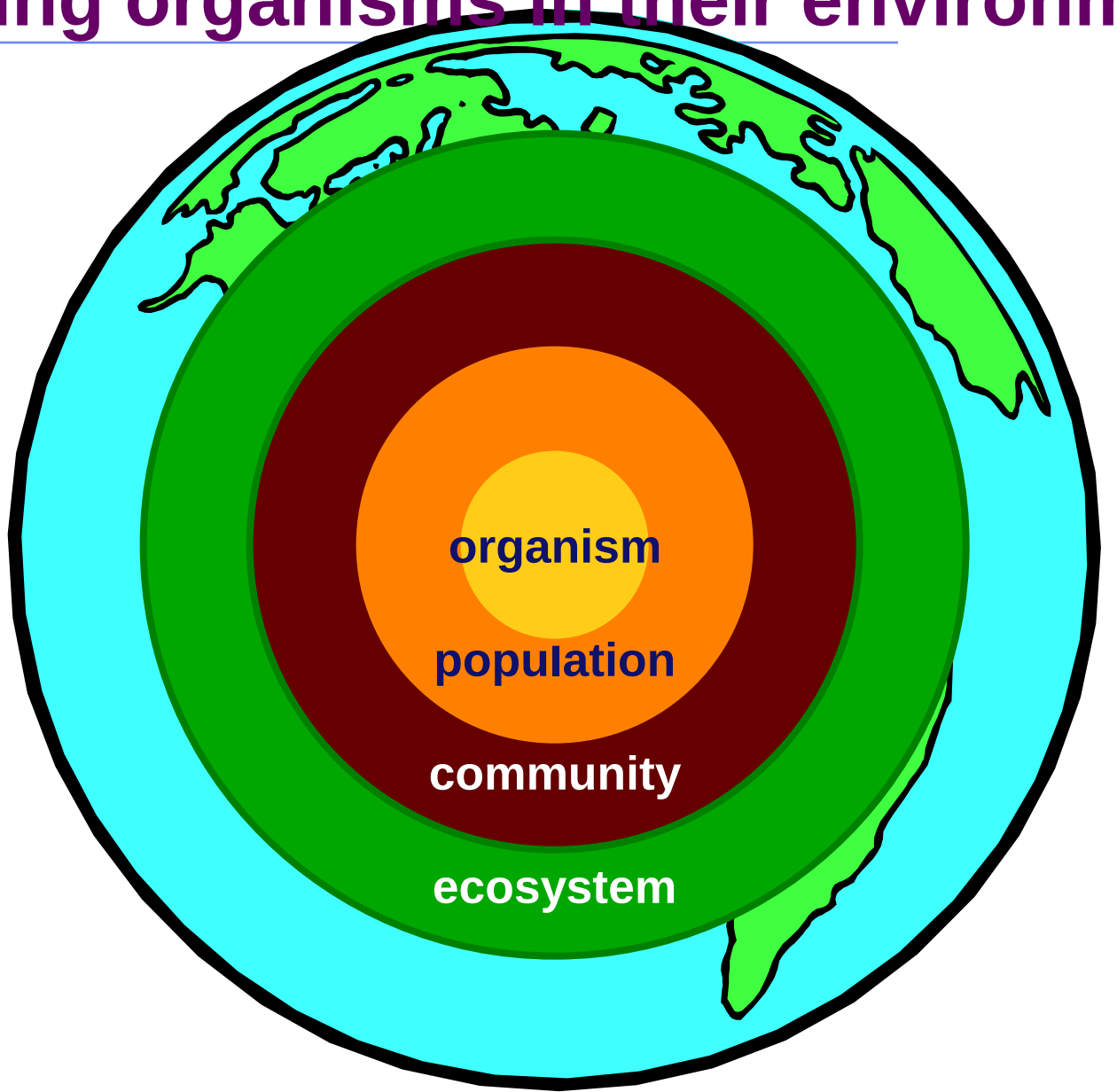

Ecosystems

Studying organisms in their environment



Essential questions

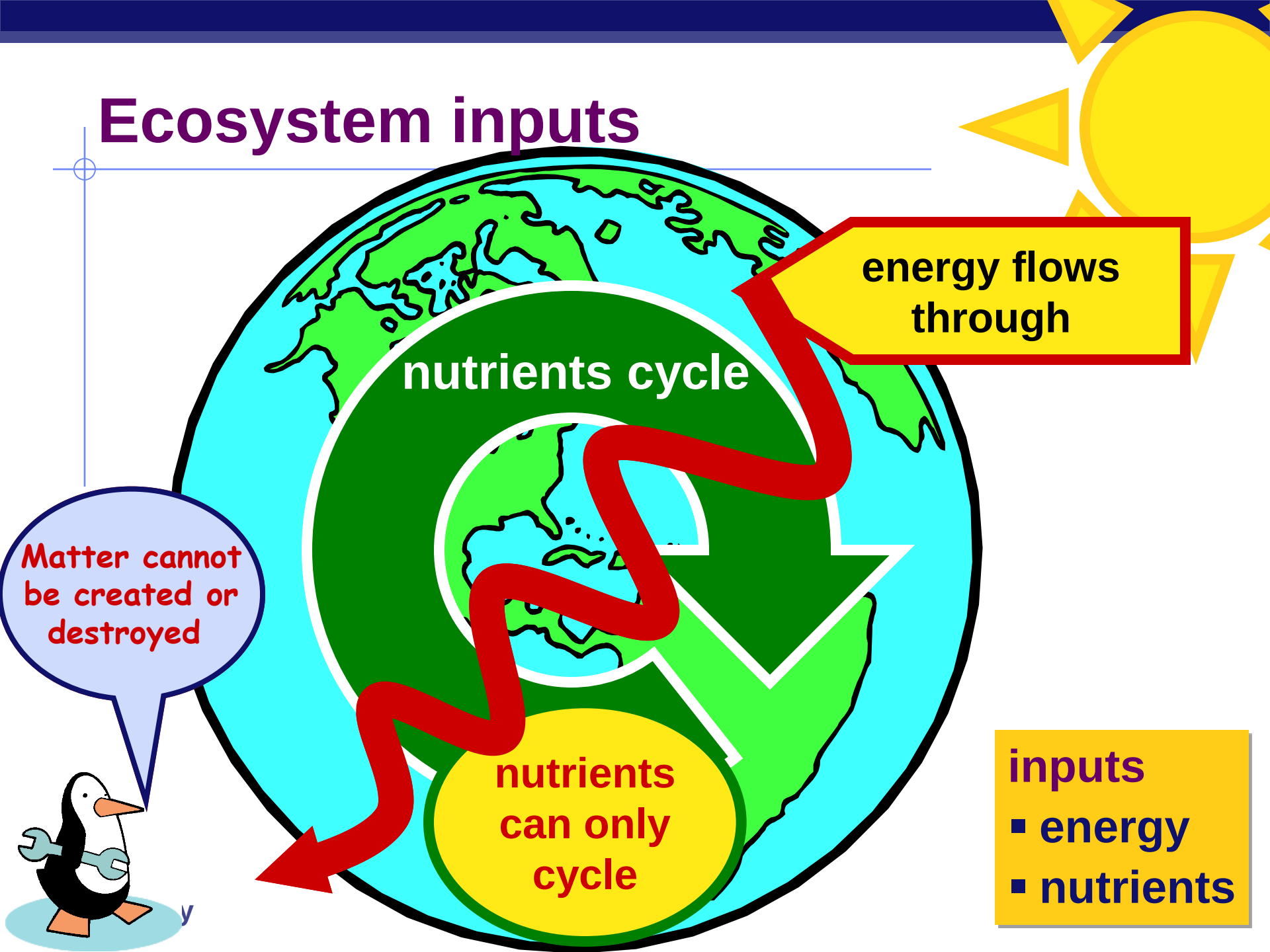
- What limits the production in ecosystems?
- How do nutrients move in the ecosystem?
- How does energy move through the ecosystem?

