Temperature is high year-round (25–29°C) with little seasonal variation
- Tropical forests are vertically layered and competition for light is intense
- Tropical forests are home to millions of animal species, including an estimated 5–30 million still undescribed species of insects, spiders, and other arthropods
- Rapid human population growth is now destroying many tropical forests

Tropical Forrest

Has the most species
BIODIVERSITY canopy = top
understory = below canopy

Hot & wet year round;
thin, poor soil



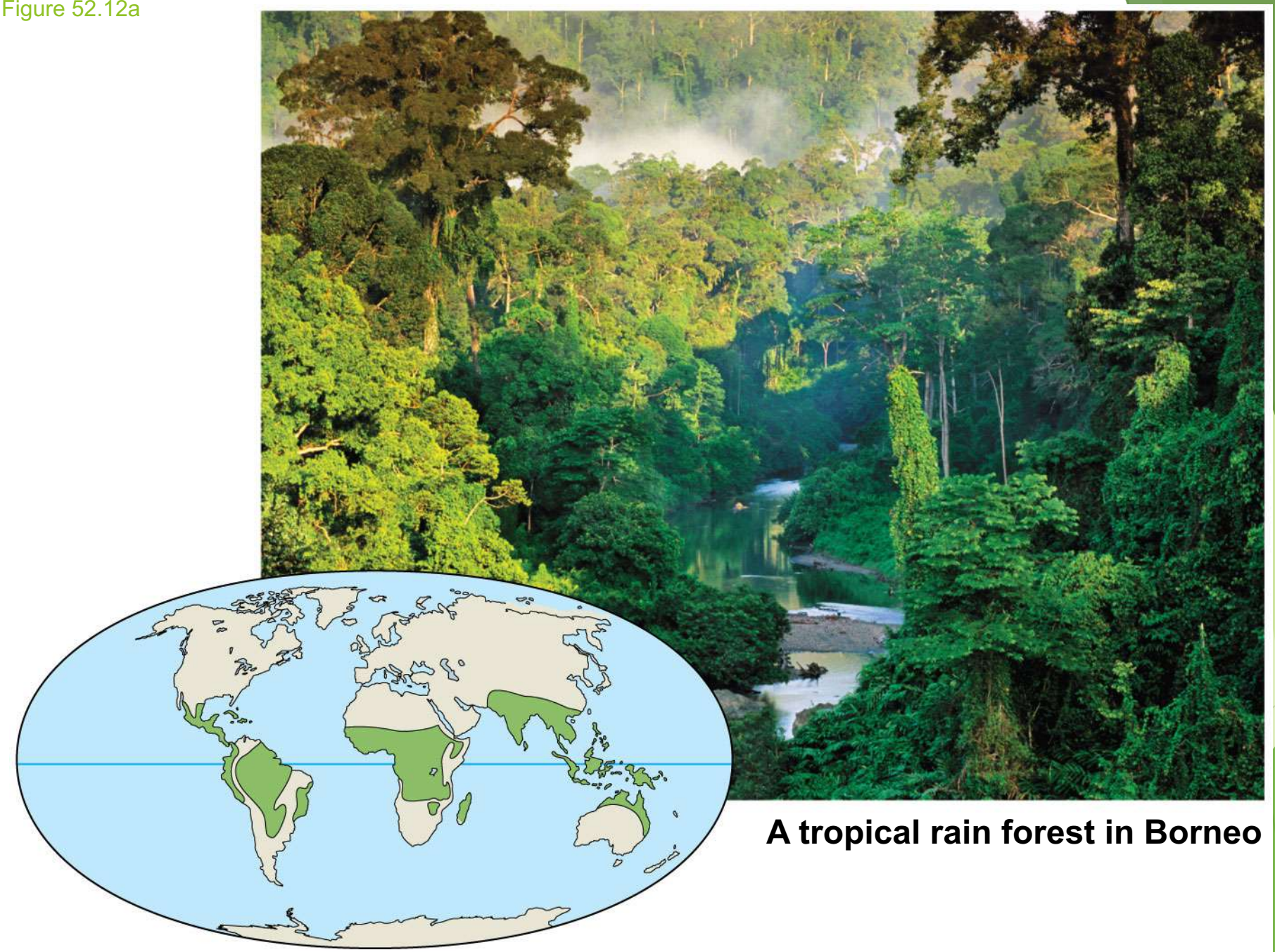
Many plants anchor themselves to the trees, like this BROMELIAD


