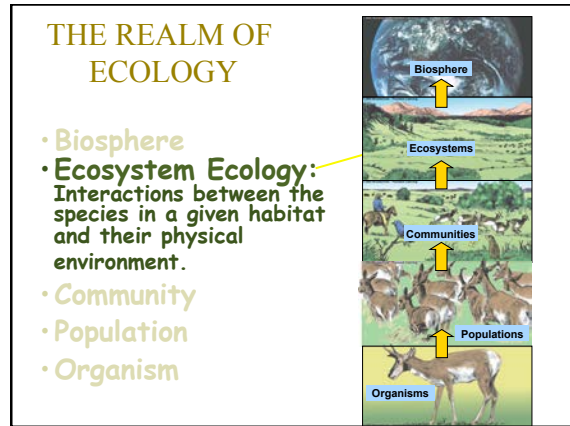
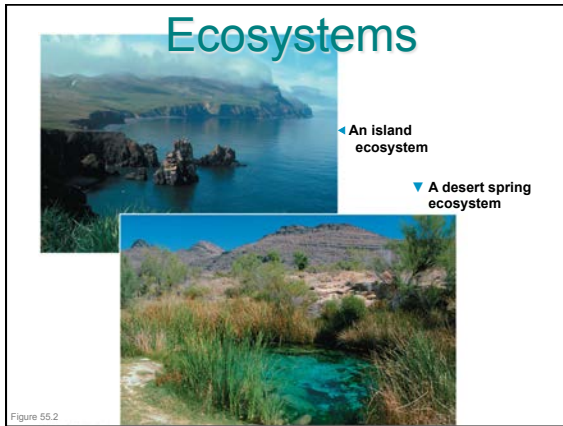
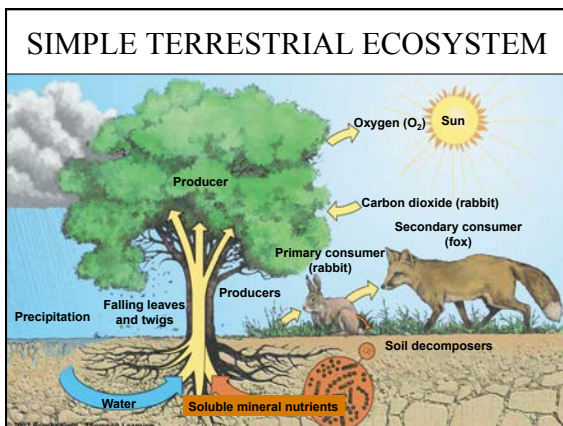
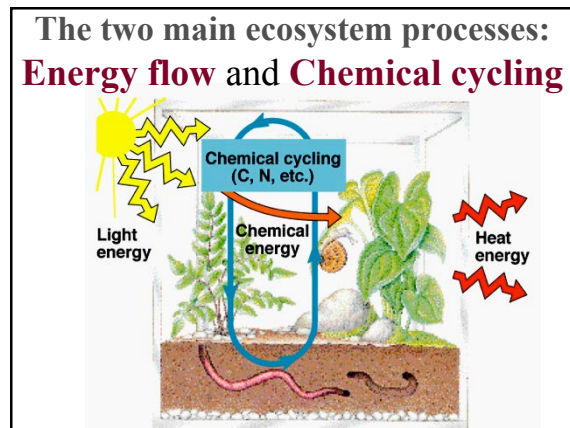


# Ecosystems



## 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

- 1<sup>st</sup> 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.