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

Ecosystem inputs



inputs

- energy
- nutrients

Generalized Nutrient cycling

Decomposition connects all trophic levels

consumers

producers

decomposers

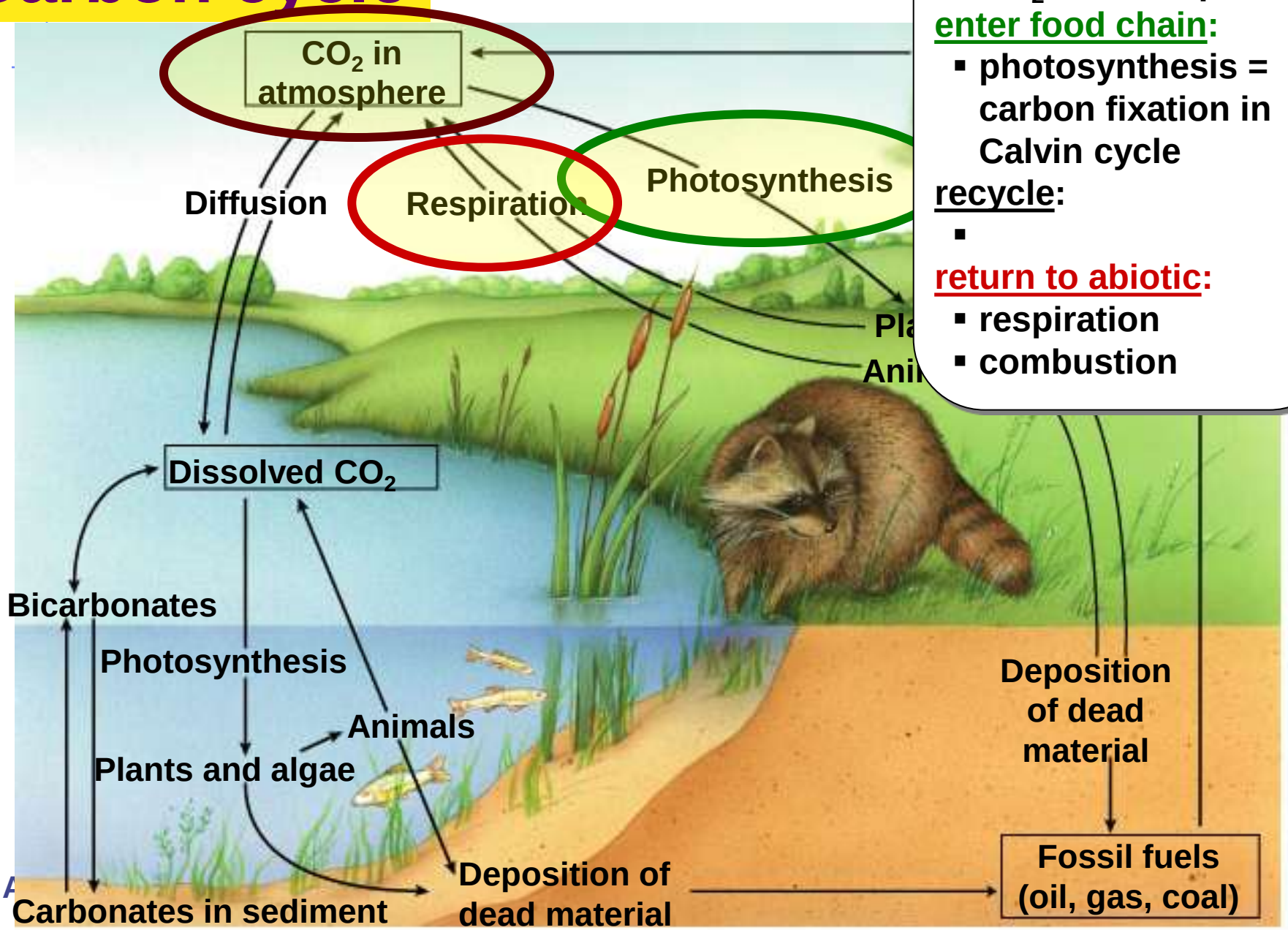
nutrients
ENTER FOOD CHAIN
= made available to producers