Parrot


Tree Frog


Jaguar

Figure 52.12a



A tropical rain forest in Borneo

TROPICAL DRY FOREST

wet/dry seasons, warm year round

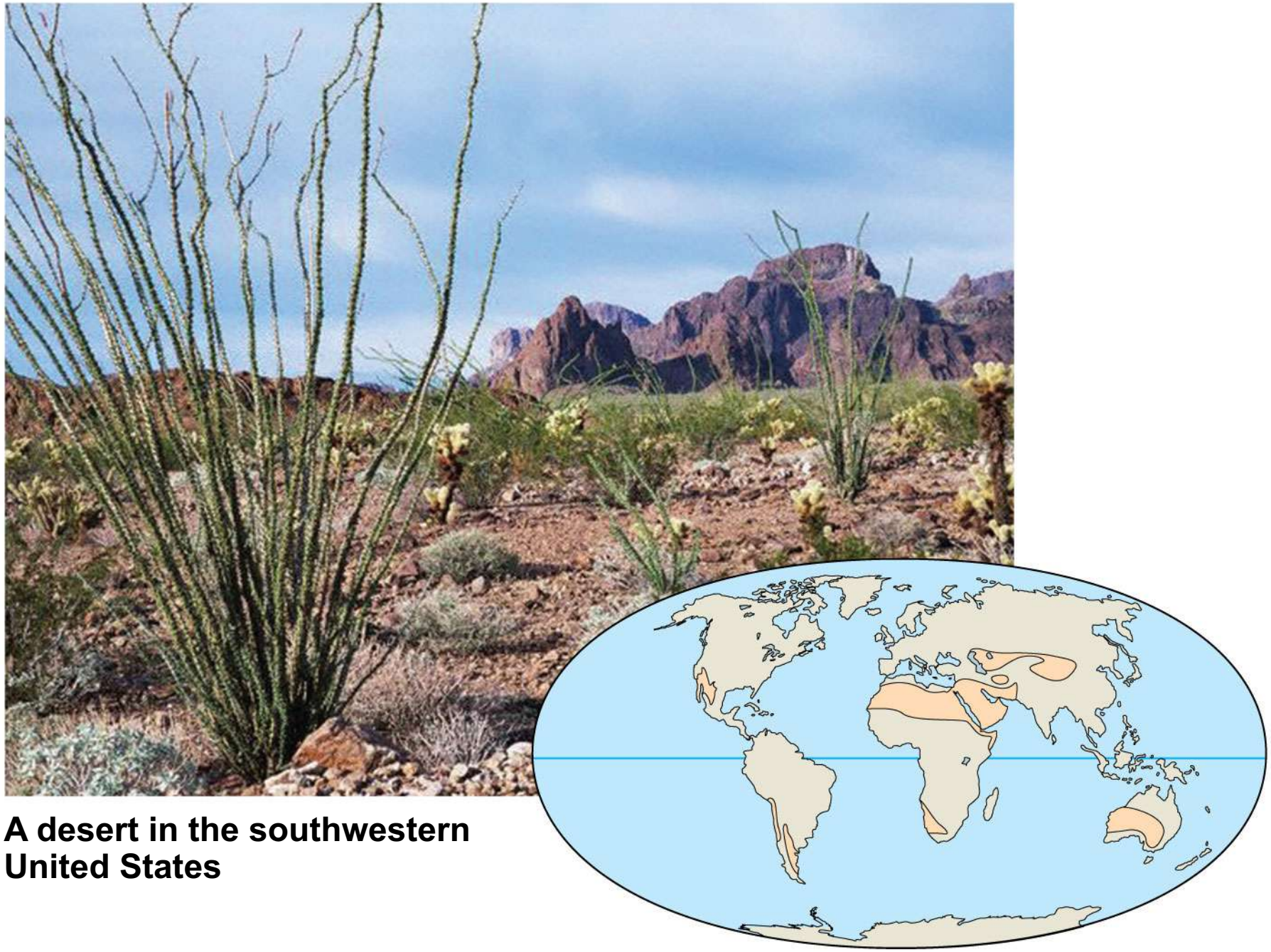
trees are deciduous -lose leaves

What lives in a tropical dry forest?

Desert

- **Deserts** occur in bands near 30°C north and south of the Equator, and in the interior of continents
- Precipitation is low and highly variable, generally less than 30 cm per year
- Deserts may be hot or cold
- Desert plants are adapted for heat and desiccation tolerance, water storage, and reduced leaf surface area
- Common desert animals include many kinds of snakes and lizards, scorpions, ants, beetles, migratory and resident birds, and seed-eating rodents; many are nocturnal
- Urbanization and irrigated have reduced the natural biodiversity of some deserts

Figure 52.12b



A desert in the southwestern United States

DESERT

dry (less than 25 cm rainfall/year)
extreme temperature changes (hot/cold)
cacti/succulent plants
organisms able to tolerate extreme conditions