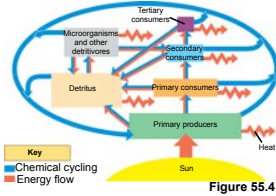
Key: Blue arrow = Chemical cycling, Red arrow = Energy flow

Figure 55.4

# Ecosystems

## Chemical matter is recycled

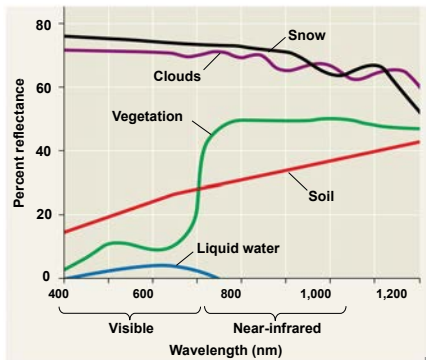
- Law of conservation of mass: Actual atoms are constantly rearranged into new molecules
- Energy needed to form new bonds, but atoms are reused
  - Carbon cycle
  - Nitrogen cycle



## Solar Energy

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

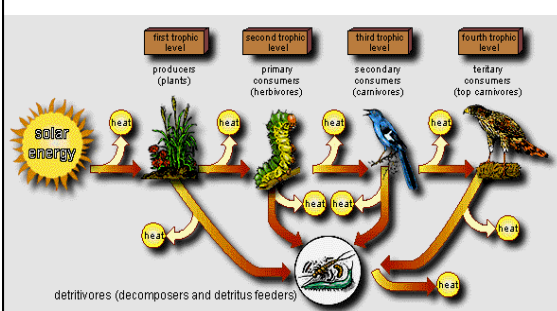
## Reflectance vs. Available Solar Energy



## Energy flows through the food web

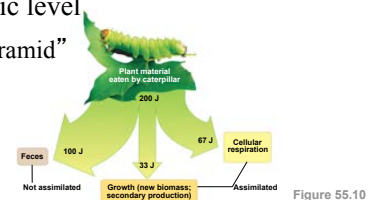
- Energy from lower trophic levels is transferred to higher trophic levels
- 5% - 20% of energy consumed is available to next trophic level
- Energy returns to the physical environment as heat
  - Remember thermodynamics!
  - *“Energy is neither created nor destroyed!”*

## Hardwood forest

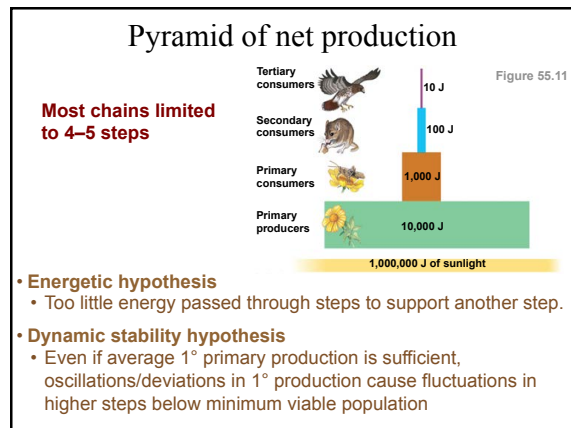
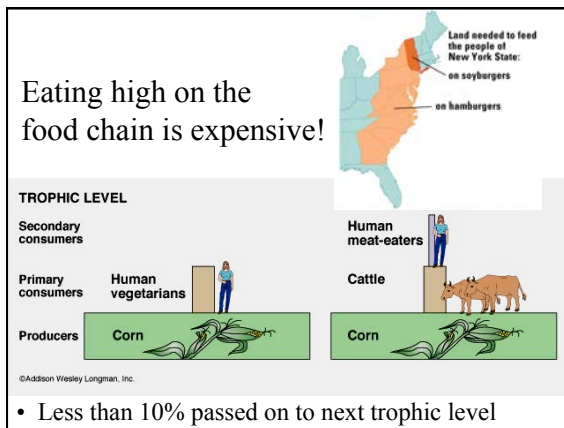
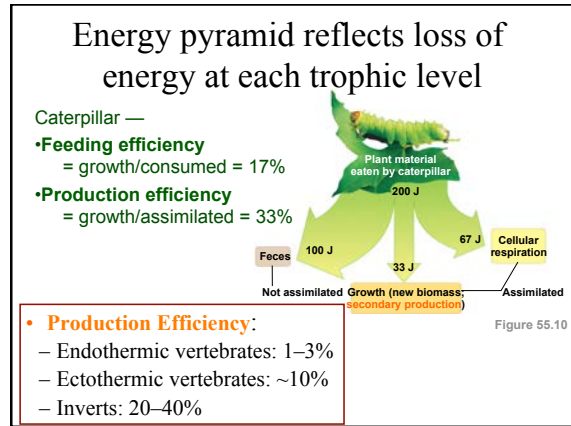
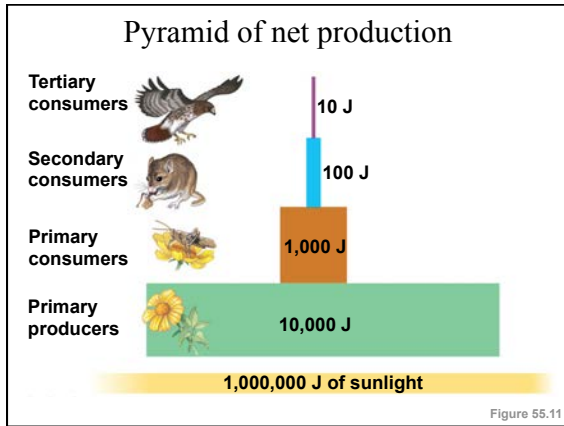


