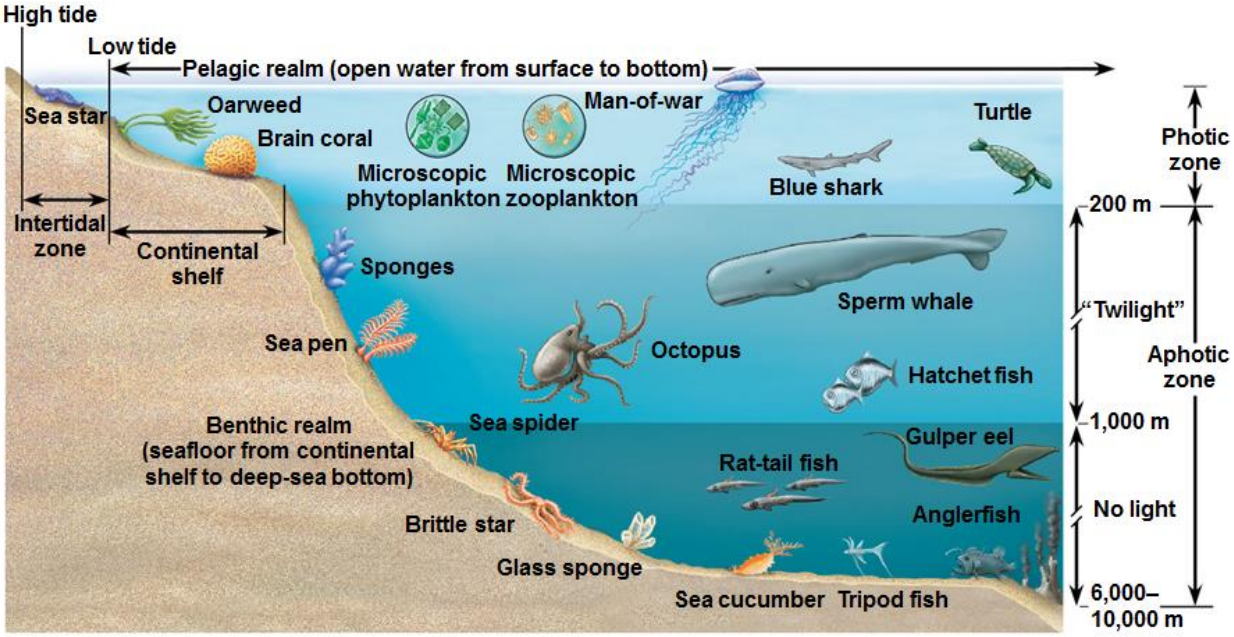
ECOLOGY UNIT OUTLINE
CHAPTER 34: The Biosphere: An Introduction to Earth's Diverse Environments

Aquatic Biomes

34.6 Sunlight and substrate are key factors in the distribution of marine organisms

1. Aquatic biomes are shaped by the availability of light and nutrients.
2. Within the oceans the
   a. **pelagic realm** includes all open water,
   b. **benthic realm** the seafloor,
   c. **aphotic zone**, where there is insufficient light for photosynthesis, and
   d. **photic zone** where light penetration is sufficient for photosynthesis and **phytoplankton** can occur.
      i. **Zooplankton** are abundant in the pelagic photic zone.
      ii. Coral reefs also occur in the photic zone.



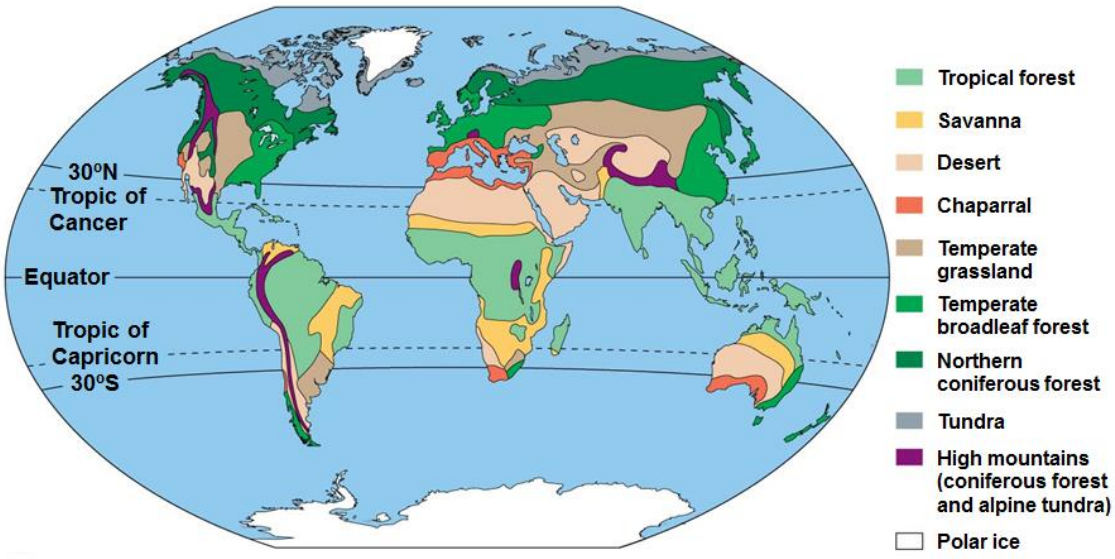
3. The marine environment includes distinctive biomes where the ocean meets the land or fresh water.
   a. **Intertidal zones** are where the ocean meets the land and the shore is pounded by waves during high tide and exposed to the sun and drying winds during low tide.
   b. **Estuaries** are productive areas where rivers meet the ocean.
   c. **Wetlands** are transitional between aquatic and terrestrial ecosystems.

Terrestrial Biomes

34.8 Terrestrial biomes reflect regional variations in climate

1. Terrestrial ecosystems are grouped into nine major types of biomes, distinguished primarily by their predominant vegetation.
2. The geographic distribution of plants and thus terrestrial biomes largely depends on climate.
3. The same type of biome may occur in geographically distant places if the climate is similar.
4. The current concern about global warming is generating intense interest in the effect of climate on vegetation patterns.
5. Biome borders may shift based on changing temperatures and precipitation

Biomes of the Biosphere



34.9 Tropical forests cluster near the equator

1. Tropical forests
   a. occur in equatorial areas,
   b. experience warm temperatures and days that are 11–12 hours long year-round, and have variable rainfall.
2. The tropical rain forest is among the most complex of all biomes.
   a. Tropical rain forests harbor enormous numbers of species.
   b. Large-scale human destruction of tropical rain forests continues to endanger many species.

