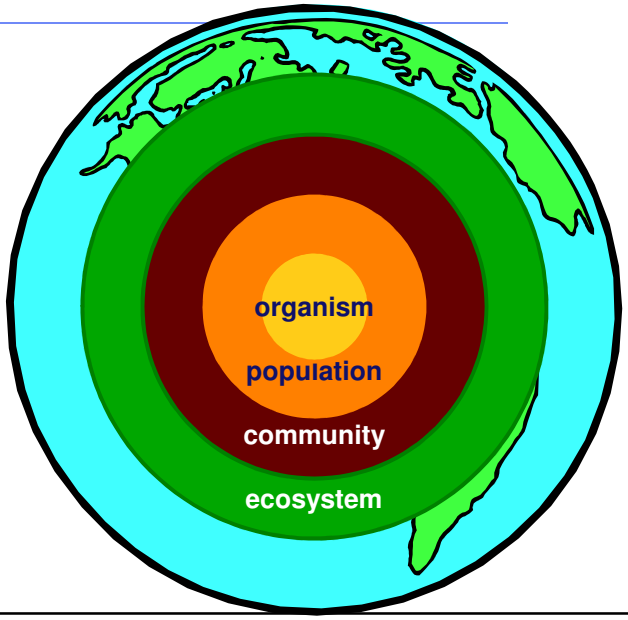
# AP Biology


## Studying Organisms In Their Environment

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## Essential questions

- What limits the production in ecosystems?
- How do nutrients move in the ecosystem?
- How does energy move through the ecosystem?