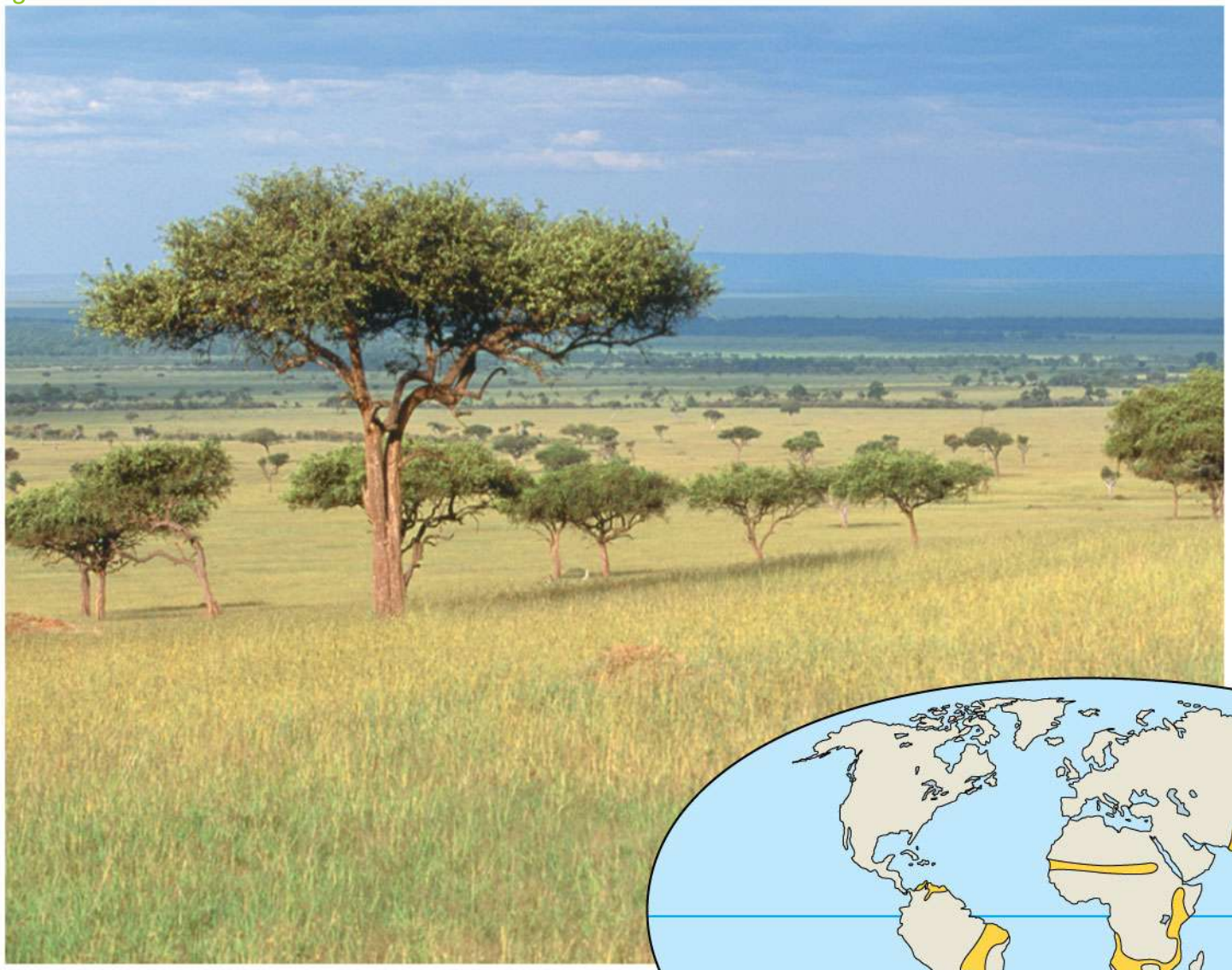
Desert Mammals

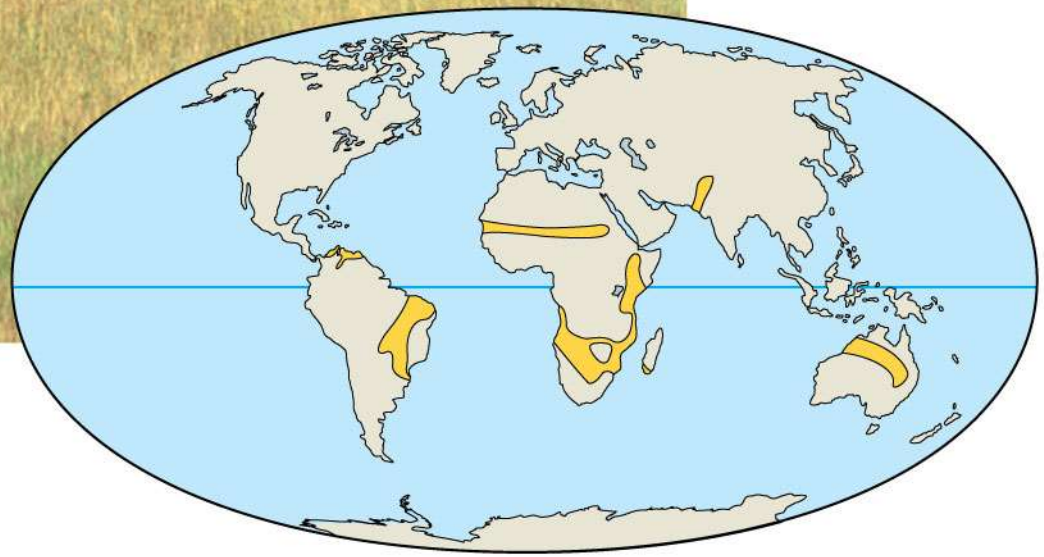
Can you name these two?

Savanna

- Equatorial and subequatorial regions
- **Savanna** precipitation is seasonal
- Temperature is warm year-round (24–29°C) but more seasonally variable than the tropics
- Grasses and forbs make up most of the ground cover
- The dominant plant species are fire-adapted and tolerant of seasonal drought
- Common inhabitants include insects and mammals such as wildebeests, zebras, lions, and hyenas
- Fires set by humans may help maintain this biome

