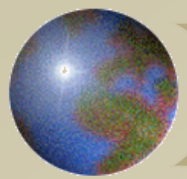


ECOLOGY

The study of the relationships between living things and their interactions with the environment

I. Levels of Organization

B. Biosphere

The area on earth where life exists and the living things found there.

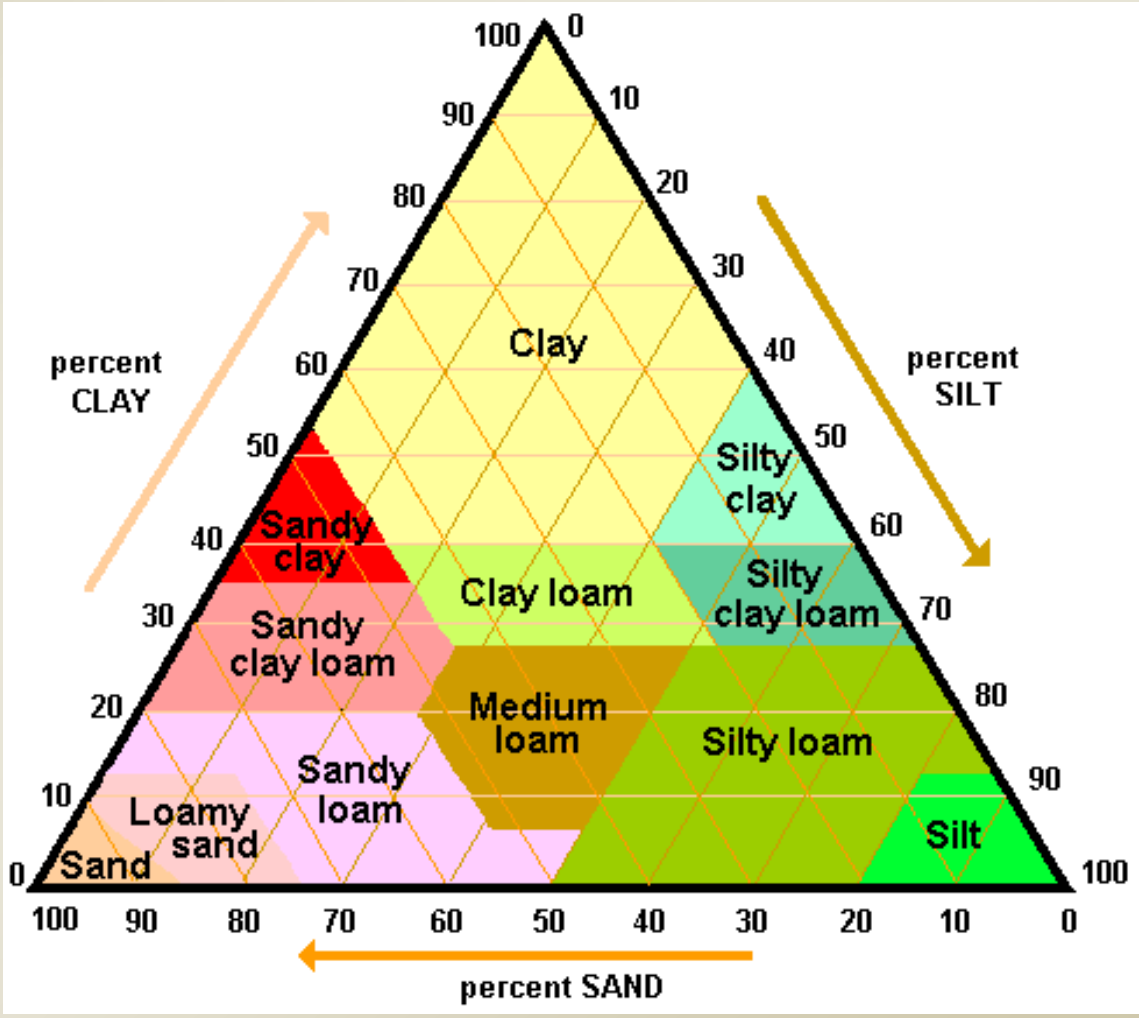
C. Biome

A large group of ecosystems that share the same climate and have similar types of communities. (ex. marine biomes)

D. *Ecosystem**: a physically distinct, self-supporting unit of interacting organisms and their environment*

1. *<u>Biotic factors</u>: living things*
2. *<u>Abiotic factors</u>: the non-living portion of the environment (soil, water, light, climate)*

The abiotic factors determine what kind of living things will be found in a particular area.