## Ecosystem

- All the organisms in a community plus abiotic factors
  - ecosystems are transformers of energy & processors of matter
- Ecosystems are self-sustaining
  - what is needed?

- capture energy
- transfer energy
- cycle nutrients

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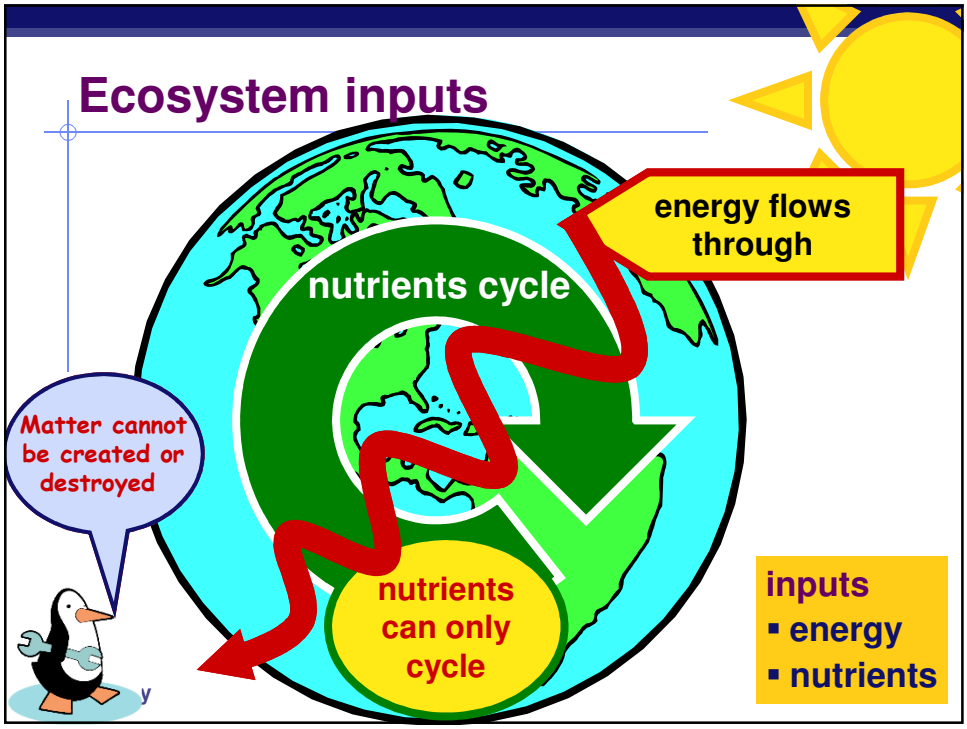
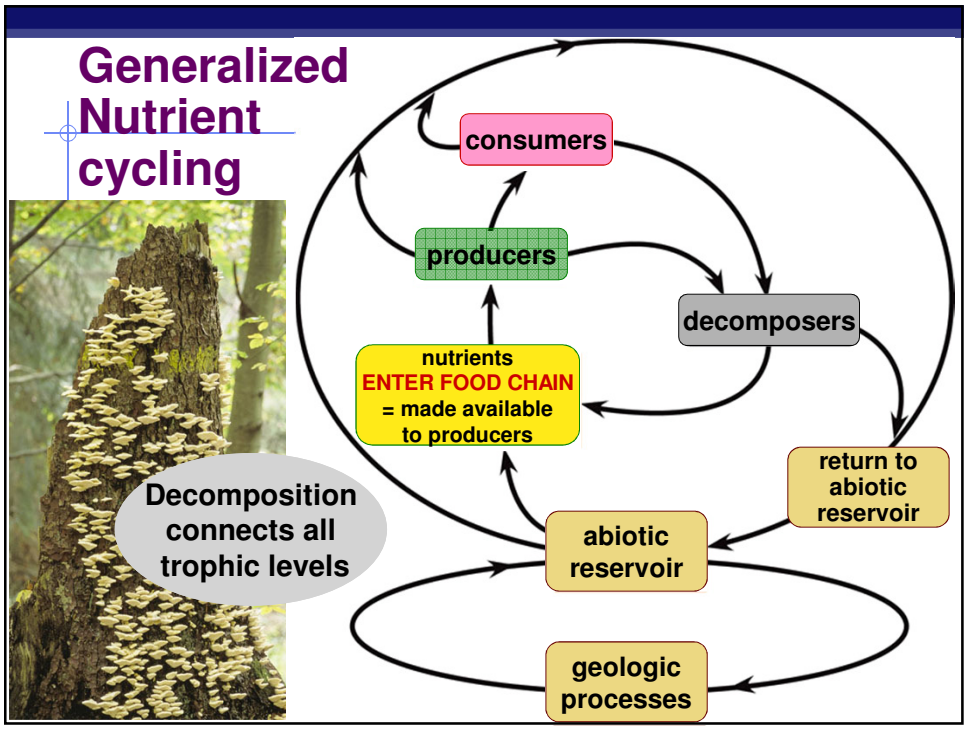