Figure 52.12c





A savanna in Kenya

TROPICAL SAVANNA

large animal herds & frequent fires

- grassland area, with a few trees

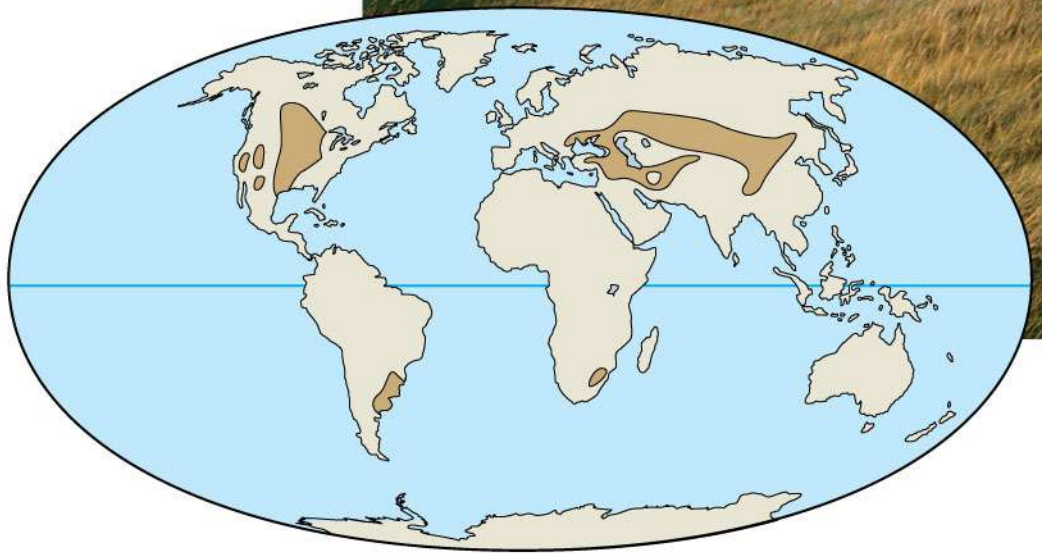
Lions
Zebra
Wildebeest
Gazelles
Elephants
Giraffes

The Lion King was set in a savanna.

Temperate Grassland

- **Temperate grasslands** are found on many continents
- Precipitation is highly seasonal
- Winters are cold (often below –10°C) and dry, while summers are hot (often near 30°C) and wet
- The dominant plants, grasses and forbs, are adapted to droughts and fire
- Native mammals include large grazers such as bison and wild horses and small burrowers such as prairie dogs
- Most grasslands have been converted to farmland