return to abiotic reservoir

abiotic reservoir

geologic processes

Carbon cycle



abiotic reservoir:
- CO_2 in atmosphere

enter food chain:
- photosynthesis = carbon fixation in Calvin cycle

recycle:
-

return to abiotic:
- respiration
- combustion

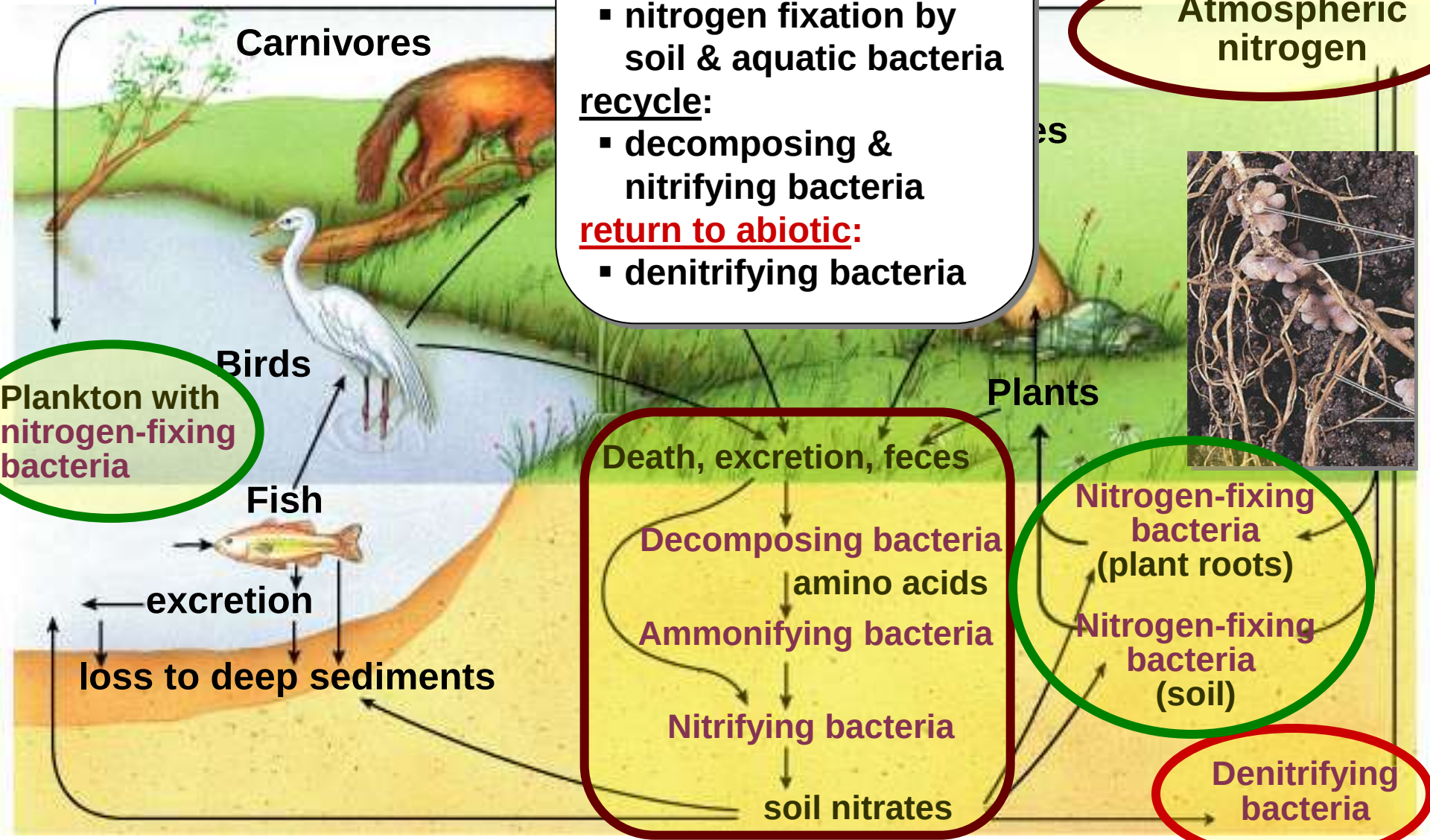
Nitrogen cycle

abiotic reservoir:
- N in atmosphere

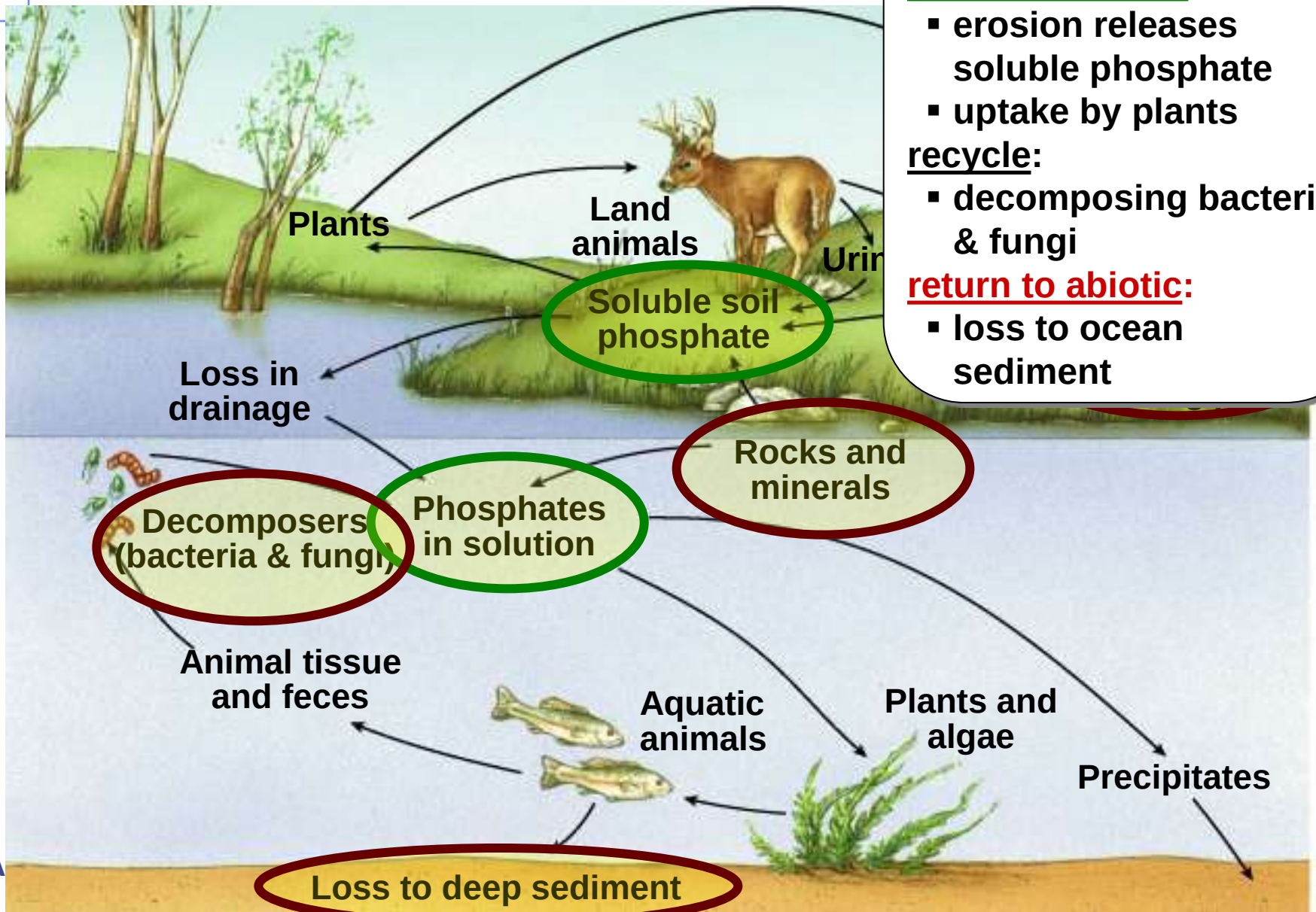
enter food chain:
- nitrogen fixation by soil & aquatic bacteria