34.10 Savannas are grasslands with scattered trees

1. **Savannas**
   a. are warm year-round, have 30–50 cm annual rainfall,
   b. experience dramatic seasonal variation, are dominated by grasses and scattered trees, and
   c. are mostly inhabited by large grazing mammals and insects.

34.11 Deserts are defined by their dryness

1. **Deserts** are the driest of all terrestrial biomes.
   a. They are characterized by low and unpredictable rainfall.
   b. **Desertification**, the conversion of semiarid regions to desert, is a significant environmental problem.

34.12 Spiny shrubs dominate the chaparral

1. The **chaparral**
   a. is a shrubland with cool, rainy winters and hot, dry summers.
   b. vegetation is adapted to periodic fires.

34.13 Temperate grasslands include the North American prairie

1. **Temperate grasslands**
   a. are mostly treeless, except along rivers or streams,
   b. experience precipitation of about 25–75 cm per year, with periodic droughts and cold winters, and in North America have historically been grazed by large bison and pronghorn.
   c. Farms have replaced most of North America's temperate grasslands.

34.14 Broadleaf trees dominate temperate forests

1. **Temperate broadleaf forests**
   a**.** grow where there is sufficient moisture to support the growth of large trees and
   b. experience wide-ranging temperatures (-30°C to 30°C) and high annual precipitation (75–150 cm).
   c. Nearly all of the original broadleaf forests in North America have been drastically altered by agriculture and urban development.

34.15 Coniferous forests are often dominated by a few species of trees

1. Cone-bearing evergreen trees, such as spruce, pine, fir, and hemlock, dominate **coniferous forests**.
2. The northern coniferous forest, or **taiga**, is the largest terrestrial biome on Earth. The taiga is characterized by long, cold winters and short, wet summers.
3. Temperate rain forests of coastal North America are also coniferous forests.

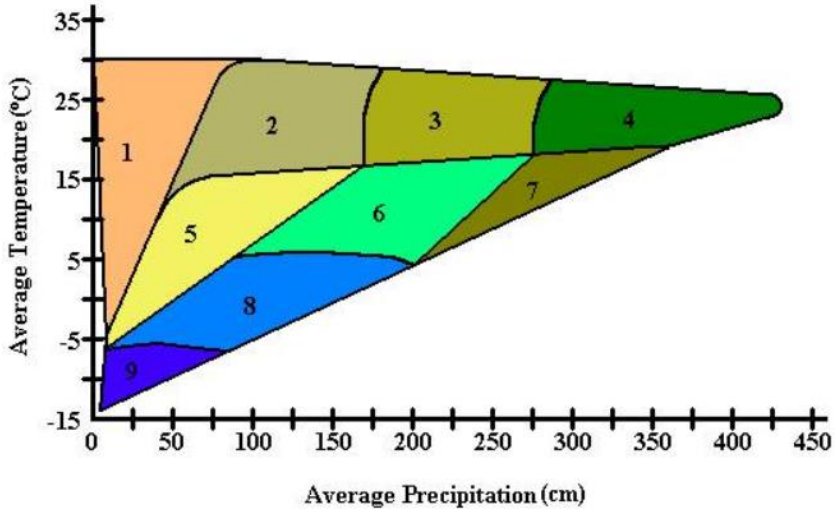
34.16 Long, bitter-cold winters characterize the tundra

1. The **tundra** covers expansive areas of the Arctic between the taiga and the frozen polar ice.
2. The treeless arctic tundra
   a. is characterized by **permafrost**, continuously frozen subsoil, and
   b. experiences little precipitation.

34.17 Polar ice covers the land at high latitudes

1. **Polar ice** covers land north of the tundra, much of the Arctic Ocean, and the continent of Antarctica.
2. Temperatures are extremely cold year-round and precipitation is very low.
3. The terrestrial polar biome is closely intertwined with the neighboring marine biome.

Comparison of Average Rainfall and Temperature for Biomes



1 - Desert	2 - Savanna
3 - Tropical Seasonal Forest	4 - Tropical Rain Forest
5 - Grassland/Shrubland	6 - Temperate Forest
7 - Temperate Rain Forest	8 - Taiga
9 - Tundra	

Word Parts

a- = without	estuary- = sea	pelag- = sea
bentho- = depths of sea	inter- = between	phyto- =plant
bio- = life	photo- = light	zo- = animal
eco- = house		

Vocabulary

1. pelagic realm- The region of an ocean occupied by seawater.

2. benthic realm - A seafloor or the bottom of a freshwater lake, pond, river, or stream

3. aphotic zone- The region of an aquatic ecosystem beneath the photic zone, where light does not penetrate enough for photosynthesis to take place.

4. photic zone - The region of an aquatic ecosystem into which light penetrates and where photosynthesis occurs.

5. phytoplankton- Algae and photosynthetic bacteria that drift passively in aquatic environments.

6. zooplankton - Animals that drift in aquatic environments.

7. intertidal zones - A shallow zone where the waters of an estuary or ocean meet land.

8. estuaries - A biome that occurs where a freshwater stream or river merges with the ocean.

9. wetlands - An ecosystem intermediate between an aquatic ecosystem and a terrestrial ecosystem, where soil is saturated with water permanently or periodically.

10. savannas- A biome dominated by grasses and scattered trees and maintained by occasional fires and drought.

11. deserts- A biome characterized by organisms adapted to sparse rainfall (less than 30 cm per year).

12. desertification- The conversion of semi-arid regions to desert.

13. chaparral - A biome dominated by spiny evergreen shrubs adapted to periodic drought and fires; found where cold ocean currents circulate offshore, creating mild, rainy winters and long, hot, dry summers.

14. temperate grasslands- A biome dominated by grasses and other nonwoody plants and maintained by seasonal drought, occasional fires, and grazing by large mammals.