Figure 52.12e

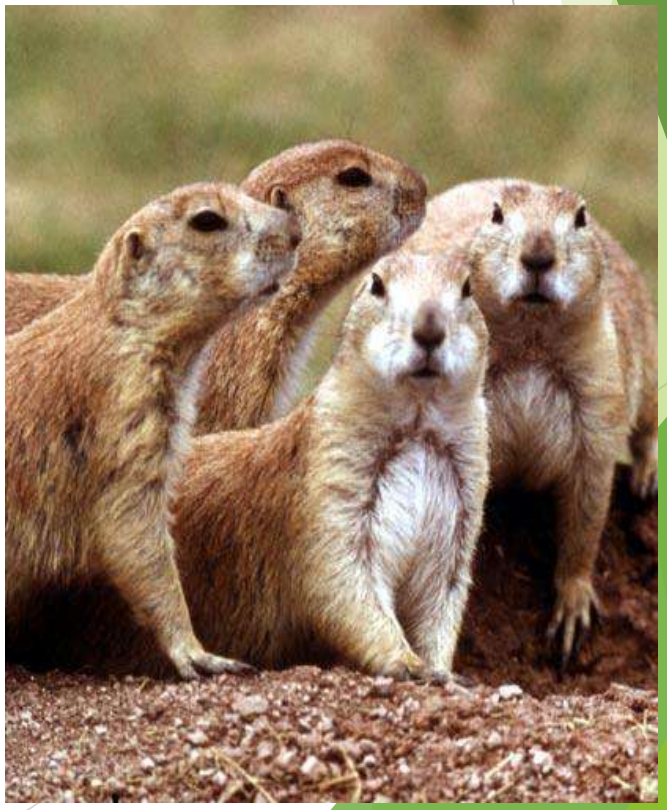


Grasslands National Park, Saskatchewan

TEMPERATE GRASSLAND

plains & prairies; Midwest
very fertile soil

4 seasons - seasonal precipitation, less rain than temperate forest



Animals of the grasslands

Prairie Dogs
Hawks / Eagles
Snakes

Sometimes deer

Foxes / Coyotes

Bison / Buffalo

Coniferous Forest

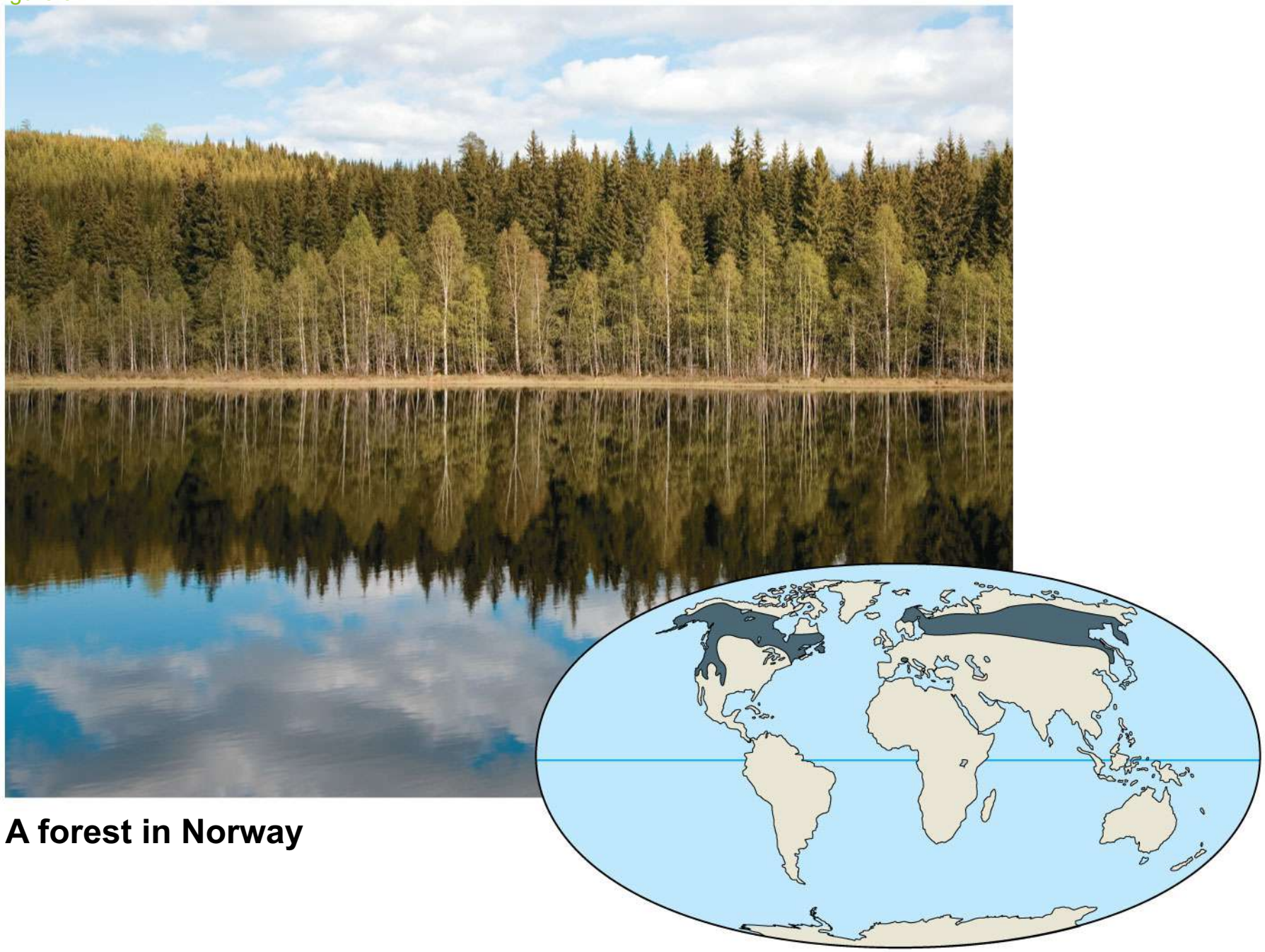
- The **northern coniferous forest**, or taiga, spans northern North America and Eurasia and is the largest terrestrial biome on Earth
- Precipitation varies; some have periodic droughts and others, especially near coasts, are wet
- Winters are cold and long while summers may be hot (e.g., Siberia ranges from –50°C to 20°C)
- Conifers such as pine, spruce, fir, and hemlock dominate
- The conical shape of conifers prevents too much snow from accumulating and breaking their branches
- Animals include migratory and resident birds, and large mammals such as moose, brown bears, and Siberian tigers

