

## Community Ecology

Ecological interactions affect how organisms evolve, and evolutionary change in turn affects ecological relationships.

## Community Ecology

### **Community Ecology**

- looking at the interactions between populations
  - + *interspecific/intraspecific interactions*
    - interactions between populations of different/same species
    - positive (+), negative (-), or neutral (0)
  - + types
    - Competition
    - Predation
    - Symbiosis

## Competition

### Competition (-/-)

- interaction between individual organisms that use the same resources present in limited supply
  - niche: set of resources/conditions necessary for survival
    - + organism's role/job in the community
  - intraspecific/interspecific competition
    - + same/different species
  - types
    - + *Interference Competition*
      - animals: overt fighting; plants: secretion of toxins
    - + *Exploitative Competition*
      - removal of a resource
  - Competitive Exclusion Principle- G.F. Gause, Russian biologist

## Predation

### Predation (+/-)

- eating of live or freshly killed organisms
  - + predators eat prey
  - + *parasitism*
    - specialized predators do not actually kill prey (host)
  - + Three hypotheses
    - When prey population decreases, predator population decreases;  
When predator population decreases, prey population increases
    - Prey populations may undergo a regular cycle
    - Predator populations may undergo a regular cycle
  - + Defense against Predators
    - cryptic coloration (camouflage)
    - aposematic coloration (warning coloration)
    - mimicry
      - + Batesian (harmless species mimics harmful model)
      - + Mullerian (harmful species resemble each other)

## Symbiosis

### Symbiosis

- close and long term association between organisms of two species
  - + Mutualism (+/+)
  - both organisms benefit from the interaction
    - + mycorrhizae, lichens
  - + Commensalism (+/0)
  - one species benefits, but other is unaffected
    - + remora-shark relationship

## Community Composition and the Question of Stability

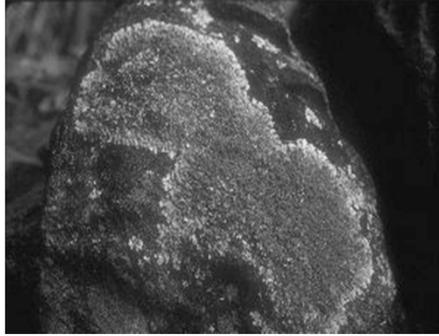
### Disturbances

- events, such as storms, fire, floods, droughts, overgrazing, etc.
  - + damage community, remove organisms, alter resource availability
    - communities are usually in a state of recovery

### Ecological Succession

- change in the composition of species over time
  - + climax community
    - final successional stage of constant species composition
  - + changes that induce succession
    - substrate texture
    - soil pH
    - soil water potential
    - light availability
    - crowding

## Primary Succession



### Primary Succession

- occurs on substrates that never previously supported living things
  - + succession on rock or lava
    - lichens
    - bacteria, protists, mosses
    - insects, other arthropods
    - r-selected species of plants
    - k-selected species of plants

## Secondary Succession

### Secondary Succession

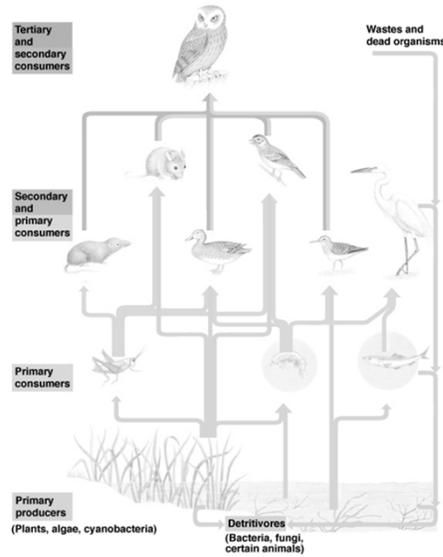
- begins in habitats where communities were destroyed by disturbances
  - + abandoned cropland