15. temperate broadleaf forests- A biome located throughout midlatitude regions, where there is sufficient moisture to support the growth of large, broadleaf deciduous trees.

16. coniferous forests- A biome characterized by conifers, cone-bearing evergreen trees.

17. taiga- The northern coniferous forest, characterized by long, snowy winters and short, wet summers, extending across North America and Eurasia to the southern border of the arctic tundra; also found just below alpine tundra on mountainsides in temperate zones.

18. tundra - A biome at the northernmost limits of plant growth and at high altitudes, characterized by dwarf woody shrubs, grasses, mosses, and lichens.

19. permafrost- Continuously frozen ground found in the arctic tundra.

20. polar ice - A terrestrial biome that includes regions of extremely cold temperature and low precipitation located at high latitudes north of the arctic tundra and in Antarctica.

CHAPTER 36: Population Ecology

Introduction

A. Individual emperor penguins face the rigors of the Antarctic climate and have special adaptations, including a downy under layer of feathers for insulation and thick layer of fat for energy storage and insulation.

B. The entire population of emperor penguins reflects group characteristics, including the survivorship of chicks and growth rate of the population.

C. Population ecologists study natural population structure and dynamics.

Population Structure and Dynamics

36.1 Population ecology is the study of how and why populations change

1. A **population** is a group of individuals of a single species that occupy the same general area.

2. Population dynamics, the interactions between biotic and abiotic factors, cause variations in population sizes.

3. Population ecology is concerned with the changes in population size and factors that regulate populations over time.

4. Populations increase through birth and immigration to an area and decrease through death and emigration out of an area.

5. Population can be estimated by the following methods

a. **Mark-recapture-** a part of a population is captured, tagged, and the released. At a later time, a part of the population is recaptured. Those individuals that were recaptured are then counted.

$$N = \frac{M \cdot S}{R}$$

N = population size estimate
M = marked individuals released
S = size of second sample
R = marked animals recaptured

b. **Indirect counting**- counting the evidence of organisms to estimate its population size

c. **Quadrants**- use of a grid to sample and document the number or organisms in a given area

36.2 Density and dispersion patterns are important population variables

1. Population density is the number of individuals of a species per unit area or volume.

Formula: # individuals of a population / A (l x w) or V (l x w x h)

2. Examples of population density include the

a. number of oak trees per square kilometer in a forest

b. number of earthworms per cubic meter in forest soil.

3. Ecologists use a variety of sampling techniques to estimate population densities.
4. Within a population's geographic range, local densities may vary greatly.
5. **Dispersion patterns** can be clumped, uniform, or random based on the way individuals are spaced within their area.
   a. In a **clumped pattern** resources are unequally distributed & individuals are grouped in patches
   b. In a **uniform pattern**, individuals are most likely interacting and equally spaced in the environment.
   c. In a **random pattern** of dispersion, the individuals in a population are spaced in an unpredictable way.

Dispersion Patterns

Clumped	Random	Uniform

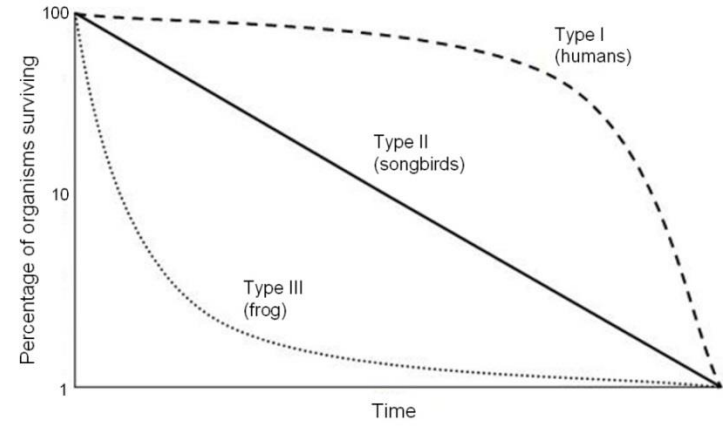
36.3 Life tables track survivorship in populations

1. **Life tables** track survivorship, the chance of an individual in a given population surviving to various ages.
2. **Survivorship curves** plot survivorship as the proportion of individuals from an initial population that are alive at each age.
3. There are three main types of survivorship curves.

a. Type I

b. Type II

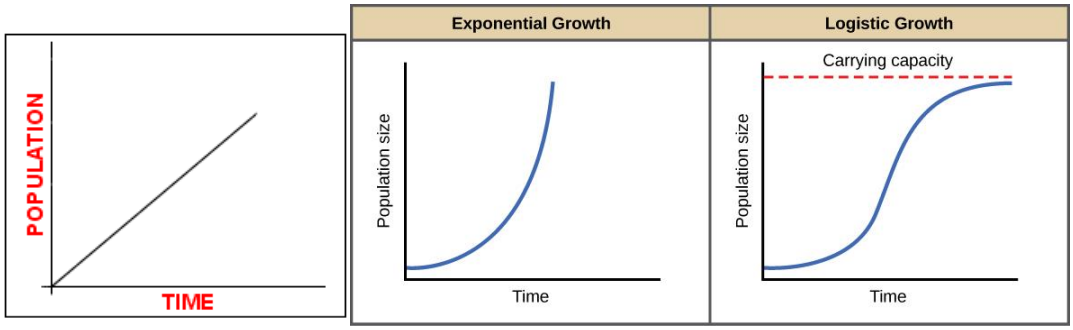
c. Type III



36.4 Idealized models predict patterns of population growth

1. The rate of population increase under ideal conditions is called **exponential growth**.
2. Eventually, one or more **limiting factors** will restrict population growth.
3. The **logistic growth model** is a description of idealized population growth that is slowed by limiting factors as the population size increases.
4. **Carrying capacity**, is the maximum population size that a particular environment can sustain.