Taiga

Evergreen forests
Bitterly long winters & short, mild summers

Moose, black bear, wolves

Figure 52.12f

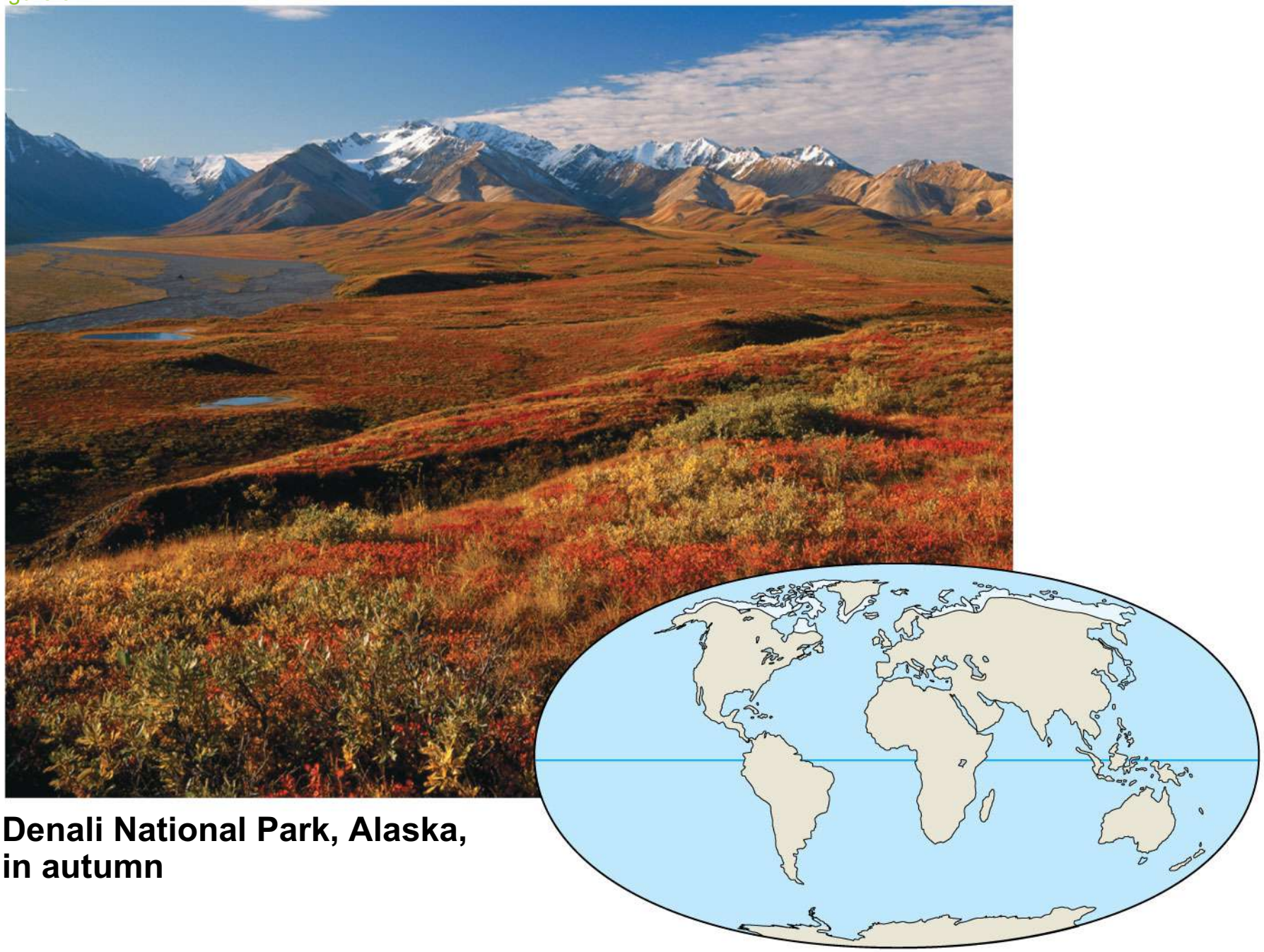


A forest in Norway

Tundra

- **Tundra** covers expansive areas of the Arctic; alpine tundra exists on high mountaintops at all latitudes
- Precipitation is low in arctic tundra, and higher in alpine tundra
- Winters are long and cold (below –30°C) while summers are relatively cool (less than 10°C)

Figure 52.12h



Denali National Park, Alaska, in autumn

TUNDRA
Permafrost = layer of permanently frozen subsoil
Strong winds -no trees, small plants

Plants = mosses, lichens, grasses
Animals = arctic fox, caribou

Other land areas include:

Mountain ranges
Polar ice caps (Arctic)

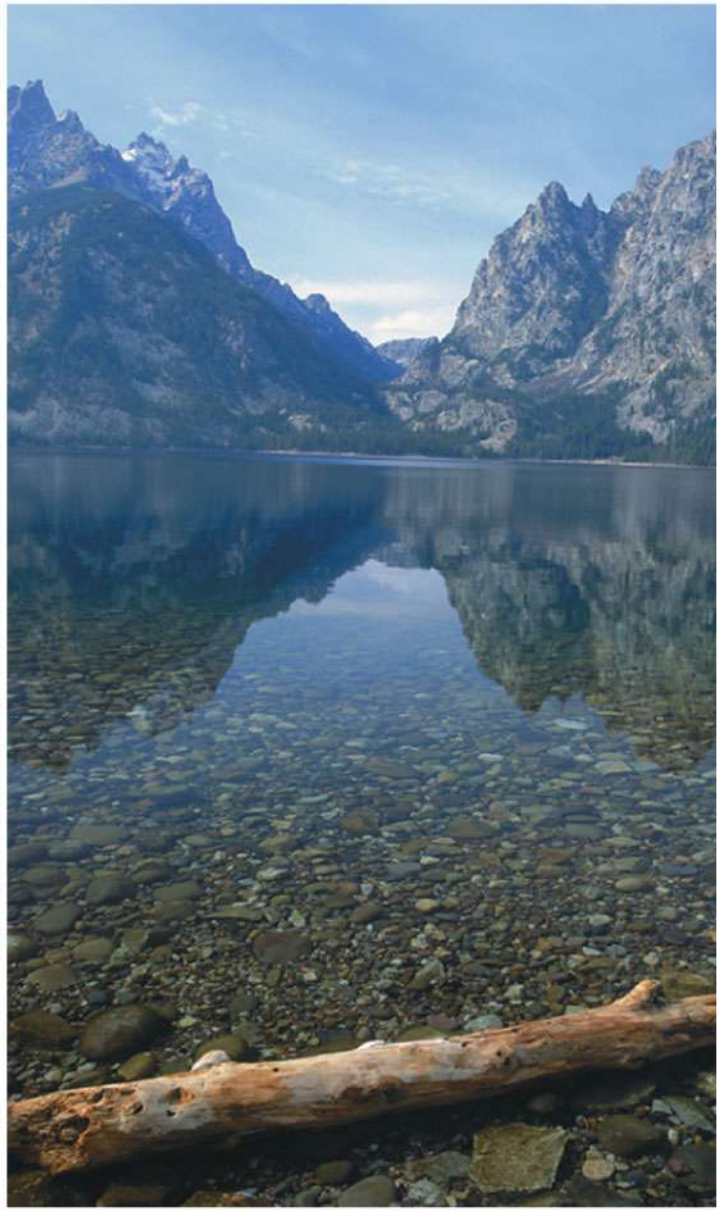
Aquatic Biomes

- Major aquatic biomes can be characterized by their physical environment, chemical environment, geological features, photosynthetic organisms, and heterotrophs

