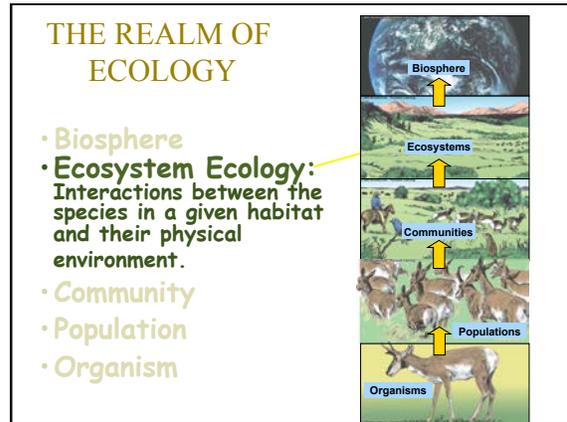
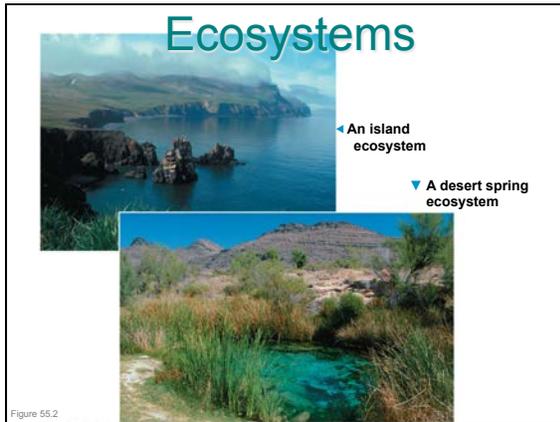
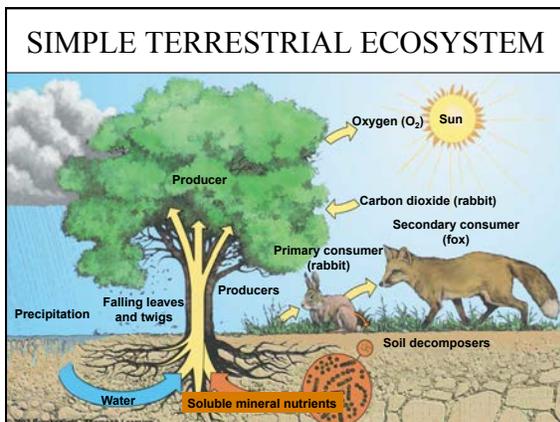
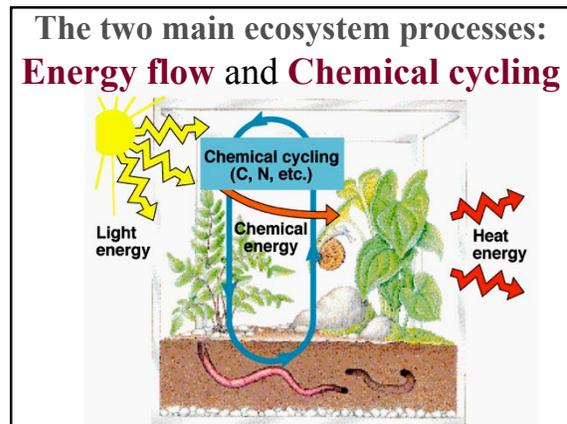


Ecosystems



Factors that Limit Communities

- **Abiotic (nonliving) Limiting Factors**
 - Temperature
 - Water
 - Soil type
 - Sunlight
 - Salinity
 - Wind stress
 - Altitude, depth
- **Biotic (living) Limiting Factors**
 - Food source
 - Competition
 - Predators
 - Social factors, mates
 - Pathogens, parasites
 - Vegetation



Energy flow is one-way

- 1st Law of thermodynamics: energy is not created, nor destroyed. But transformed.
- Energy enters ecosystems through photosynthesis or chemosynthesis.
- Some energy is transformed as used by producers; some is passed through food chain
- All energy eventually dissipates as heat. Thus must always be replenished.