Linear

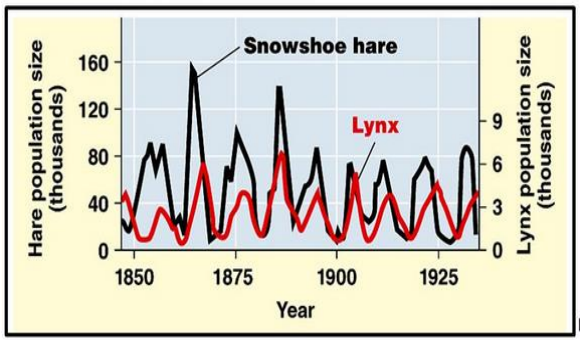


36.5 Multiple factors may limit population growth

1. The logistic growth model predicts that population growth will slow and eventually maintain as population density increases.
2. At increasing population densities, **density-dependent** rates result in declining births and increases in deaths.
3. **Intraspecific competition** is
   a. competition between individuals of the same species for limited resources and
   b. is a density-dependent factor that limits growth in natural populations.
4. Limiting factors may include food, nutrients, retreats for safety, or nesting sites.
5. In many natural populations, abiotic factors such as weather may affect population size well before density-dependent factors become important.
6. **Density-independent factors** are unrelated to population density. These may include fires, storms, habitat destruction by human activity, or seasonal changes in weather (for example, in aphids).

36.6 Some populations have "boom-and-bust" cycles

1. Some populations fluctuate in density with regularity.
2. Boom-and-bust cycles may be due to food shortages or predator-prey interactions.



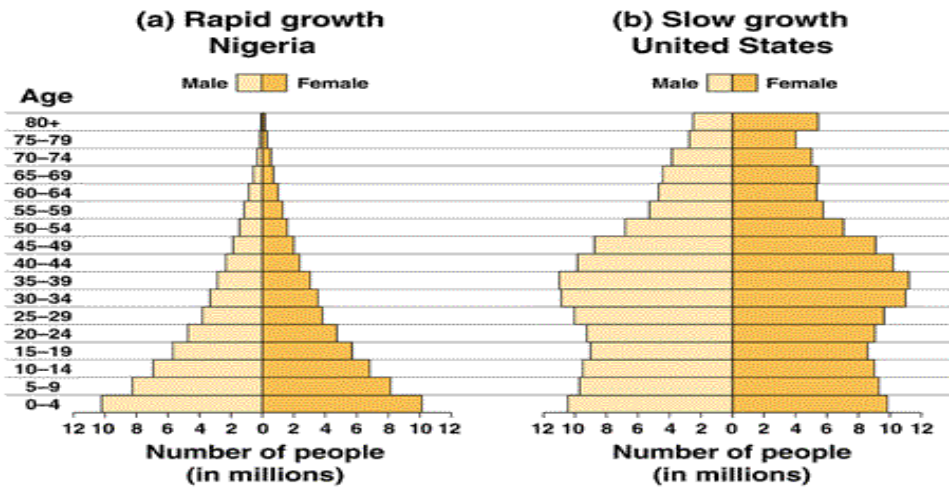
The Human Population

36.9 The human population continues to increase, but the growth rate is slowing

1. The human population grew rapidly during the 20th century - currently stands at about 7.7 billion.
2. In the developing nations death rates have dropped, birth rates are still high, and these populations are growing rapidly.
3. The **age structure** of a population is the proportion of individuals in different age groups and affects the future growth of the population.

36.10 Age structures reveal social and economic trends

1. Age-structure diagrams reveal a population's growth trends and social / economic trends



Chapter 36: Population Ecology

Word Parts

capit- = head
demo- = people
graphy = writing
intra- = within

Vocabulary

1.population ecology- The study of how and why populations change.

2.population-A group of individuals of a single species that occupy the same general area.

3.population density- The number of a species per unit of area or volume.

4.dispersion patterns-The way individuals in a population are spaced.

5.clumped-Individuals are aggregated in patches**.**

6.uniform-Even dispersion of a population.

7.random-Organisms are spaced in a patternless, unpredictable manner.

8.life table-A table of data summarizing mortality in a population.

9.survivorship curves-A plot of the proportion of alive individuals.

10.type I survivorship curve-The organism produces few offspring but cares for them well, creating a low mortality rate.

11.type II survivorship curve-Survivorship curve that exhibits a uniform rate of decline. Characteristic of birds, small mammals, and reptiles.

12.type III survivorship curve-The organism produces many offspring but does not take care of them very much.

13.exponential growth model-The rate the population would grow without any limiting factors.

14.limiting factor-An environmental factor that can limit the population growth of a certain population.

15.logistic growth model-A growth model that describes a population whose growth is initially exponential, but slows as the population approaches the carrying capacity of the environment.

16.carrying capacity-Largest number of individuals of a population that an environment can support.

17.density dependent-The factors that are limited by population density i.e. amount of food

18. density independent- The factors that are not limited by population density, i.e. natural disaster

Chapter 37: Communities and Ecosystems

Introduction

A. Natural ecosystems are valuable because they

1. provide natural resources,support outdoor recreation, and provide natural services including
   a. buffering against hurricane damage, recycling nutrients, preventing erosion, and pollinating crops.

Community Structure and Dynamics

37.1 A community includes all the organisms inhabiting a particular area

1. Community ecology is concerned with factors that influence species composition and distribution of communities and affect community stability.
2. A biological **community** is an assemblage of all the populations of organisms living close enough together for potential interaction and described by its species composition.
3. The boundaries of a community vary with the research question to be investigated. For example, the boundaries of a community could be defined as a pond or the intestinal microbes of a pond organism

37.2 Interspecific interactions are fundamental to community structure

1. **Interspecific interactions** are relationships with individuals of other species in the community, greatly affect population structure and dynamics, and can be categorized by their effect on the interacting populations.
2. **Interspecific competition** occurs when populations of two different species compete for the same limited resource.
   a. In **predation**, one species (the predator) kills and eats another (the prey).
   b. In **herbivory**, an animal consumes plant parts or algae.
   c. **Types of Symbiosis**
      1) In **mutualism**, both populations benefit.
      2) In **parasitism**, the host plants or animals are victimized by parasites or pathogens.
      3) **commensalism**- one organism benefits while the other is neither hurt nor helped.

37.3 Competition may occur when a shared resource is limited

1. An **ecological niche** is the sum of an organism's use of the biotic and abiotic resources in its environment.
2. Interspecific competition occurs when the niches of two populations overlap.
3. Competition lowers the carrying capacity of competing populations because the resources used by one population are not available to the other population.