recycle:
- decomposing & nitrifying bacteria

return to abiotic:
- denitrifying bacteria



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

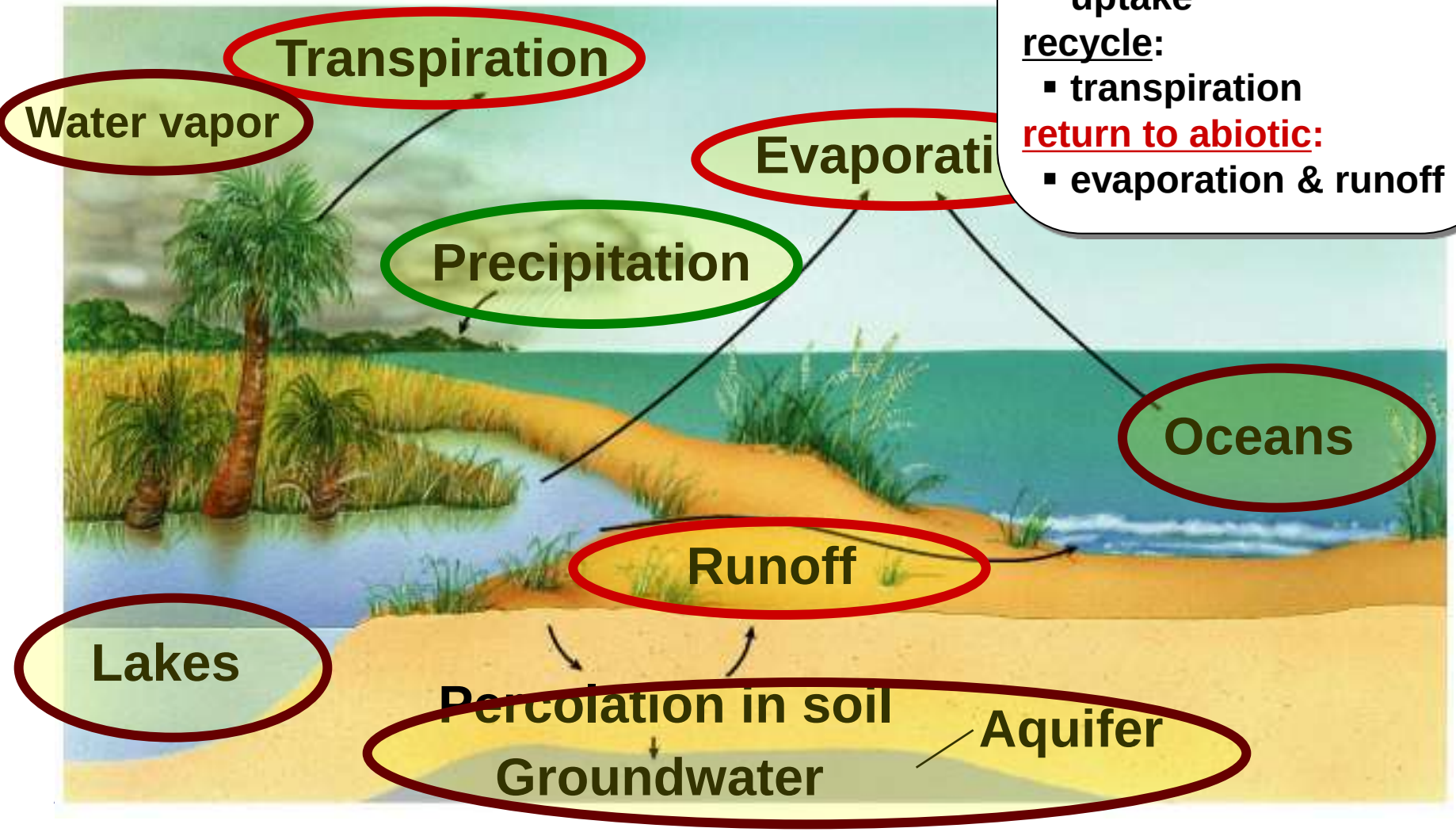
Water cycle

abiotic reservoir:
- surface & atmospheric water

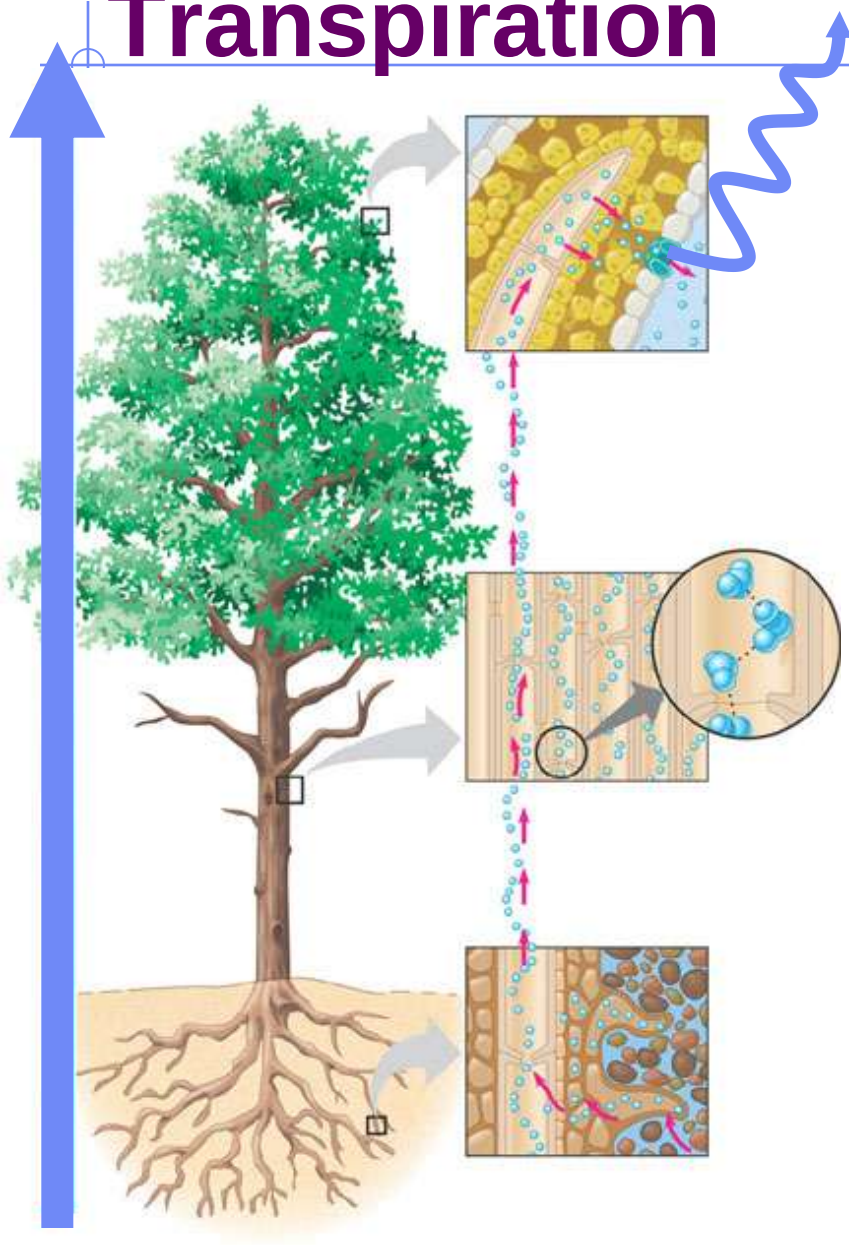
enter food chain:
- precipitation & plant uptake