## Energy pyramid reflects loss of energy at each trophic level

- 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"*

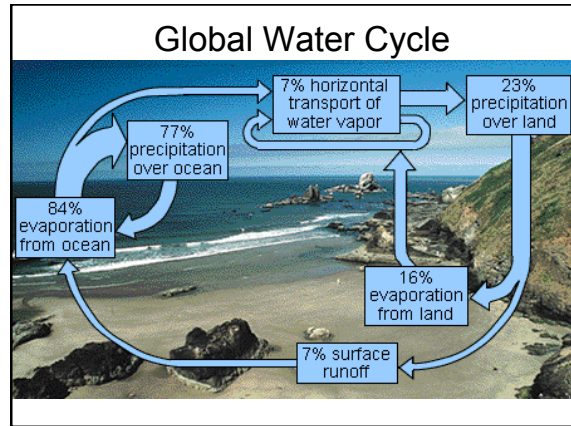
- Materials enter producers from atmosphere or soil.
- Return to abiotic world through respiration and decomposition.
- Biologically important materials:
  - Water (H<sub>2</sub>O)
  - Carbon (CO<sub>2</sub>)
  - Nitrogen (N<sub>2</sub>, NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup>, NH<sub>4</sub>)

**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

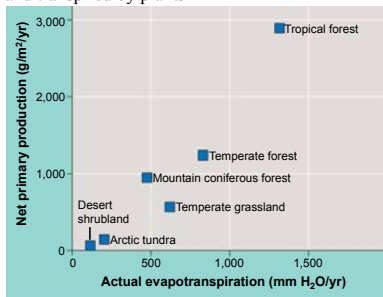
### Global Water Cycle

- Humidity: water in atmosphere
- Precipitation: rain, snow
- Surface transport:
  - puddles, groundwater, rivers, oceans
- Groundwater transport
  - aquifers
- Evaporation:
  - transpiration: water loss from plants; helps maintain local humidity
  - from organisms: sweat, urine, respiration

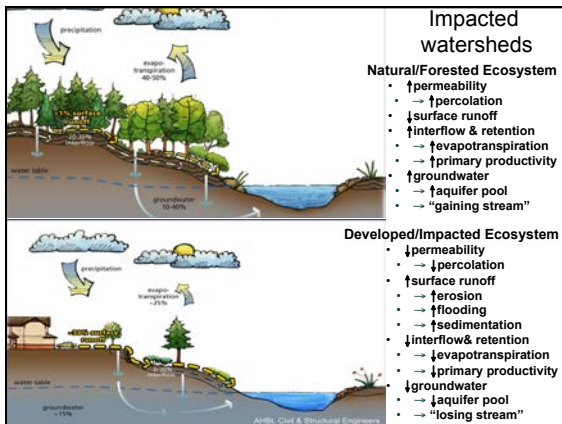


### Water cycle & NPP

- 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