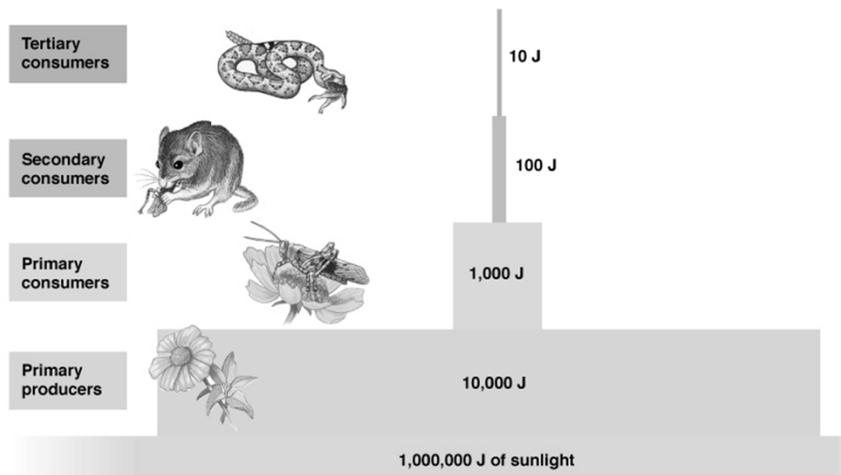
# Ecosystems

## Trophic Levels

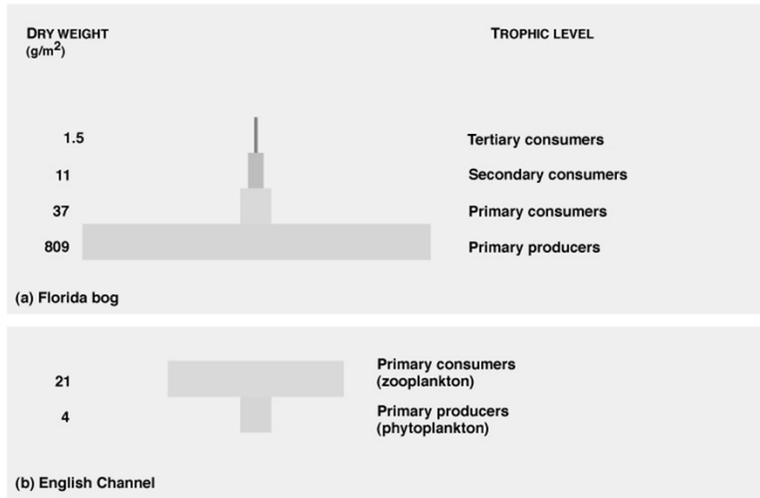
- Primary producers
  - + autotrophs (plants, protists, cyanobacteria, chemosynthetic bacteria)
- Primary consumers
  - + herbivores
- Secondary consumers
  - + primary carnivores
- Tertiary consumers
  - + secondary carnivores
- Detritivores
  - + decomposers (fungi, bacteria, earthworms, insects, scavengers)



# Pyramid of Energy

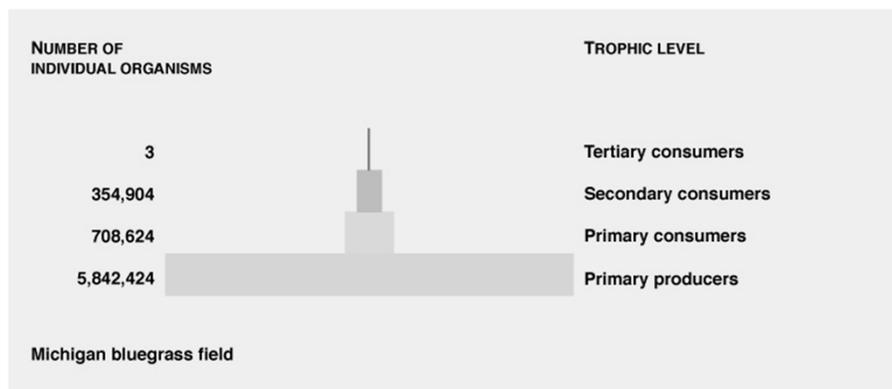


# Pyramid of Biomass



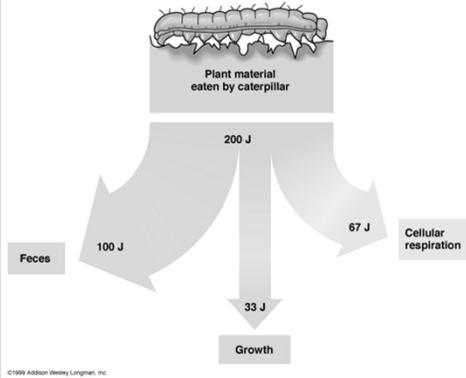
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# Pyramid of Numbers



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# Ecological Efficiency



## Ecological Efficiency

- proportion of energy represented at one trophic level that is transferred to the next
- + average efficiency=10%
- only 10% of productivity is transferred to next level
- remaining 90% is consumed by metabolism