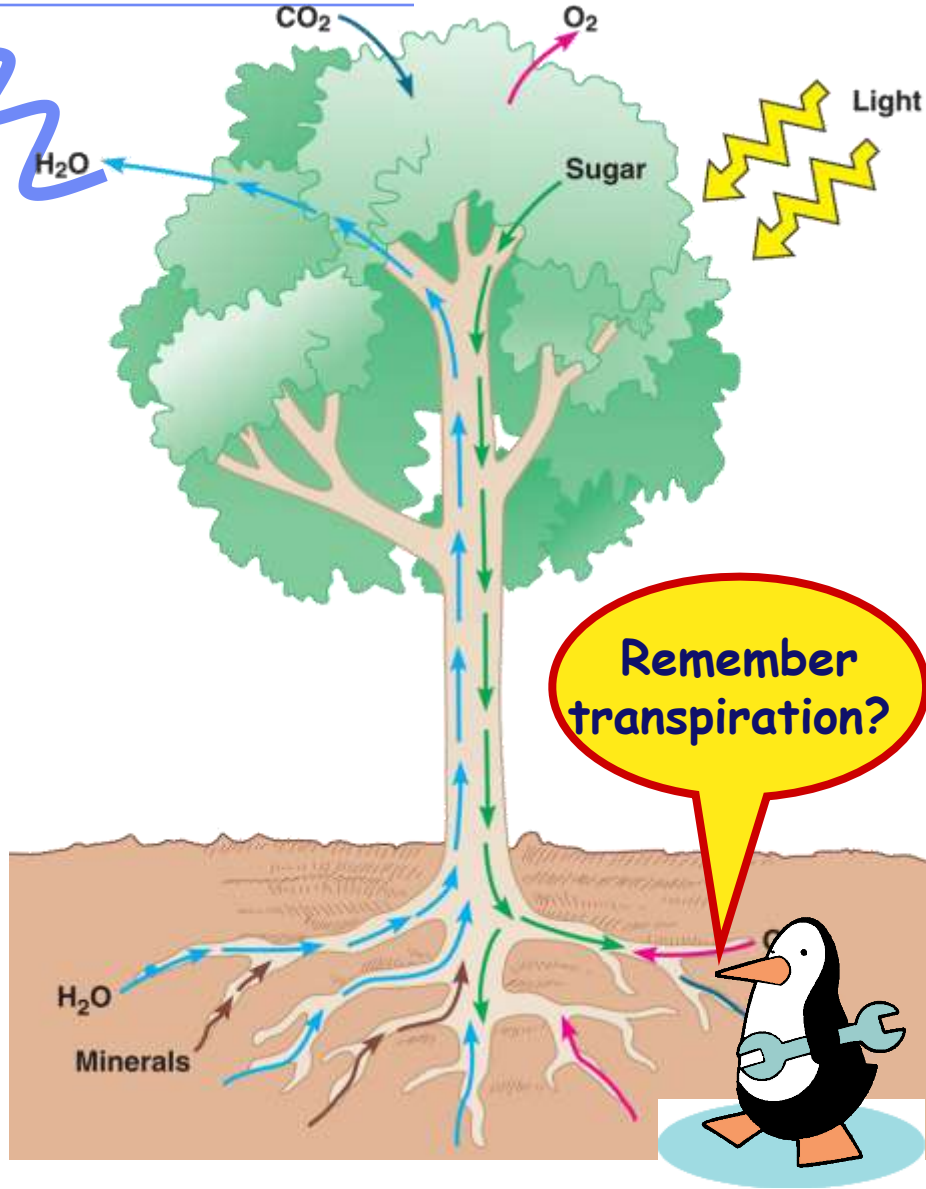
recycle:
- transpiration

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**

forest → desert

desertification

Repairing the damage

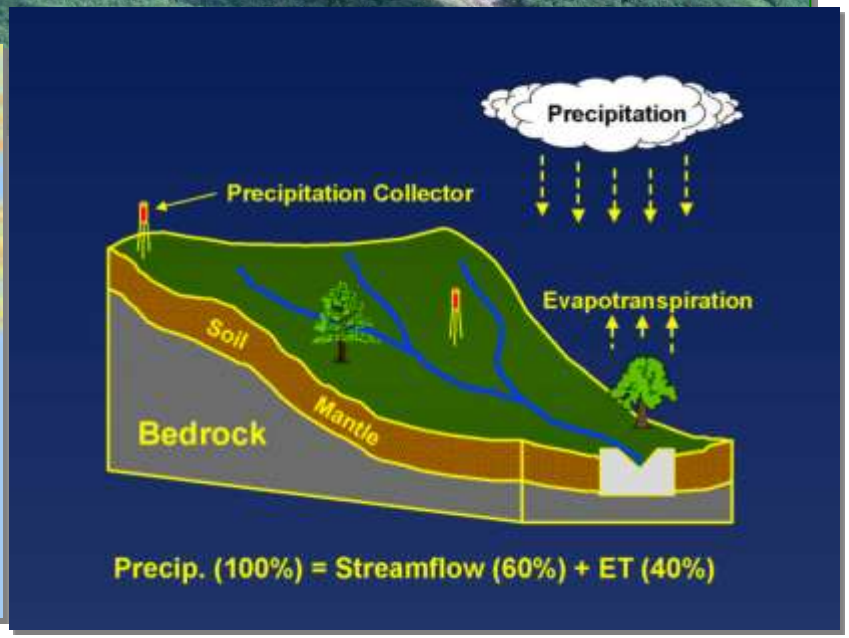
- The Greenbelt Movement
  - planting trees in Kenya
  - restoring a sustainable ecosystem
  - establishing democracy
  - empowering women