Key:

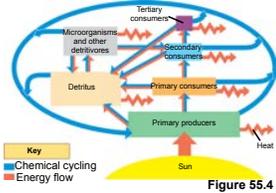
- Blue arrow: Chemical cycling
- Red arrow: Energy flow

Figure 55.4

Ecosystems

Chemical matter is recycled

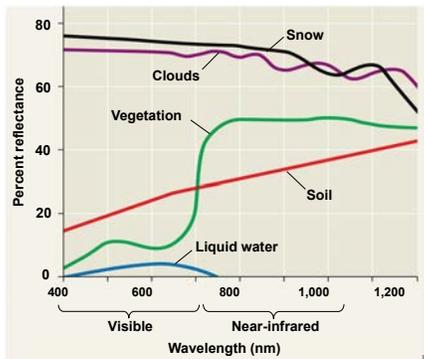
- Law of conservation of mass: Actual atoms are constantly rearranged into new molecules
- Energy needed to form new bonds, but atoms are reused
 - Carbon cycle
 - Nitrogen cycle



Solar Energy

- Different ecosystems have dissimilar solar illumination
 - Latitude
 - Topography
 - Depth (aquatic)
 - Reflectance

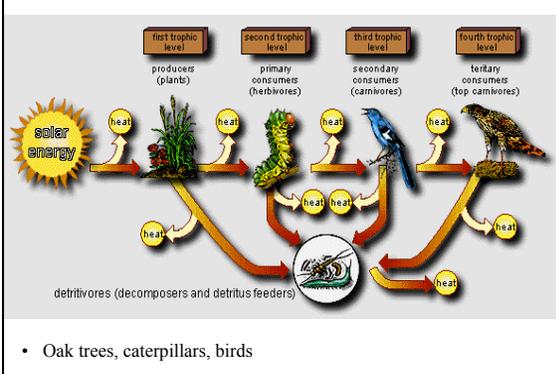
Reflectance vs. Available Solar Energy



Energy flows through the food web

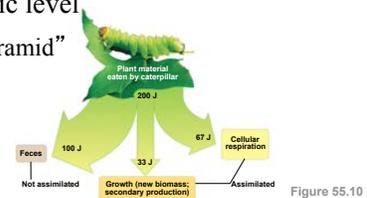
- Energy from lower trophic levels is transferred to higher trophic levels
- 5% - 20% of energy consumed is available to next trophic level
- Energy returns to the physical environment as heat
 - Remember thermodynamics!
 - *“Energy is neither created nor destroyed!”*

Hardwood forest

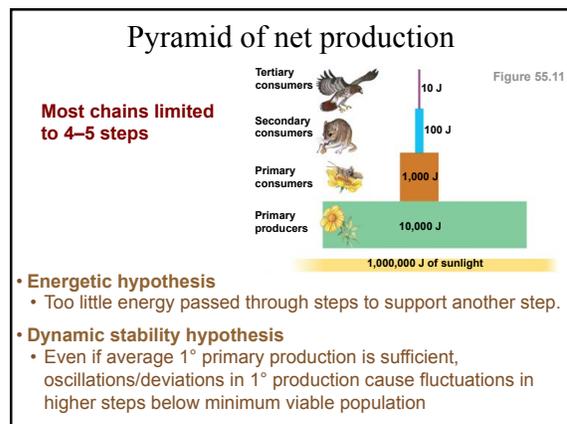
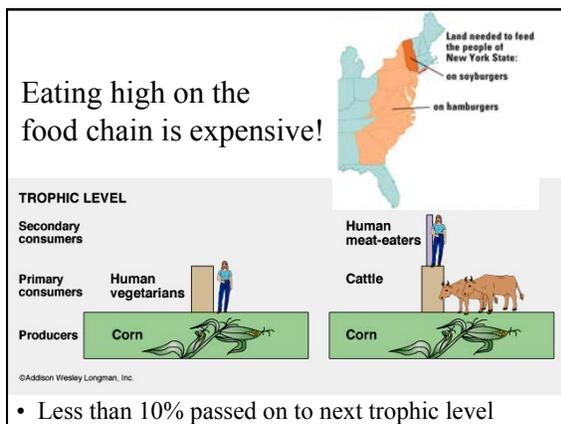
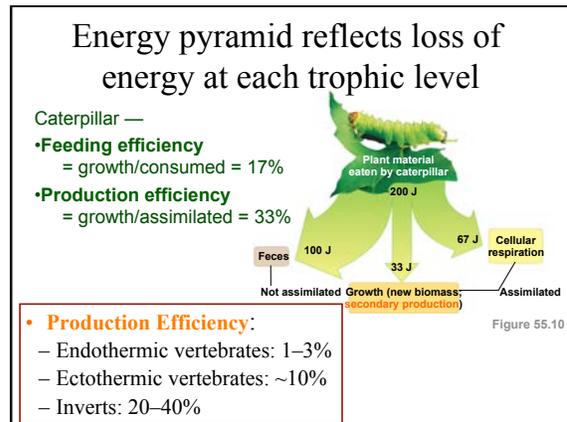
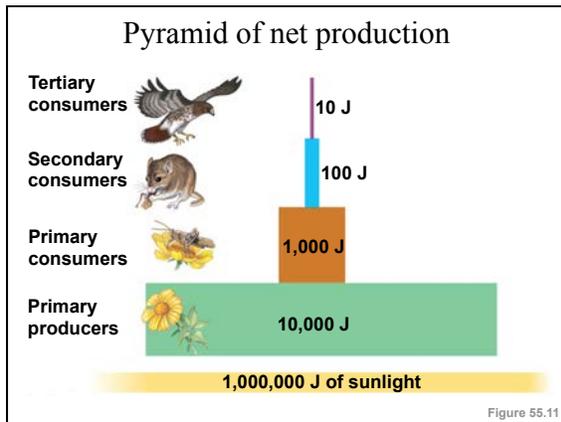