Ecosystem inputs
energy flows through
nutrients cycle
Matter cannot be created or destroyed
nutrients can only cycle
inputs
▪ energy
▪ nutrients


Generalized Nutrient cycling
consumers
producers
decomposers
nutrients ENTER FOOD CHAIN = made available to producers
return to abiotic reservoir
abiotic reservoir
geologic processes
Decomposition connects all trophic levels

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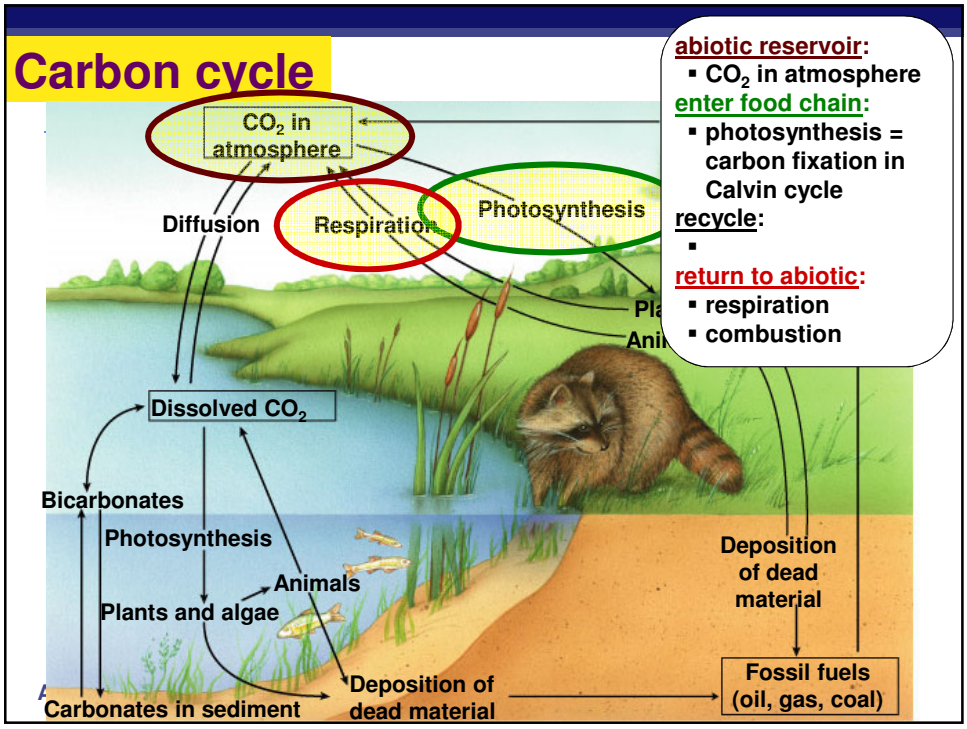
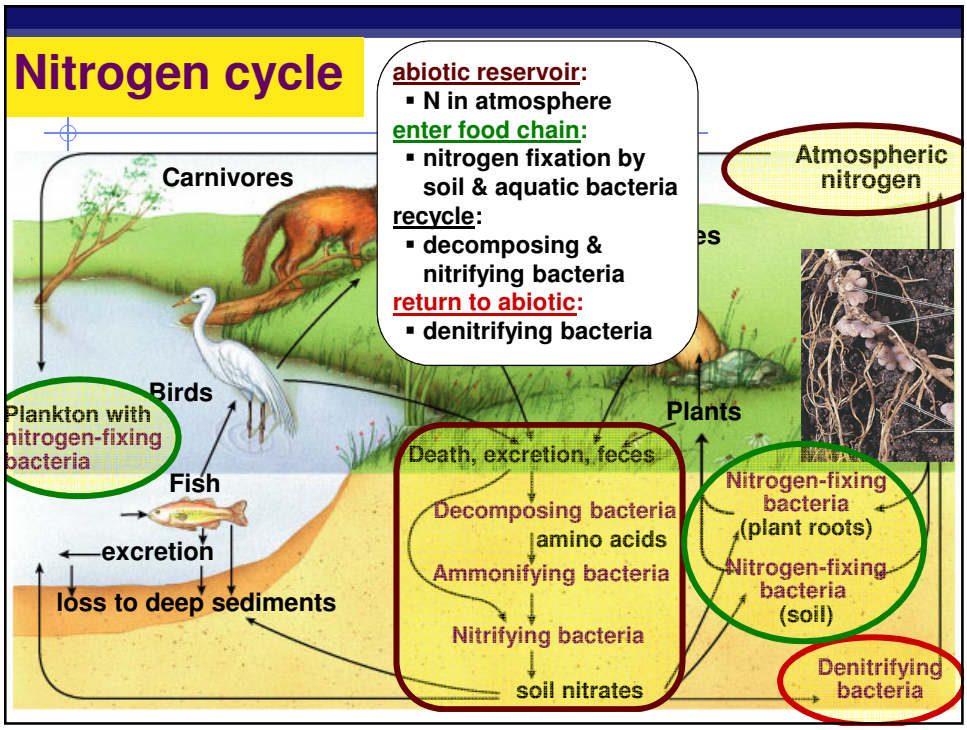

Carbon cycle
abiotic reservoir:
▪ $CO_2$ in atmosphere
enter food chain:
▪ photosynthesis = carbon fixation in Calvin cycle
recycle:
▪
return to abiotic:
▪ respiration
▪ combustion
$CO_2$ in atmosphere
Diffusion
Respiration
Photosynthesis
Dissolved $CO_2$
Bicarbonates
Photosynthesis
Animals
Plants and algae
Deposition of dead material
Fossil fuels (oil, gas, coal)
Carbonates in sediment
Deposition of dead material


Nitrogen cycle
abiotic reservoir:
▪ N in atmosphere
enter food chain:
▪ nitrogen fixation by soil & aquatic bacteria
recycle:
▪ decomposing & nitrifying bacteria
return to abiotic:
▪ denitrifying bacteria
Atmospheric nitrogen
Carnivores
Birds
Plankton with nitrogen-fixing bacteria
Fish
excretion
loss to deep sediments
Plants
Death, excretion, feces
Decomposing bacteria
amino acids
Ammonifying bacteria
Nitrifying bacteria
soil nitrates
Nitrogen-fixing bacteria (plant roots)
Nitrogen-fixing bacteria (soil)
Denitrifying bacteria