Wangari Maathai

Nobel Peace prize 2004

Studying ecosystems

Hubbard Brook Experimental Forest

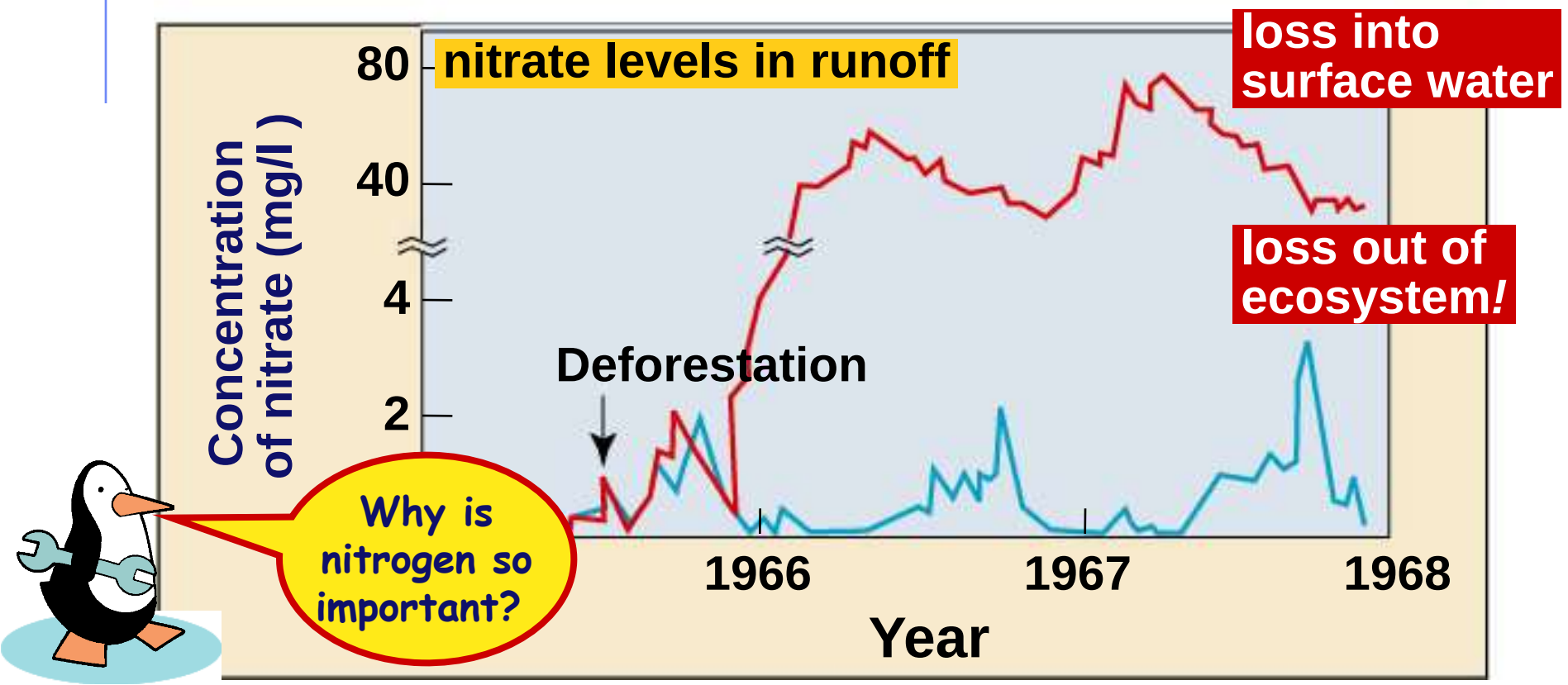


Effects of deforestation

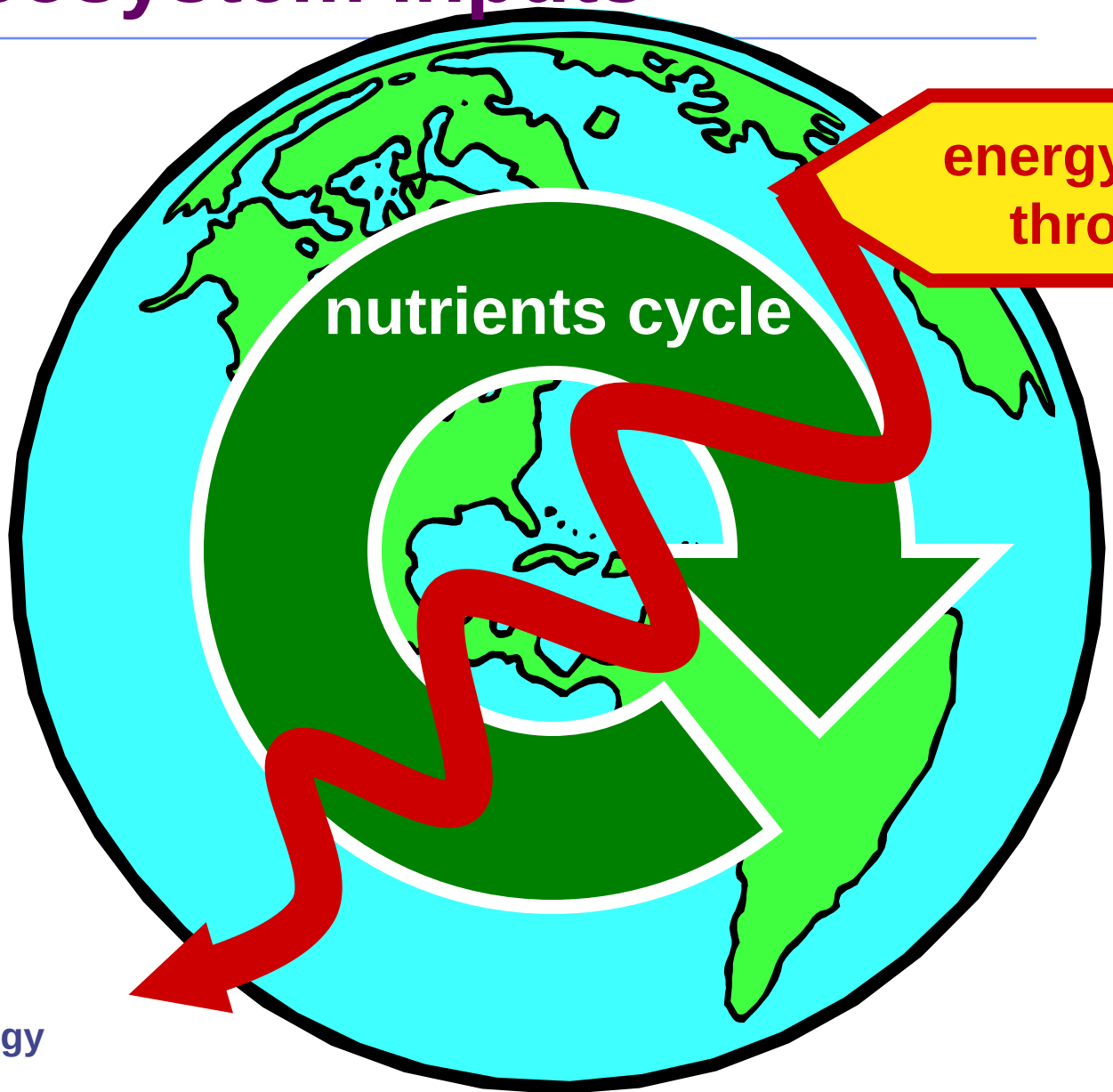
40% increase in runoff

- loss of water

- 60x loss in nitrogen
- 10x loss in calcium



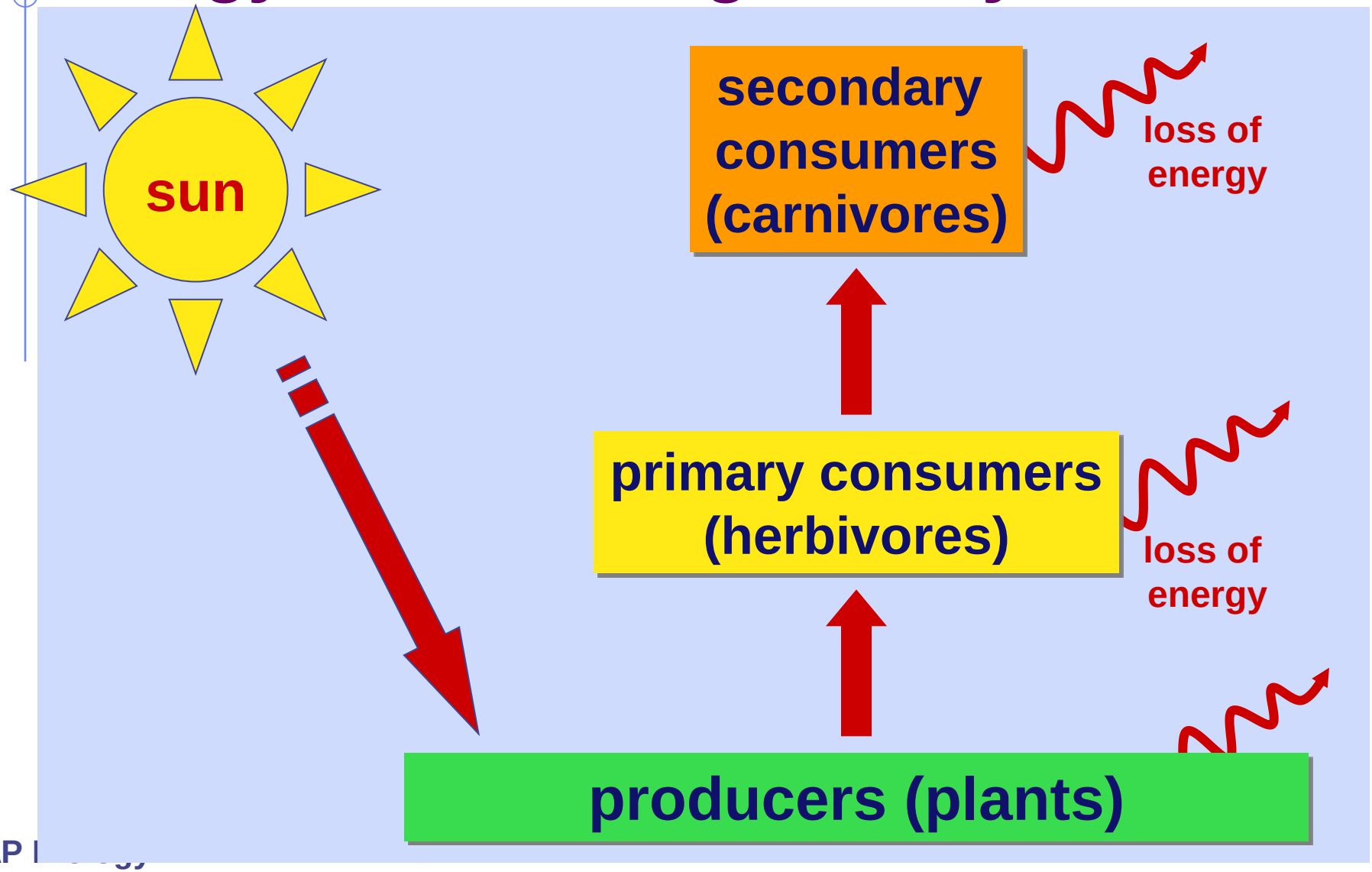
Ecosystem inputs



inputs

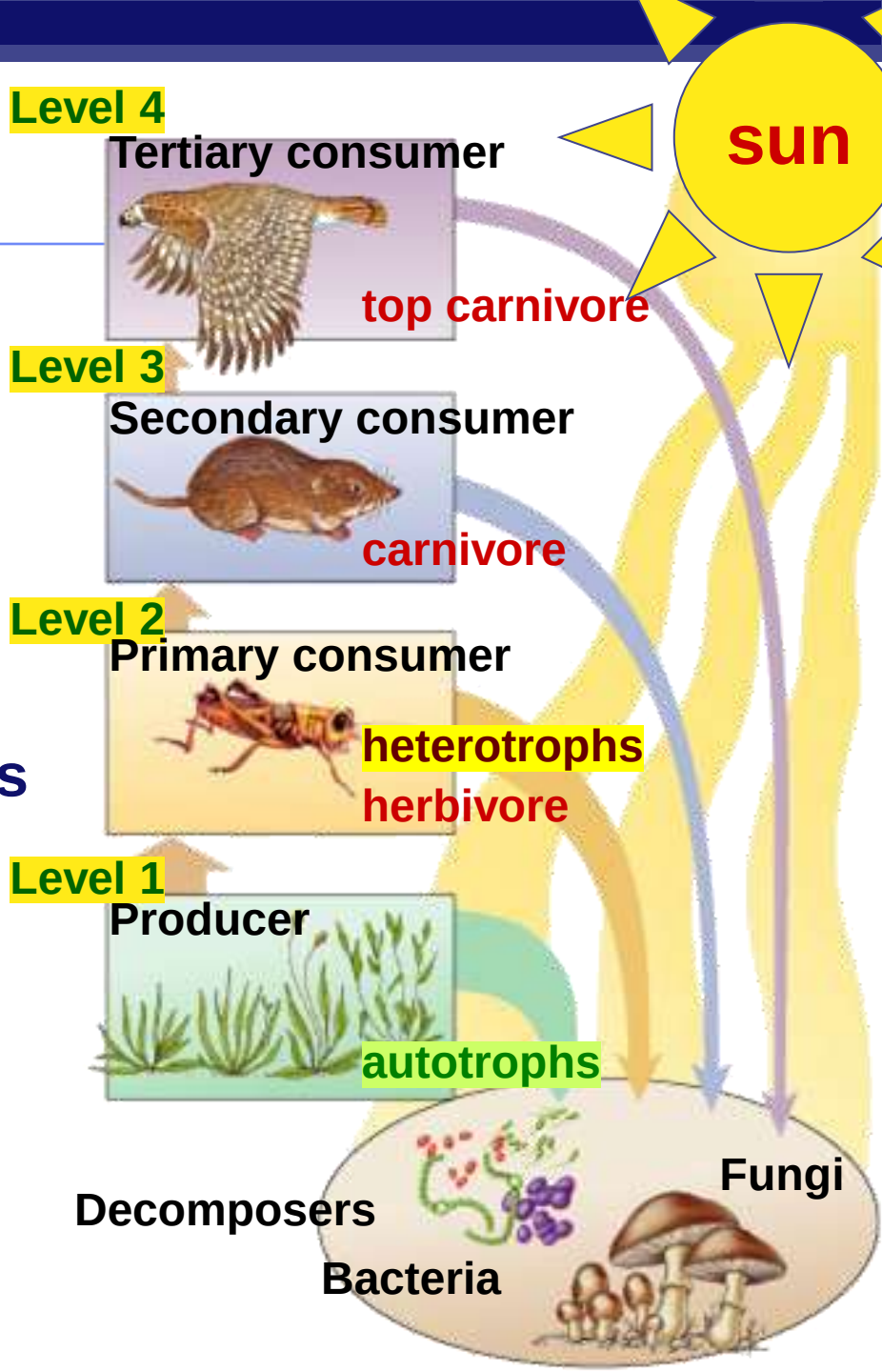