Energy pyramid reflects loss of energy at each trophic level

- Only 1% of solar energy reaching Earth is used by living systems
- Only ~10% of energy consumed is available to next trophic level
 - “Energy Pyramid”



Ecosystems



Biogeochemical cycles:
"life-earth-chemical"

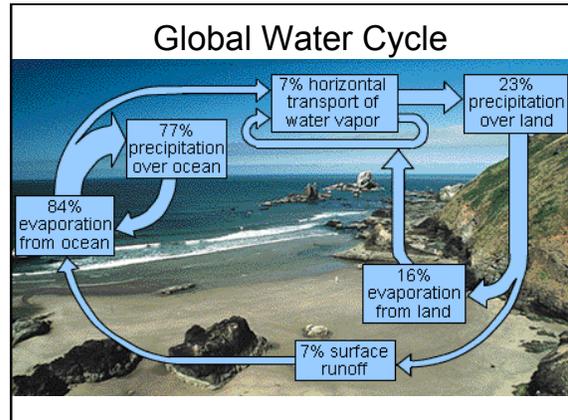
- Materials enter producers from atmosphere or soil.
- Return to abiotic world through respiration and decomposition.
- Biologically important materials:
 - Water (H₂O)
 - Carbon (CO₂)
 - Nitrogen (N₂, NO₃⁻, NO₂⁻, NH₄)

Pools or Reservoirs of Materials

- Pools available:
 - **Abiotic:** atmosphere, soil, water, geological
 - **Biotic:** living or dead organic matter
- Materials cycle between pools
- Size of pools constant only if entry equals exit

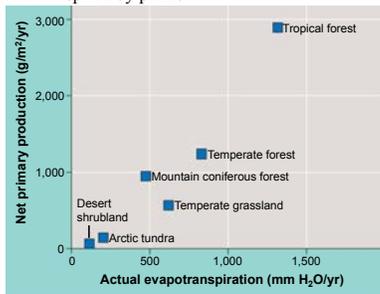
Global Water Cycle

- Humidity: water in atmosphere
- Precipitation: rain, snow
- Surface transport: rivers, creeks, runoff
- Groundwater transport: percolation, interflow
- Reservoirs: oceans, lakes, aquifers
- Evaporation:
 - transpiration: water loss from plants; helps maintain local humidity
 - from other organisms: sweat, respiration

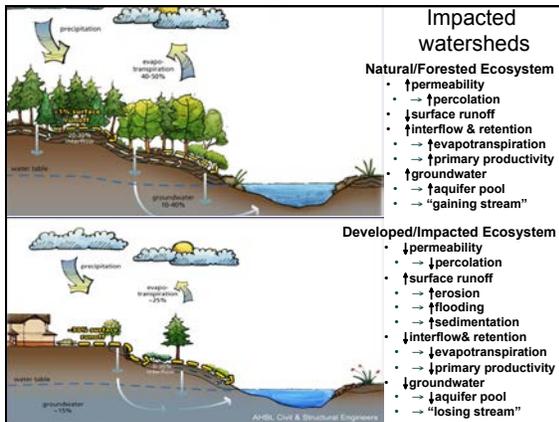


Water cycle & NPP

- Actual **evapotranspiration** = annual amount of water evaporated from a landscape and transpired by plants



Watershed



Human activity disrupts local water cycles

- Diversion of surface transport
 - Irrigation
 - Dams
- Disruption of soil water retention (watershed disturbance)
 - Clear cutting of forests
 - Overgrazing
 - Permeability — compaction & loss of organic content
 - Also causes loss of minerals through runoff
 - Further losses of vegetation
 - Desertification

Ecosystems