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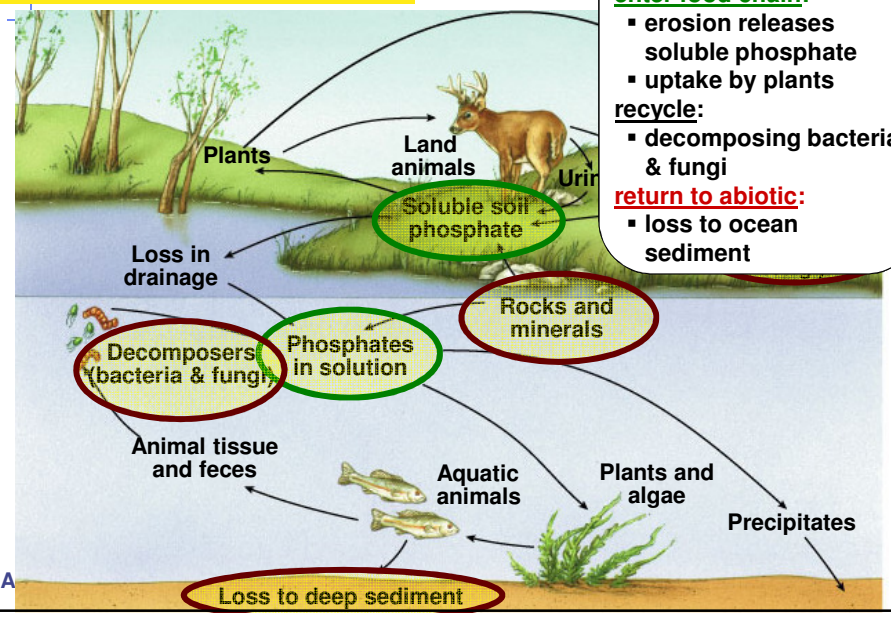
## Phosphorus cycle