37.4 Mutualism benefits both partners

1. Reef-building corals and photosynthetic dinoflagellates illustrate the win/win nature of mutualism. Photosynthetic dinoflagellates
   a. gain shelter in the cells of each coral polyp, produce sugars used by the polyps, and
   b. provide at least half of the energy used by the coral animals.

37.5 Predation leads to diverse adaptations in prey species

1. Predation benefits the predator but kills the prey.
2. Prey adapt using protective strategies that include
   a. camouflage, mechanical defenses, and chemical defenses.

37.6 Herbivory leads to diverse adaptations in plants

1. Herbivores and plants undergo **coevolution**,
   a. a series of reciprocal evolutionary adaptations in two species,
   b. in which change in one species acts as a new selective force on another.
2. A plant whose body parts have been eaten by an animal must expend energy to replace the loss.
   a. Thus, numerous defenses against herbivores have evolved in plants.
   b. Plant defenses against herbivores include spines and thorns and chemical toxins.

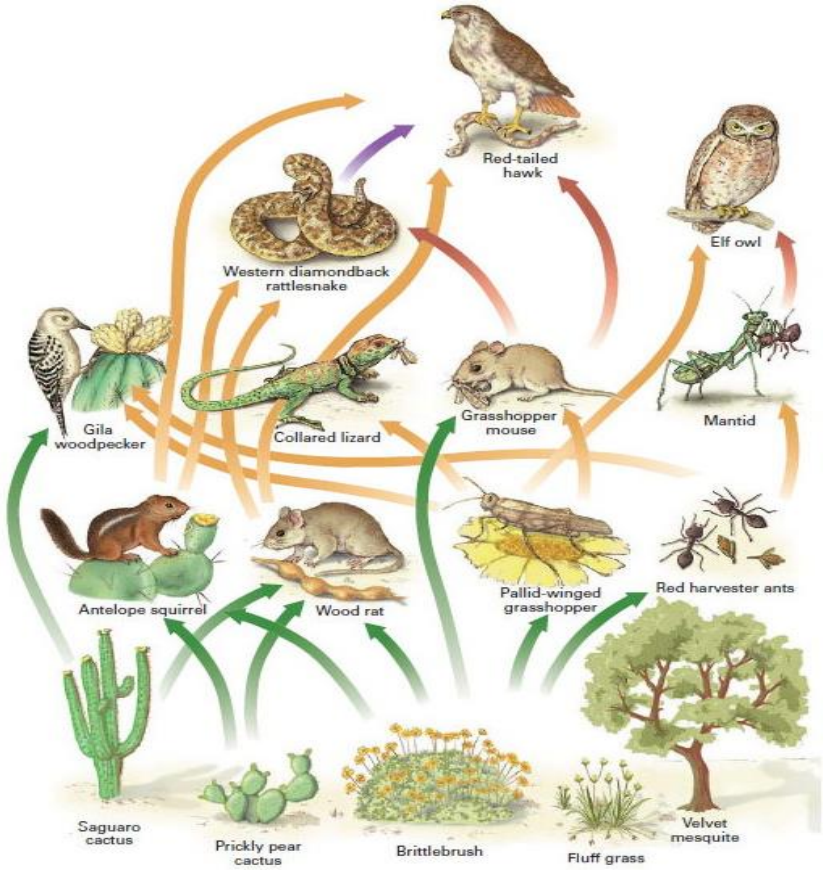
37.7 Parasites and pathogens can affect community composition

1. A parasite lives on or in a host from which it obtains nourishment.
   a. Internal parasites include nematodes and tapeworms.
   b. External parasites include mosquitoes, ticks, and aphids.
2. Pathogens are disease-causing microscopic parasites that include bacteria, viruses, fungi, or protists.
3. Non-native pathogens can have rapid and dramatic impacts.
   a. The Dutch Elm tree has been devastated by the fungus *Ceratocystis ulmi*.
4. Non-native pathogens can cause a decline of the ecosystem.

37.8 Trophic structure is a key factor in community dynamics

1. The **trophic structure** of a community is a pattern of feeding relationships consisting of several different levels.
   a. The sequence of food transfer up the trophic levels is known as a **food chain**.
   b. The transfer of food moves chemical nutrients and energy from producers up through the trophic levels in a community.\
2. **Producers** are autotrophs and support all other trophic levels.
3. Consumers are heterotrophs.
   a. Herbivores are **primary consumers**.
   b. **Secondary consumers** typically eat herbivores.
   c. **Tertiary consumers** typically eat secondary consumers.
   d. **Quaternary consumers** typically eat tertiary consumers.
4. **Detritivores** derive their energy from **detritus**, the dead material produced at all the trophic levels.
5. **Decomposers** are mainly prokaryotes and fungi and secrete enzymes that digest molecules in organic materials and convert them into inorganic forms, in the process called **decomposition**.

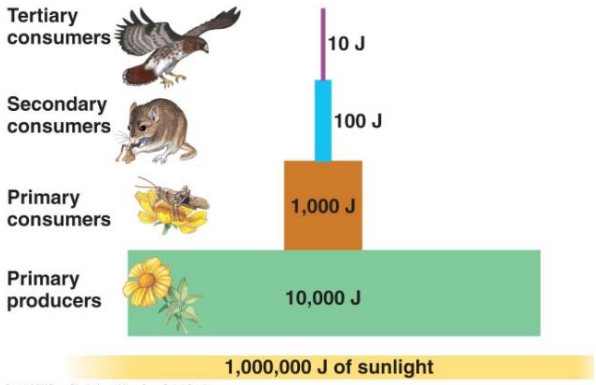
Desert Food Web



37.9 Food chains interconnect, forming food webs

1. A **food web** is a network of interconnecting food chains.
2. Consumers may eat more than one type of producer and several species of consumers may feed on the same species of producer.
3. **Pyramid of energy, number, or biomass**- diagram that shows a decreasing progression going up the pyramid for a food chain.