Lakes

- Size varies from small ponds to very large lakes
- Temperature lakes may have a seasonal thermocline; tropical lowland lakes have a year-round thermocline
- **Oligotrophic lakes** are nutrient-poor and generally oxygen-rich
- **Eutrophic lakes** are nutrient-rich and often depleted of oxygen if ice covered in winter

Figure 52.16a



An oligotrophic lake in Grand Teton National Park, Wyoming

A eutrophic lake in the Okavango Delta, Botswana

- Eutrophic lakes have more surface area relative to depth than oligotrophic lakes
- Rooted and floating aquatic plants live in the shallow and well-lighted **littoral zone** close to shore
- Water is too deep in the **limnetic zone** to support rooted aquatic plants; small drifting animals called zooplankton graze on the phytoplankton
- Zooplankton are drifting heterotrophs that graze on the phytoplankton
- Invertebrates live in the benthic zone
- Fishes live in all zones with sufficient oxygen
- Human induced nutrient enrichment can lead to algal blooms, oxygen depletion, and fish kills

Freshwater Ecosystems

A. Flowing-water ecosystem, rivers, streams, creeks,
B. Standing- water ecosystem, lakes & ponds

Trout, herons, eagles, bass, bluegill, crayfish, water snakes, turtles

Figure 52.16c

A headwater stream in the Great Smoky Mountains

The Loire river (in France) far from its headwaters

Freshwater Ecosystems

A. Flowing-water ecosystem, rivers, streams, creeks,
B. Standing- water ecosystem, lakes & ponds

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Wetlands

- A **wetland** is a habitat that is inundated by water at least some of the time and that supports plants adapted to water-saturated soil
- Wetlands have high organic production and decomposition and have low dissolved oxygen
- Wetlands can develop in shallow basins, along flooded river banks, or on the coasts of large lakes and seas

Wetlands

- Wetlands are among the most productive biomes on Earth
- Plants include lilies, cattails, sedges, tamarack, and black spruce
- Wetlands are home to diverse invertebrates and birds, as well as otters, frogs, and alligators
- Humans have destroyed up to 90% of wetlands; wetlands purify water and reduce flooding

Figure 52.16b

A basin wetland in the United Kingdom

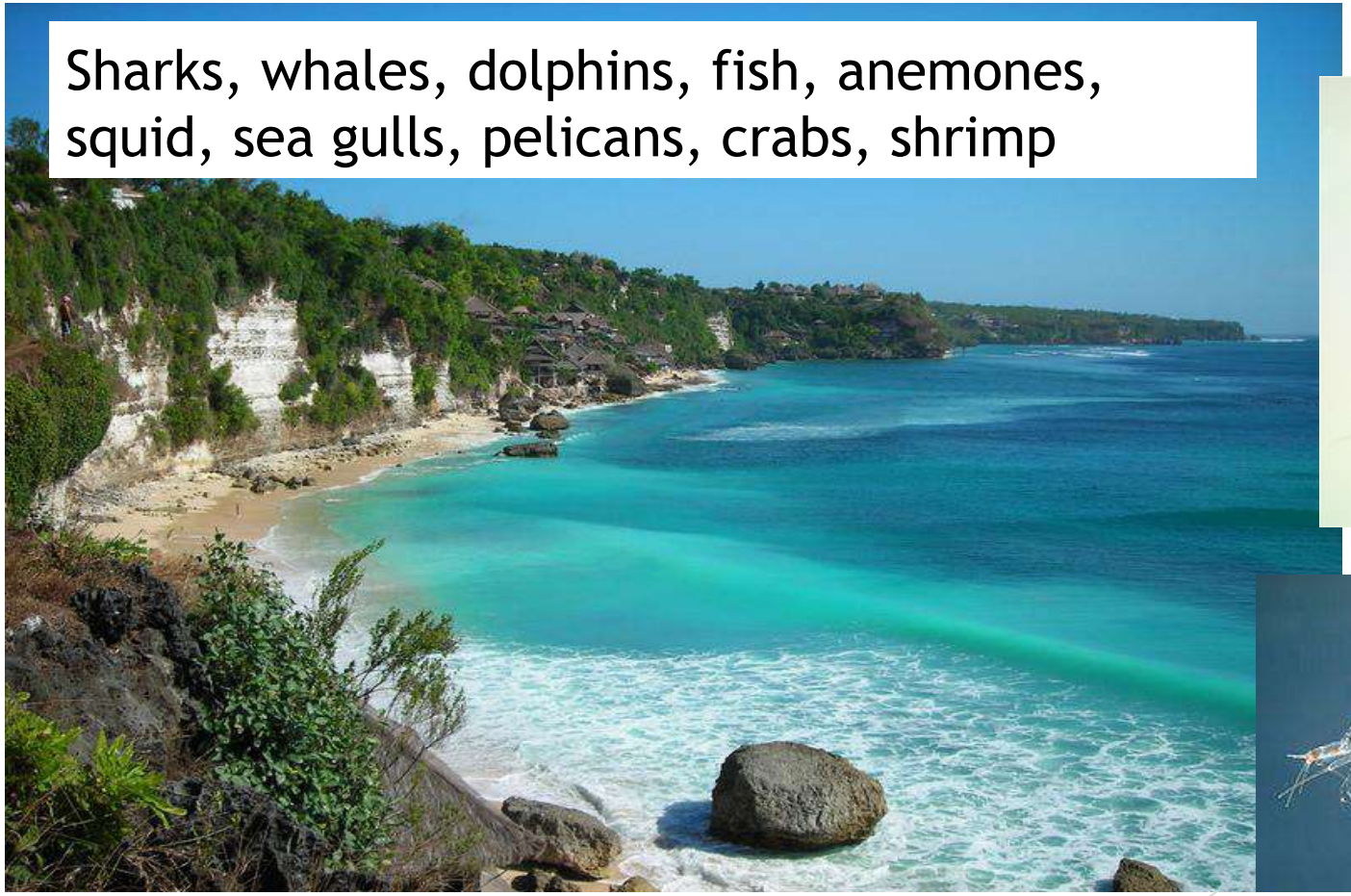
Estuary = area where freshwater meets sea