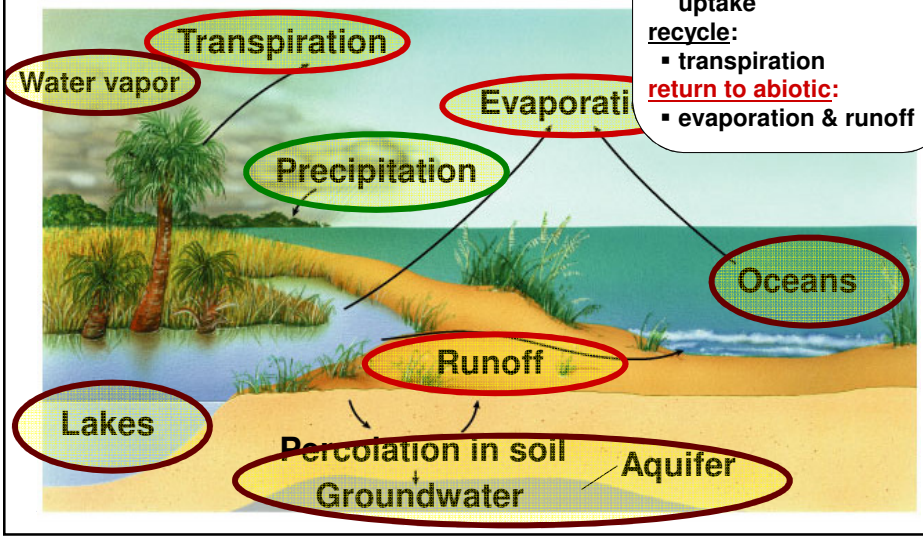

**abiotic reservoir:**
- rocks, minerals, soil

**enter food chain:**
- erosion releases soluble phosphate
- uptake by plants

**recycle:**
- decomposing bacteria & fungi

**return to abiotic:**
- loss to ocean sediment

## Water cycle



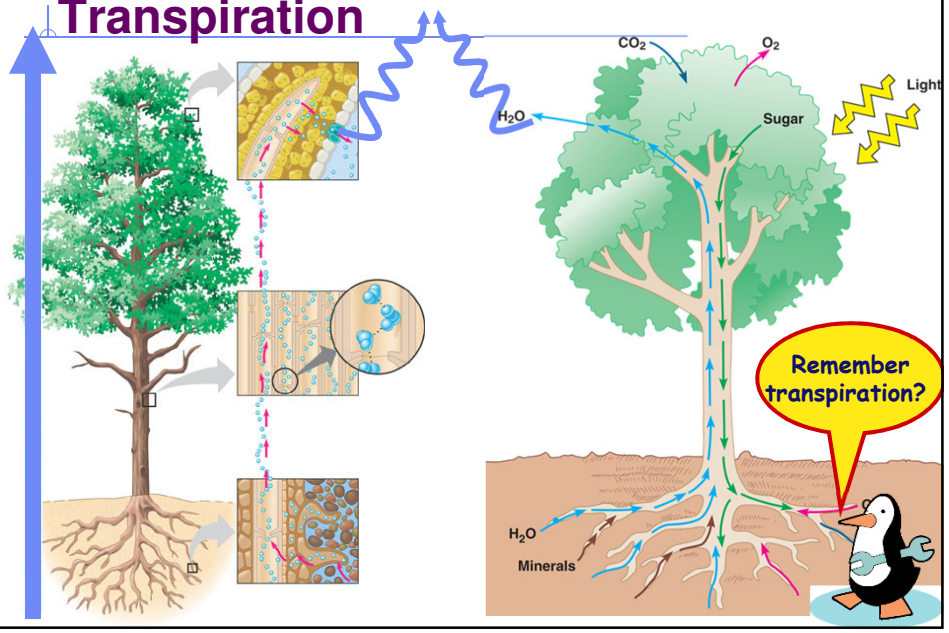

**abiotic reservoir:**
- surface & atmospheric water

**enter food chain:**
- precipitation & plant uptake

**recycle:**
- transpiration

**return to abiotic:**
- evaporation & runoff

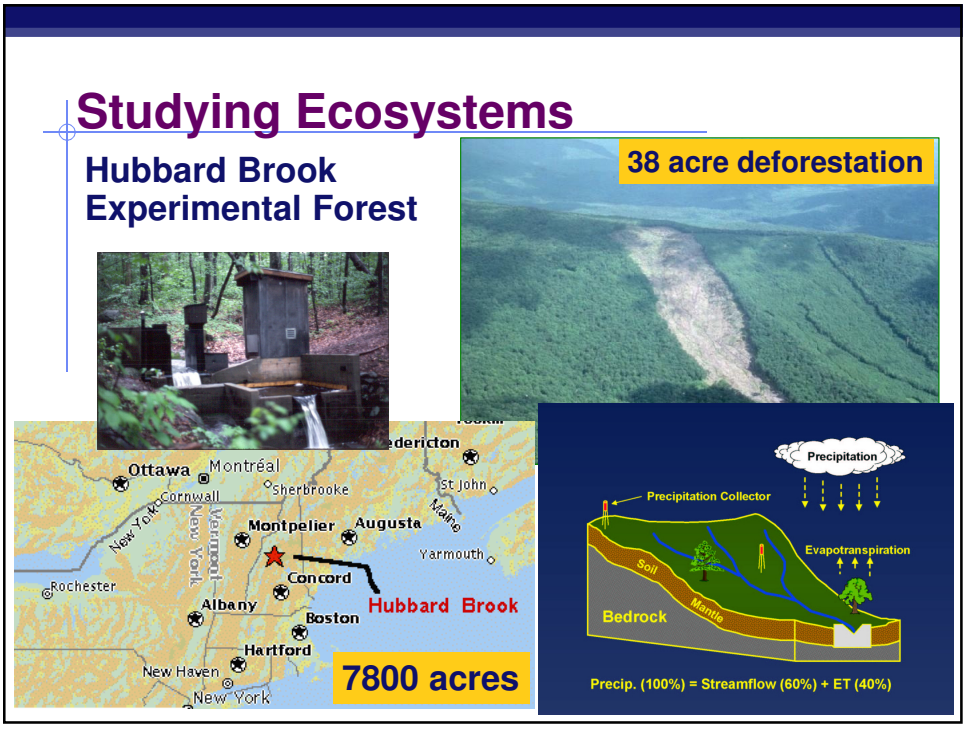
## Transpiration




## Breaking The Water Cycle

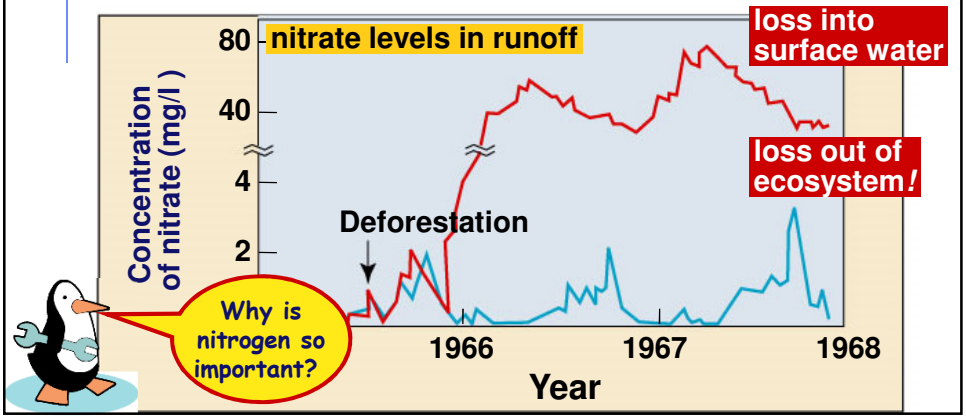
- Deforestation breaks the water cycle
  - groundwater is not transpired to the atmosphere, so precipitation is not created