- **energy**
- **nutrients**

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**



Inefficiency of energy transfer

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

sun

17% growth

only this energy moves on to the next level in the food chain

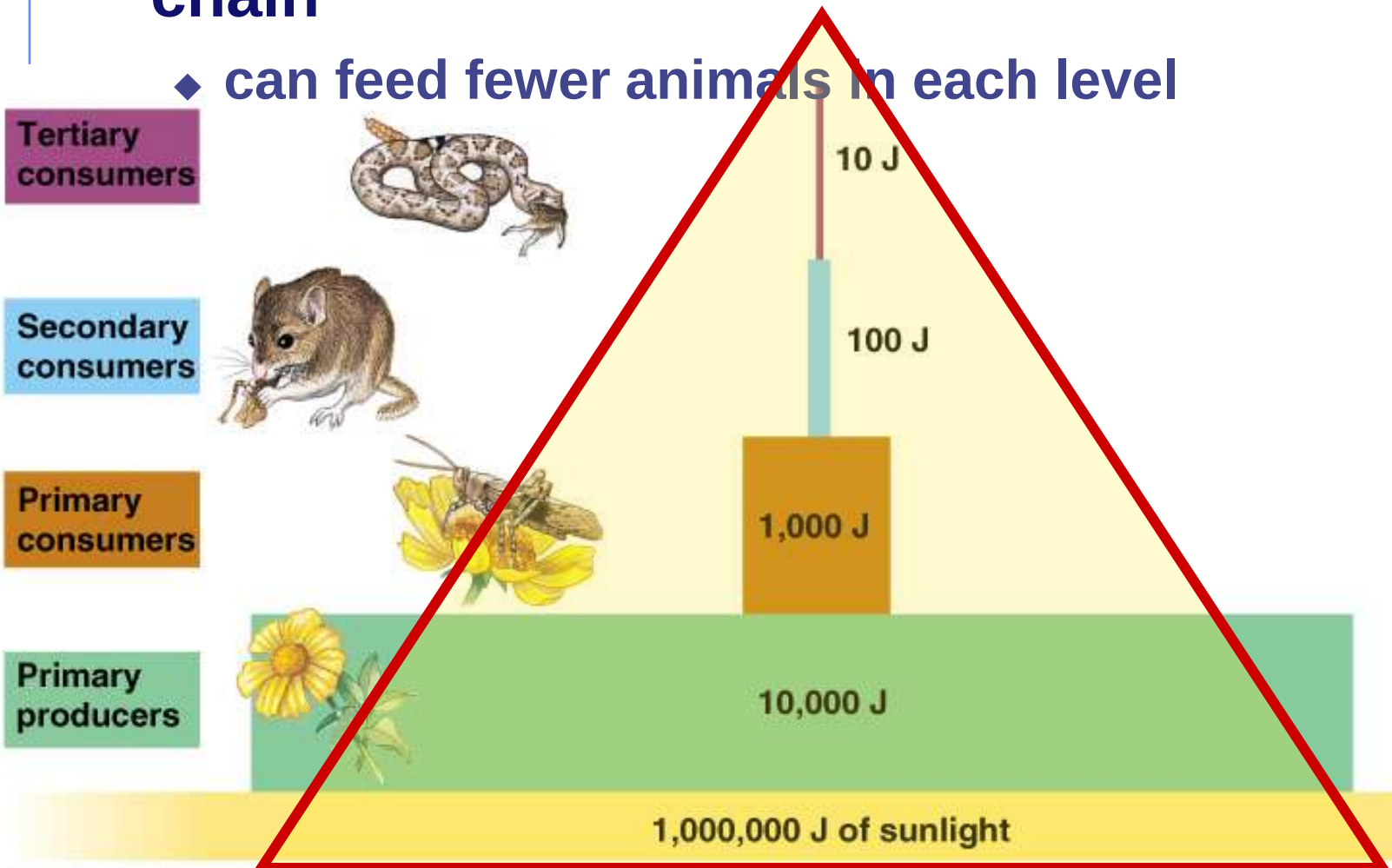
33% cellular respiration

energy lost to daily living

50% waste (feces)