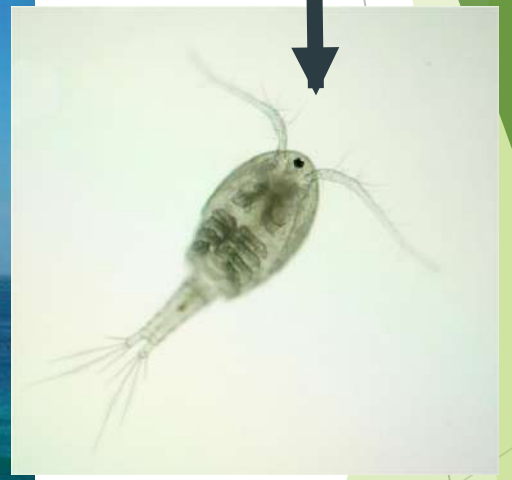
Wetlands = water covers soil

Marine Ecosystem

A. Photic zone - area sunlight reaches
B. Aphotic zone- permanently dark

*Plankton - microscopic organisms found in water





Estuaries

- An **estuary** is a transition area between river and sea
- Salinity varies with the rise and fall of the tides
- Estuaries are nutrient rich and highly productive
- Estuaries include a complex network of tidal channels, islands, natural levees, and mudflats

- Saltmarsh grasses and algae are the major producers
- An abundant supply of food attracts marine invertebrates, fish, waterfowl, and marine mammals
- Humans consume oysters, crabs, and fish
- Human interference upstream has disrupted estuaries worldwide

Match the description or organism to its biome.

1. Monkeys & bromeliads
2. Caribou
3. Penguins
4. Low amount of rainfall (less than 25 cm), extreme temperatures
5. Also called a prairie
6. Has aphotic and photic layer
7. Maples, oaks, and red buds
8. Wildfires in California
9. Permafrost
10. Lions, zebras, giraffes
11. Cactus and succulent plants
12. Swamps and bogs and flooded areas
13. Canopy & Understory
14. Trout, Bass, Snapping Turtles
15. Pine trees, moose and wolves

Match the description or organism to its biome.

1. Monkeys & bromeliads - Tropical Rainforest
2. Caribou - Taiga (Coniferous Forest)
3. Penguins - Polar
4. Low amount of rainfall, extreme temperatures - Desert
5. Also called a prairie - Temperate Grassland
6. Has aphotic and photic layer - Ocean
7. Maples, oaks, and red buds - Temperate Deciduous Forest
8. Wildfires in California - Chaparral
9. Permafrost - Tundra
10. Lions, zebras, giraffes - Savanna
11. Cactus and succulent plants - Desert
12. Swamps and bogs and flooded areas - Wetlands
13. Canopy & Understory - Tropical Rainforest
14. Trout, Bass, Snapping Turtles - Freshwater (Lake, River)
15. Pine trees, moose and wolves - Taiga (coniferous)

1. Rainforests receive more [light / rain / wind] than other biomes.
2. Areas where the river meets the ocean: _____

3. Freshwater ecosystems are classified as
   a. salt or fresh
   b. flowing or standing
   c. deep or shallow
   d. tropical or temperate

4. Natural disturbances, such as fire, can result in
   [succession / commensalism]

5. Maple trees, oak trees and red buds are found in what biome? ____
6. The prairie and the savanna are both types of _____
7. When two organisms live in close association, it is called
   [succession / symbiosis / competitive exclusion

8. Where is plankton found? _____
9. Temperate zones have [extreme / mild] temperatures.
10. The first species to enter a new ecosystem is called a
    [opportunist / pioneer / successor]

11. Two microscopic organisms are placed in a container with a limited amount of resources. One species (X) lives in the bottom of the container near the soil and sand and feeds from the scraps that fall to the bottom. The other species (Y) spends its time swimming in the open water and feeds from the food at the surface. Each species therefore has a separate:

a. habitat b. ecosystem
c. community d. niche

12. In the container above, a third species is added (Z). This organism also lives in the soil at the bottom and feeds from the same things as Species X. After a period of time, scientists noted that species X had disappeared from the container. This illustrates:

a. competitive exclusion
b. symbiosis
c. parasitism
d. mutualism

13. Which of the following are areas of study focuses on the exchange of energy, organisms, and materials between ecosystems?

a. Population ecology
b. Organismal ecology
c. Landscape ecology
d. Ecosystem ecology
e. Community ecology

14. Which of the following biomes is correctly paired with the description of its climate?

a. Savanna-low temperature, precipitation uniform during the year
b. Tundra-long summers, mild winters
c. Coniferous Forrest- relatively short growing season, mild winters
d. Tropical forests-nearly constant day length and temperature
e. Grasslands- relatively warm winters, most rainfall in the summer