Energy Pyramid



37.10 Species diversity includes relative abundance and species richness

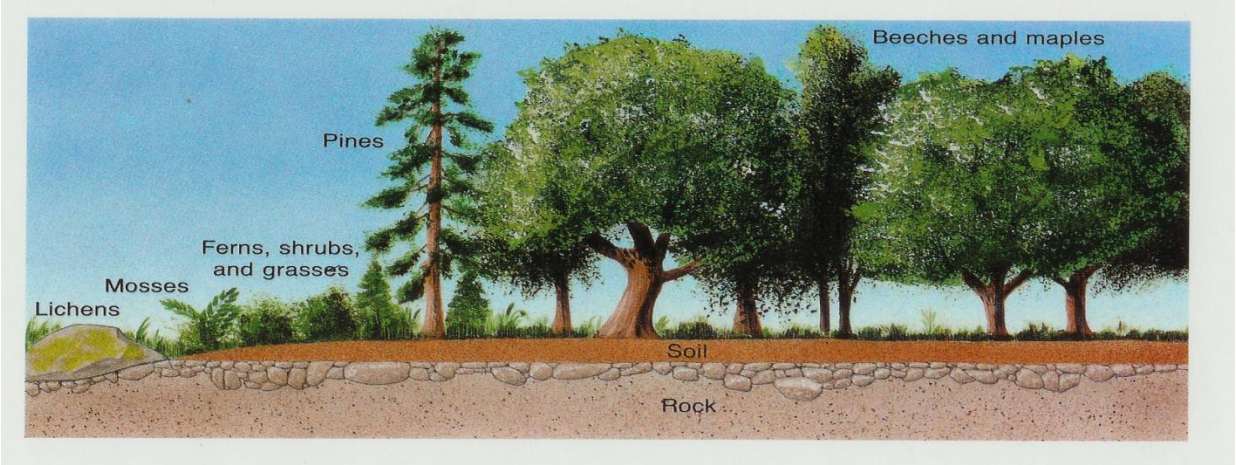
1. **Species diversity** is defined by two components:
   a. species richness, the number of species in a community, and relative abundance, the proportional representation of a species in a community.
2. Plant species diversity in a community affects the species diversity of animals.
3. Species diversity has consequences for pathogens.
4. Low species diversity is characteristic of most modern agricultural ecosystems.

37.11 Some species have a disproportionate impact on diversity

1. A **keystone species** is a species whose impact on its community is larger than its biomass or abundance indicates and occupies a niche that holds the rest of its community in place.
2. Examples of keystone species in marine ecosystems include *Pisaster* sea stars and long-spined sea urchins.

37.12 Disturbance is a prominent feature of most communities

1. **Disturbances**
   a. are events that damage biological communities and include storms, fires, floods, droughts, overgrazing, or human activity.
   b. The types, frequency, and severity of disturbances vary from community to community.
2. Communities change drastically following a severe disturbance that strips away vegetation and removes significant amounts of soil.
3. **Ecological succession** results from colonization by a variety of species, which are replaced by a succession of other species.



4. **Primary succession** begins in a virtually lifeless area with no soil.
5. **Secondary succession** occurs when a disturbance destroys an existing community but leaves the soil intact i.e. fires, tornadoes, & hurricanes.

37.13 Invasive species can devastate communities

1. **Invasive species**
   a. are organisms that have been introduced into non-native habitats by human actions and
   b. have established themselves at the expense of native communities.
   c. The absence of natural enemies often allows rapid population growth of invasive species.
2. Examples of invasive species include the deliberate introduction of pythons in the Everglades or cane toads into Australia.

Ecosystem Structure and Dynamics

37.14 Ecosystem ecology emphasizes energy flow and chemical cycling

1. An **ecosystem** consists of all the organisms (biotic) in a community and the abiotic environment with which the organisms interact.
2. In an ecosystem,
   a. **energy flow** moves *through* the components of an ecosystem and
   b. **chemical cycling** is the transfer of materials *within* the ecosystem.
3. A terrarium represents the components of an ecosystem and illustrates the fundamentals of energy flow.

37.15 Primary production sets the energy budget for ecosystems

1. **Primary production**
   a. is carried out by producers,
   b. is the amount of solar energy converted to chemical energy by an ecosystem's producers for a given area and during a given time period, and
   c. produces **biomass**, the amount of living organic material in an ecosystem.
2. Different ecosystems vary in their primary production and contribution to the total production of the biosphere.

37.16 Energy supply limits the length of food chains

1. A caterpillar represents a primary consumer.
2. Of the organic compounds a caterpillar ingests, about 50% is eliminated in feces, 35% is used in cellular respiration, and 15% is used for growth.
3. Only about **10% of the energy stored** at each trophic level is available to the next level.

37.17 A pyramid of production explains the ecological cost of meat

1. When humans eat grain or fruit, we are primary consumers, beef or other meat from herbivores, we are secondary consumers, and fish like trout or salmon, we are tertiary or quaternary consumers.
2. Therefore, the human population has about ten times more energy available to it when people eat plants instead of the meat of herbivores.
3. Eating meat of any kind is expensive economically and environmentally.

37.18 Chemicals are cycled between organic matter and abiotic reservoirs

1. Ecosystems are supplied with a continual influx of energy from the sun and Earth's interior.
2. Except for meteorites, there are no extraterrestrial sources of chemical elements.
3. Thus, life also depends on the recycling of chemicals.
4. **Biogeochemical cycles** include biotic components, abiotic components, and **abiotic reservoirs**, where a chemical accumulates or is stockpiled outside of living organisms.
5. Biogeochemical cycles can be local or global.