Repairing the Damage
The Greenbelt Movement
planting trees in Kenya
restoring a sustainable ecosystem
establishing democracy
empowering women
Wangari Maathai
Nobel Peace prize 2004

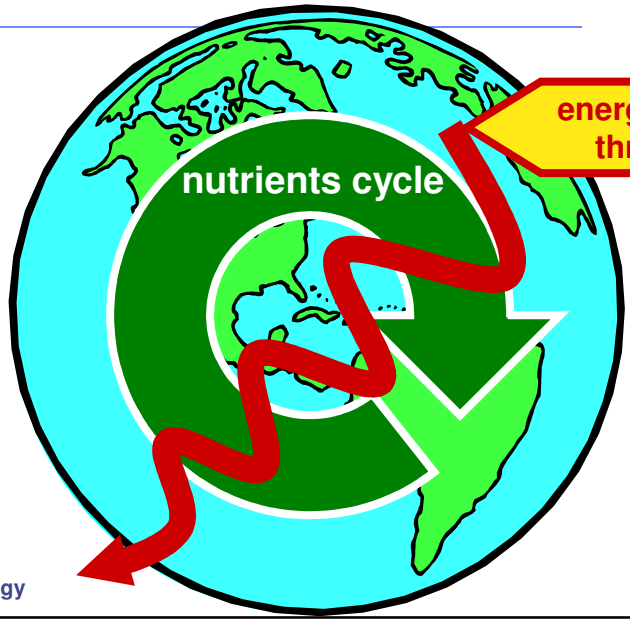

Studying Ecosystems
Hubbard Brook Experimental Forest
38 acre deforestation
Ottawa
Montréal
Sherbrooke
St John
Cornwall
Montpelier
Augusta
Yarmouth
Rochester
Concord
Albany
Boston
Hubbard Brook
Hartford
New Haven
New York
7800 acres
Precipitation
Precipitation Collector
Evapotranspiration
Soil
Bedrock
Mantle
Precip. (100%) = Streamflow (60%) + ET (40%)

## Effects of Deforestation

- 40% increase in runoff
  - loss of water
- 60x loss in nitrogen
- 10x loss in calcium