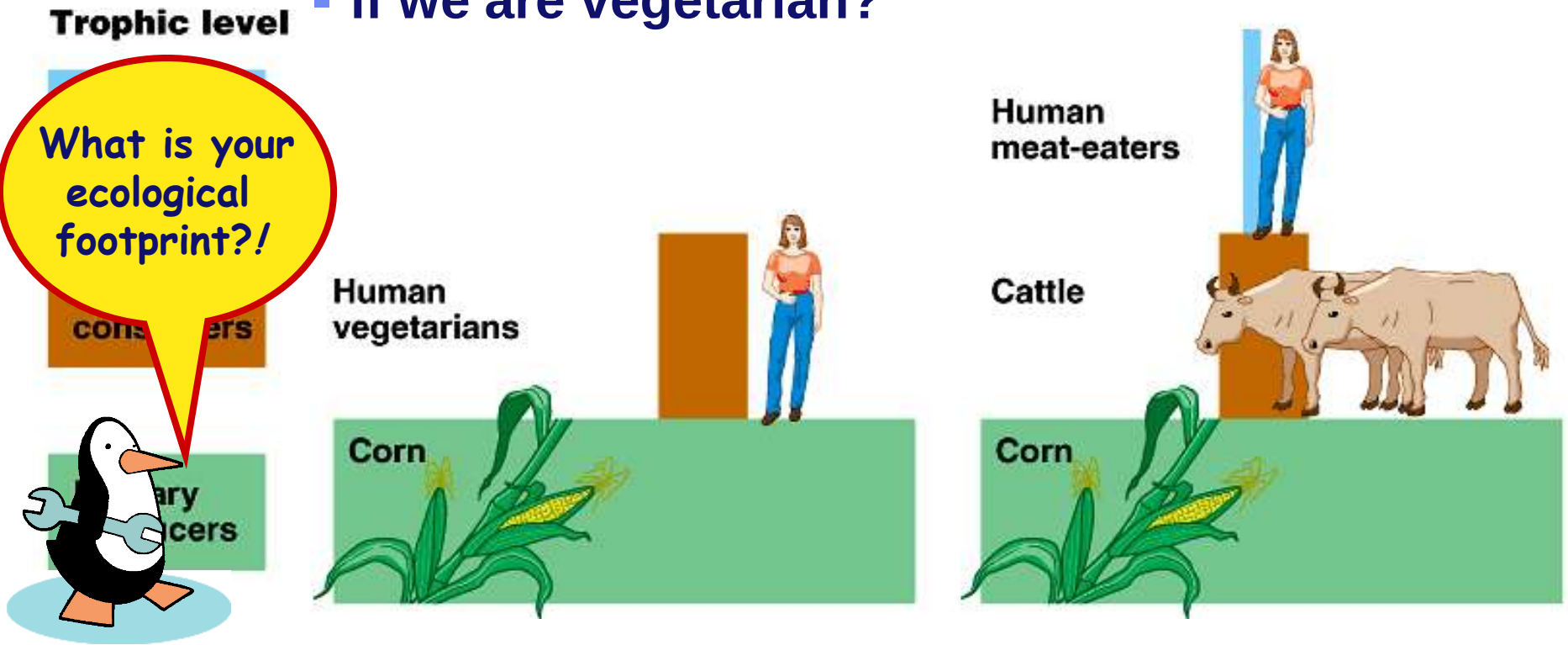
Ecological pyramid

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



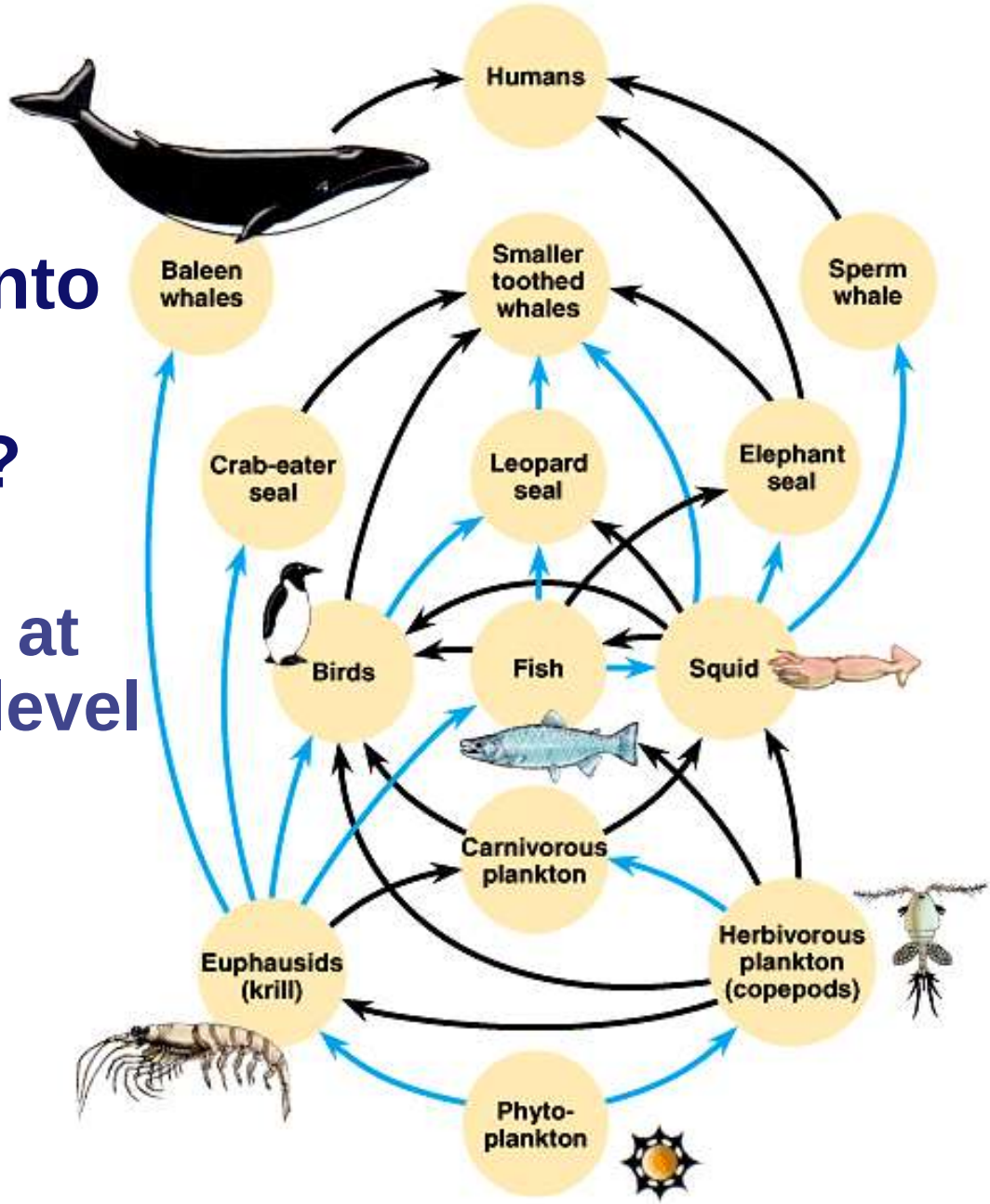
Humans in food chains

- 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?



Any Questions?? We're working on a lot of them!

AP