# Food Chains and Food Webs

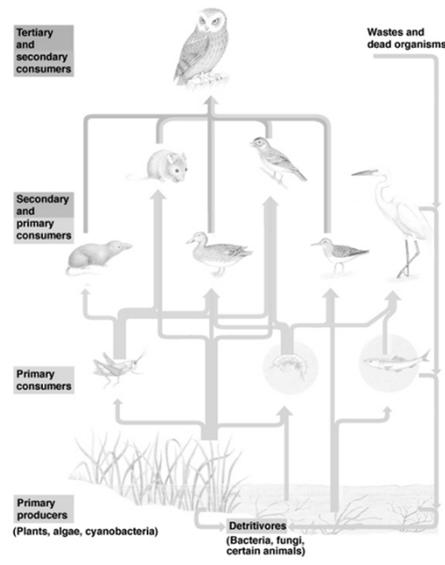
## Food Chain

- linear flow chart of who eats whom

grass --> zebra --> lion --> vulture

## Food Webs

- expanded, more complete

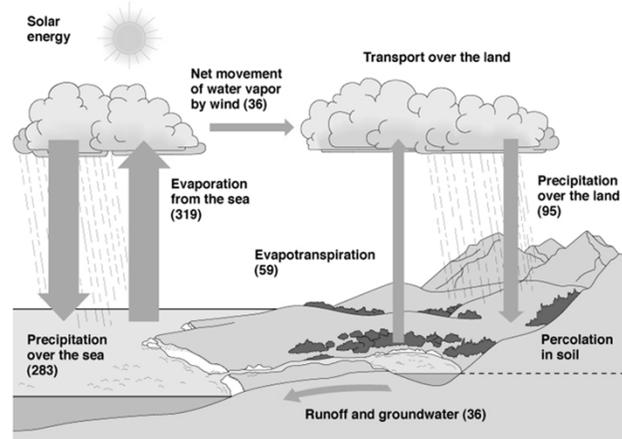


# Biogeochemical Cycles

## Biogeochemical Cycles

- flow of essential elements from the environment to living things and back to the environment
  - + reservoirs
    - major storage locations
  - + assimilation
    - processes through which element incorporates into terrestrial plants and animals
  - + release
    - processes through which element returns to the environment

## Hydrologic Cycle (water cycle)

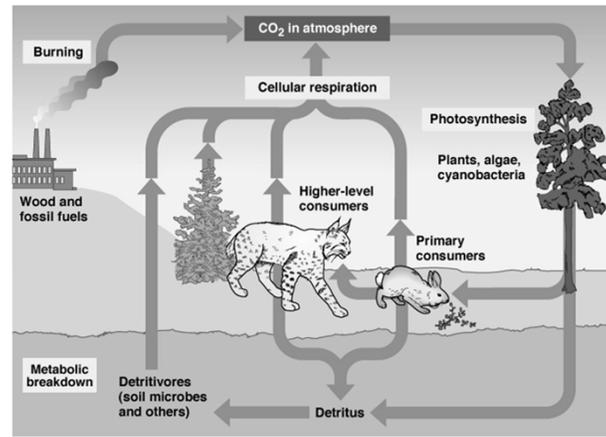


Reservoirs: oceans, air, groundwater, glaciers

Assimilation: plants absorb from soil; animals eat/drink

Release: plants transpire; animals/plants decompose

## Carbon Cycle

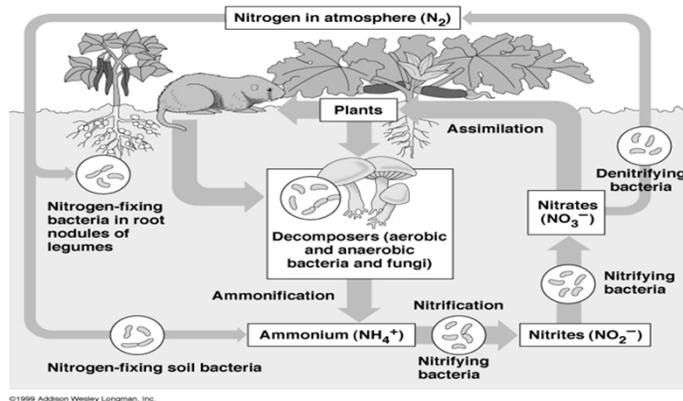


Reservoirs: atmosphere (CO<sub>2</sub>), fossil fuels, peat, cellulose

Assimilation: plants via photosynthesis; consumers

Release: respiration and decomposition; burn fossil fuels

## Nitrogen Cycle

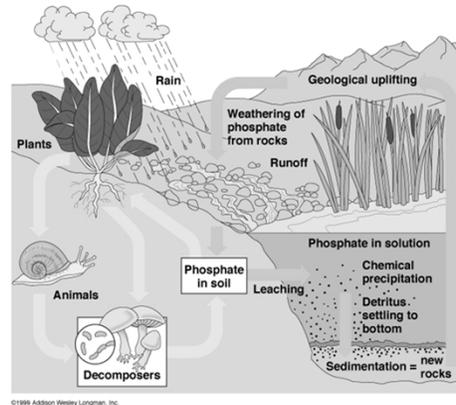


Reservoirs: atmosphere (N<sub>2</sub>); soil (ammonium, ammonia, nitrite, nitrate)

Assimilation: plants absorb from soil; animals consume plants/animals

Release: denitrifying and detritivorous bacteria; animal excretion

## Phosphorous Cycle



Reservoirs: rocks

Assimilation: plants absorb from soil (phosphate); consumers

Release: decomposition; excretion in waste products

## Biomes

### Biome

- region of biosphere characterized by vegetation and adaptations of organisms inhabiting the environment
  - + *Tropical rain forest* (high temp., heavy rainfall)
  - + *Savannahs* (grassland with scattered trees)
    - tropical, but receive less rainfall than rain forest
  - + *Temperate grasslands* (North American prairie)
    - receive less water/lower temp. than savannahs
  - + *Temperate deciduous forests* (warm summer/cold winters)
  - + *Deserts* (hot and dry)
  - + *Taigas* (coniferous forests)
    - precipitation in the form of snow
  - + *Tundras* (Lambau Field)
    - permafrost
  - + *Fresh water biomes* (ponds, lakes, streams, rivers)
  - + *Marine biomes* (estuaries, intertidal zones, continental shelves, coral reefs, pelagic oceans)