## Ecosystem Inputs




- inputs
  - energy
  - nutrients

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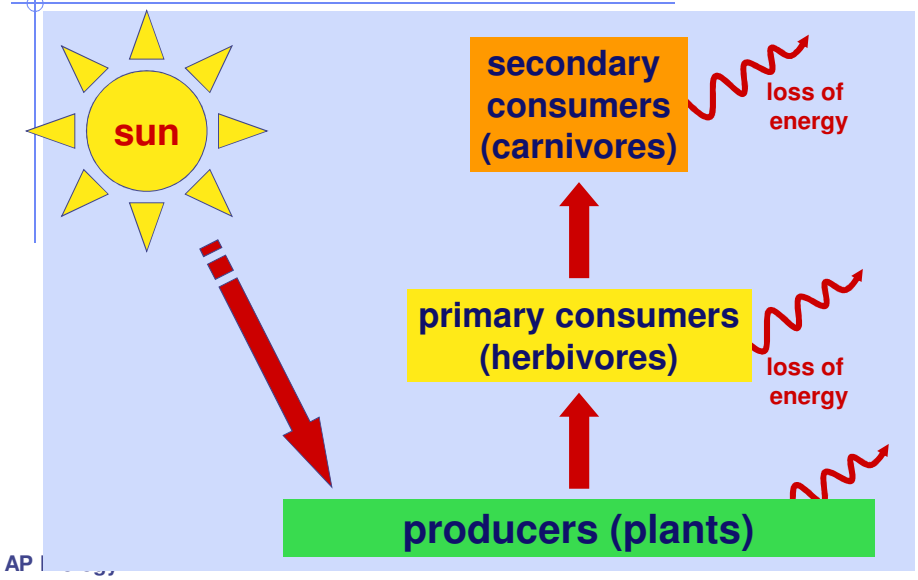
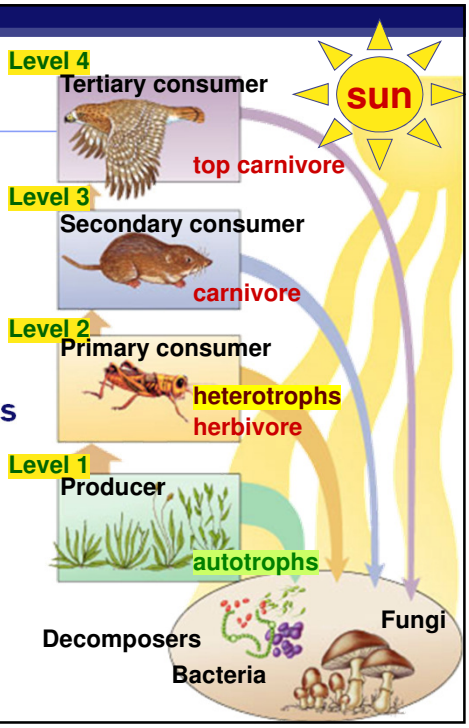
## Energy Flows Through Ecosystems




## Food chains

- Trophic levels
  - feeding relationships
  - start with energy from the sun
  - captured by plants
    - 1st level of all food chains
  - food chains usually go up only 4 or 5 levels
    - inefficiency of energy transfer
  - all levels connect to decomposers



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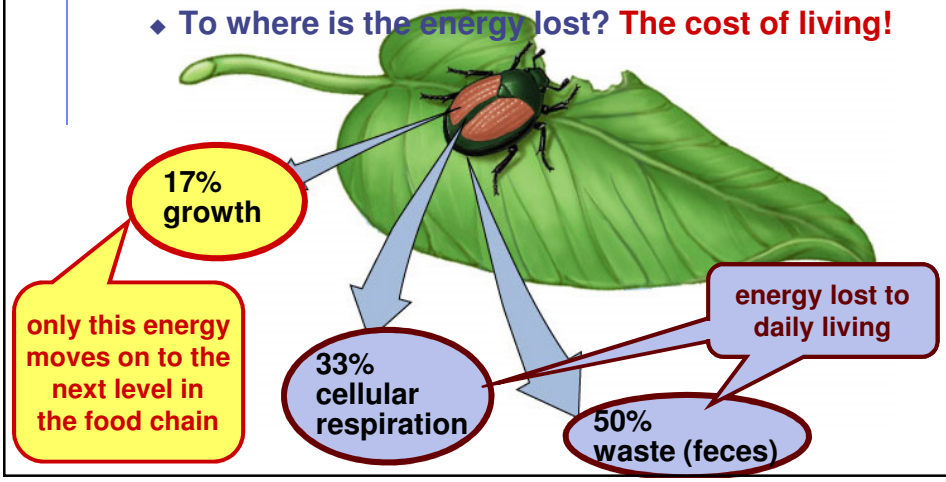
## Inefficiency of Energy Transfer