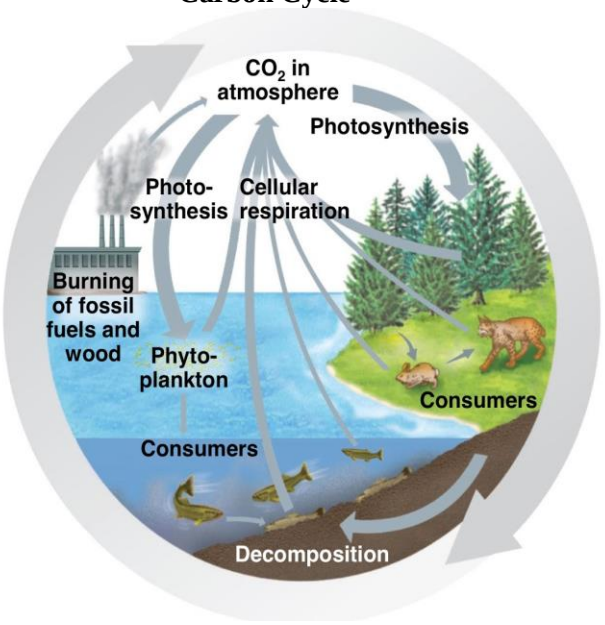
37.19 The carbon cycle depends on photosynthesis and respiration

1. Carbon
   a. the major ingredient of all organic molecules and
   b. found in the atmosphere, fossil fuels, and dissolved in carbon compounds in the ocean.
2. The return of CO_2 to the atmosphere by respiration closely balances its removal by photosynthesis.
3. The carbon cycle is affected by burning wood and fossil fuels.

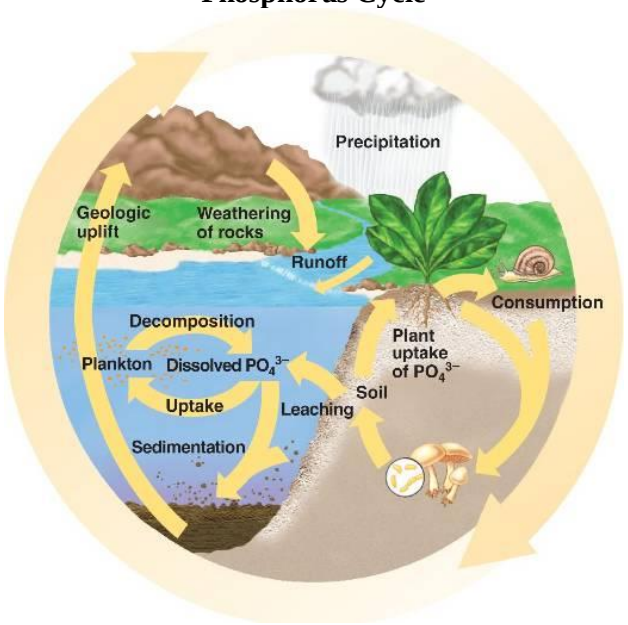
37.20 The phosphorus cycle depends on the weathering of rock

1. Organisms require phosphorus for nucleic acids, phospholipids, and ATP.
2. The phosphorus cycle does not have an atmospheric component.
3. Rocks are the only source of phosphorus for terrestrial ecosystems.
4. Plants absorb phosphate ions in the soil and build them into organic compounds.
5. Phosphates are returned to the soil by decomposers.
6. Phosphate levels in aquatic ecosystems are typically low enough to be a limiting factor.