sun

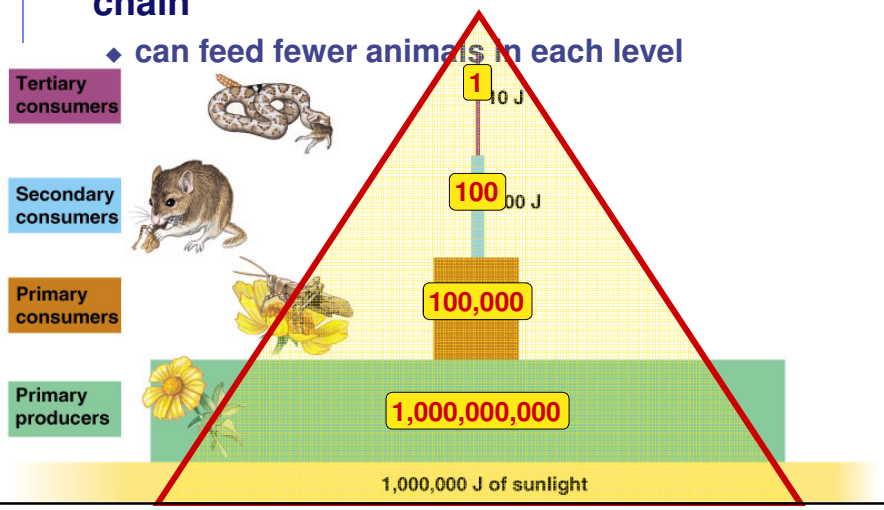
- Loss of energy between levels of food chain
  - To where is the energy lost? The cost of living!




## Ecological Pyramid

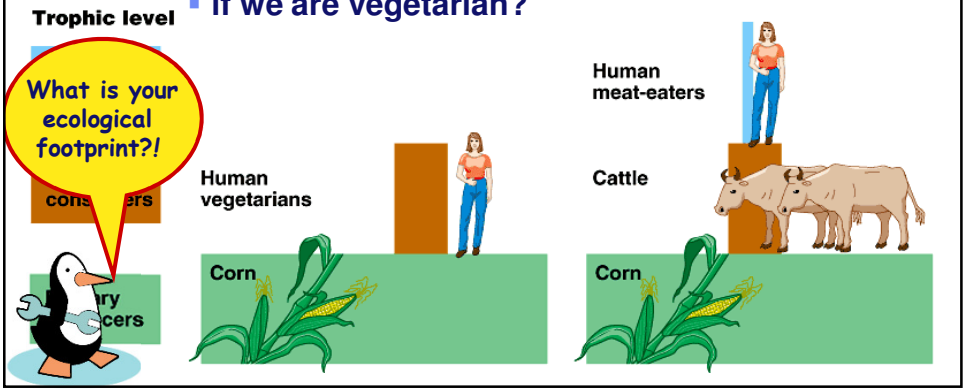
sun

- Loss of energy between levels of food chain
  - can feed fewer animals in each level



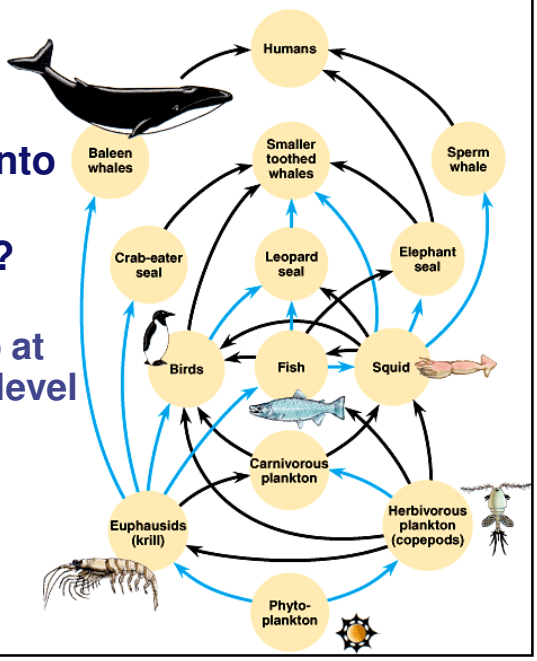
## Humans In Food Chains

- Dynamics of energy through ecosystems have important implications for human populations
  - how much energy does it take to feed a human?
    - if we are meat eaters?
    - if we are vegetarian?




## Food Webs

- Food chains are linked together into food webs
- Who eats whom?
  - a species may weave into web at more than one level
    - bears
    - humans
      - eating meat?
      - eating plants?

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Any Questions?? We're working on a lot of them!
NORTHEASTERN FOREST EXPERIMENT STATION
PARTMENT OF AGRICULTURE