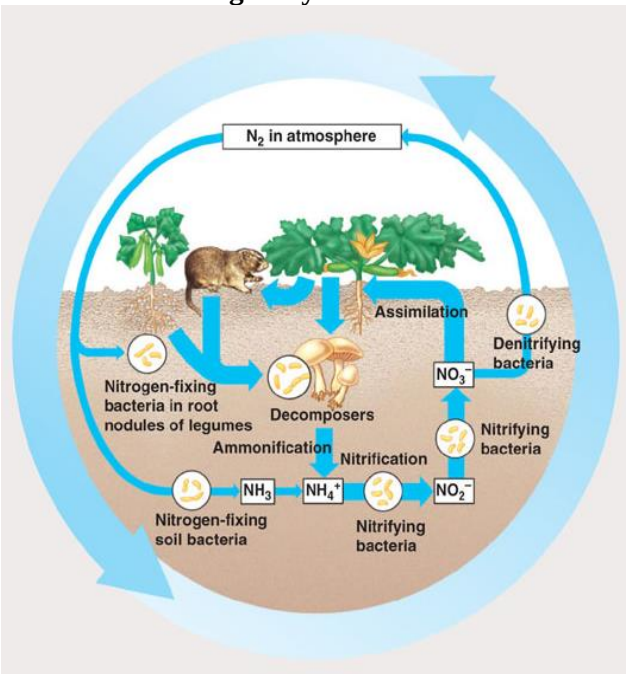
Carbon Cycle



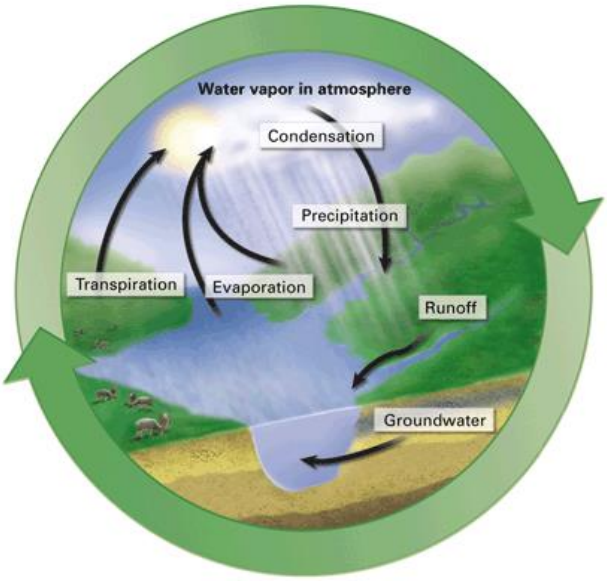
Phosphorus Cycle



Nitrogen Cycle



Water Cycle

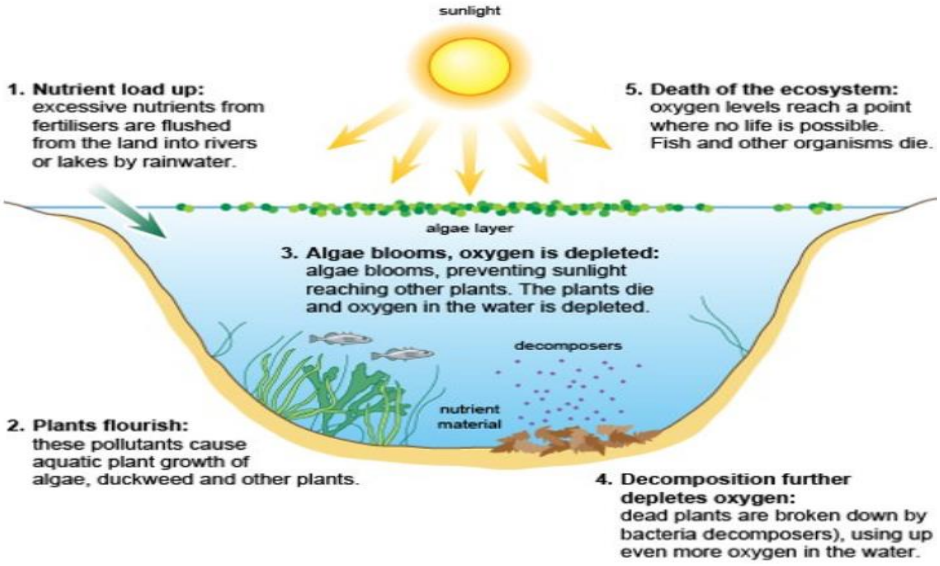


37.21 The nitrogen cycle depends on bacteria

1. Nitrogen is an ingredient of proteins and nucleic acids, essential to the structure and functioning of all organisms, and a crucial and often limiting plant nutrient.
2. Nitrogen has 2 abiotic reservoirs:the atmosphere, in which about 80% is nitrogen gas, & soil.
3. **Nitrogen fixation**
   a. converts N_2 to compounds of nitrogen that can be used by plants and is carried out by some bacteria.

37.22 A rapid inflow of nutrients degrades aquatic ecosystems

1. Over time, standing water ecosystems
   a. gradually accumulate nutrients from the decomposition of organic matter and fresh influx from the land, and primary production increases in a process known as **eutrophication.**



37.23 Ecosystem services are essential to human well-being

1. Although agricultural and other managed ecosystems are necessary to supply our needs, we also depend on services provided by natural ecosystems.
2. Healthy ecosystems supply fresh water and some foods, recycle nutrients, decompose wastes, and regulate climate and air quality.
3. Enormous increases in food production have come at the expense of natural ecosystems and the services they provide.
4. Human activities also threaten many forest ecosystems and the services they provides

Chapter 37: Communities and Ecosystems

Word Parts

a- = without
bio- = life
de- = from, down, out
detrit- = wear off
geo- = Earth
herb- = grass
inter- = between
mutu- = reciprocal
quatr- = four
terti- = three
-vora = eat

Vocabulary

1. community-all of the populations within a defined region or area.

2. species diversity-A variety of species that make up a community; concerns both species richness (the total number of different species) and the relative abundance of different species.

3. trophic structure-The feeding relationships in a community; determines the route of energy flow and the pattern of chemical cycling in an ecosystem.

4. interspecific competition-Competition between individuals or populations of two or more species requiring a limited resource, may inhibit population growth and structure communities.

5. **intraspecific competition**- Competition between members of a population for a limited resource

6. competition exclusion principle-The concept that populations of two species cannot coexist in a community in their niches are nearly identical. Using their resources more efficiently and having a reproductive advantage, one of the populations will eventually out-compete and eliminate the other.

7. niche-A population's role in its community; the sum total of a population's use of the (a)biotic resources of its habitat.

8. resource partitioning-The division of environmental resources by co-existing species such that the niche of each species differs by one or more significant factors from the niches of all coexisting species.

9. predation-An interaction between species in which one species, the predator, eats the other, the prey.

10.predator-The consumer in a biological community.

11. prey-The organism eaten by the predator.

12. keystone species-A species that is not usually abundant in a community, yet exerts a strong control on the community structure by the nature of its ecological role or niche.

14. herbivore-An animal that only eats plants and algae.

15. coevolution-An evolutionary change in which adaptations in one species act as a selective force on a second species, inducing adaptations that in turn act as a selective force on the first species; a mutual influence on the evolution of two different interacting species.

16. symbiotic relationship- A close association between organisms of two or more species.

17. parasitism-A type of symbiotic relationship in which a parasite, a type of predator, lives within or on the surface of a host, from which it derives food.

18. pathogen-A disease-causing organism.

19. commensalism-A type of symbiotic relationship in which one partner benefits without significantly affecting the other.

20. mutualism-A type of symbiotic relationship in which both partners benefit.

21. disturbance-In an ecological sense, a force that changes a biological community and usually removes some organisms from it (for example, a natural disaster).

22. ecological succession- The process of biological community change resulting from a disturbance; a transition in the species composition of a biological community, often following a flood, a fire, or a volcanic eruption.

23. primary succession- A type of ecological succession in which a biological community arises in an area without soil.

24. secondary succession-A type of ecological succession that occurs where a disturbance has destroyed an existing biological community, but left the soil intact.

25. food chain-A sequence of food transfers from producers through several levels of consumers in an ecosystem.

26. producer-An organism - usually a plant, algae, or an autotrophic bacterium - that makes organic food molecules from carbon dioxide, water, and other inorganic raw materials.

27. consumer-An organism that obtains food by eating plants or by eating animals that have eaten plants.

28. primary consumer-A consumer that eats plants/algae.

29. secondary consumer-A consumer that eats primary consumers.

30. tertiary consumer-A consumer that eats secondary consumers.

31.quaternary consumer-A consumer that eats tertiary consumers.

32. decomposer-Also known as a "detritivore," an organism that derives its energy from organic wastes and dead organisms (detritus).

33. decomposition-The breakdown of organic materials to inorganic ones.

34. food web-A network of interconnecting food chains.

35. energy flow-The passage of energy through the components of an ecosystem.

36.chemical cycling-The use and reuse of chemical elements (such as carbon) within an ecosystem.

37.biomass-The amount (mass) of organic material in an ecosystem.

38. primary production-The amount of solar energy converted to chemical energy (organic compounds) by autotrophs in an ecosystem during a given time period.

39. biogeochemical cycle-Any of various chemical circuits which involve both biotic and abiotic components of an ecosystem.

40. abiotic reservoir-The part of an ecosystem where chemicals (like carbon and nitrogen) accumulates or is stockpiled outside of living organisms.