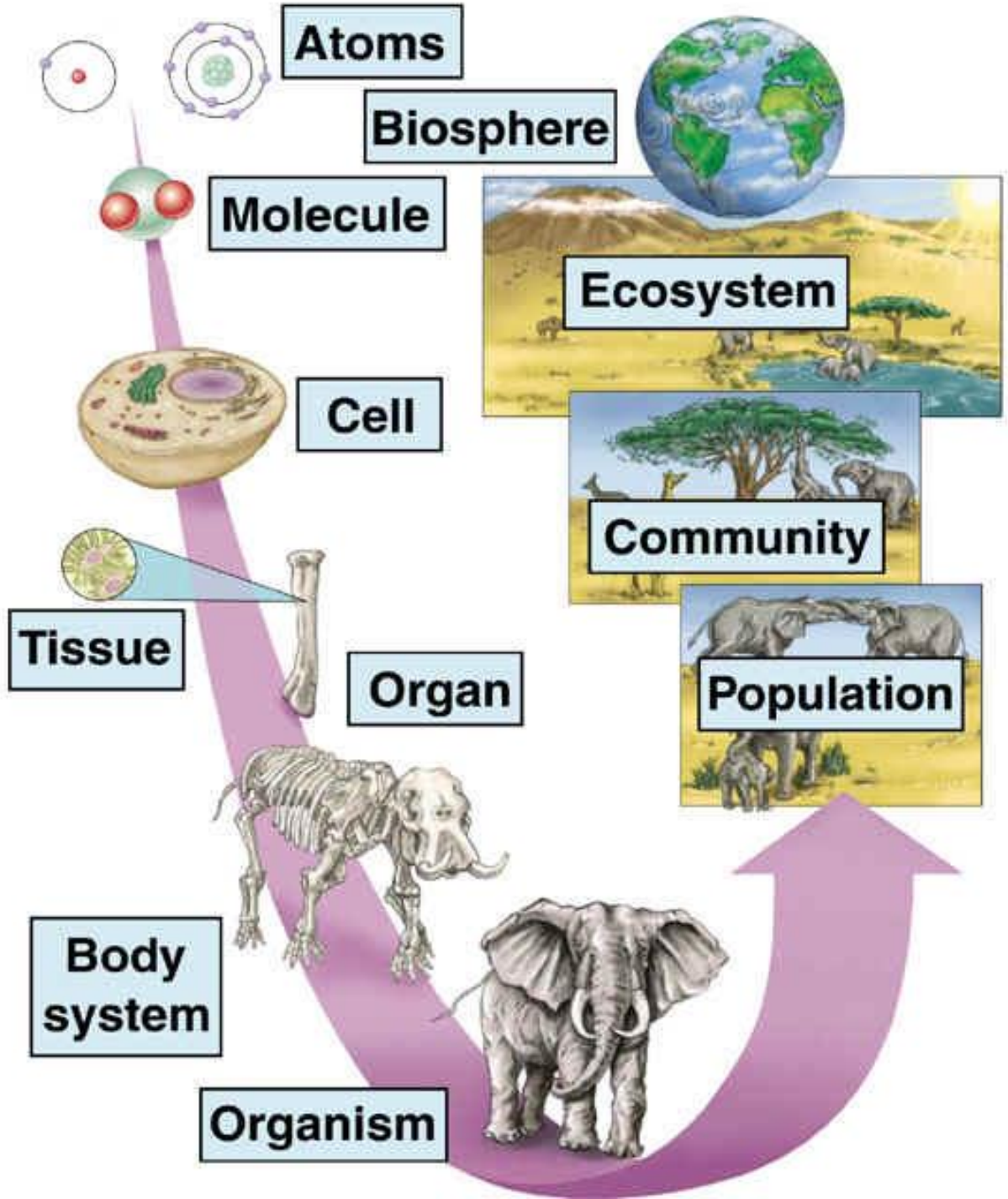


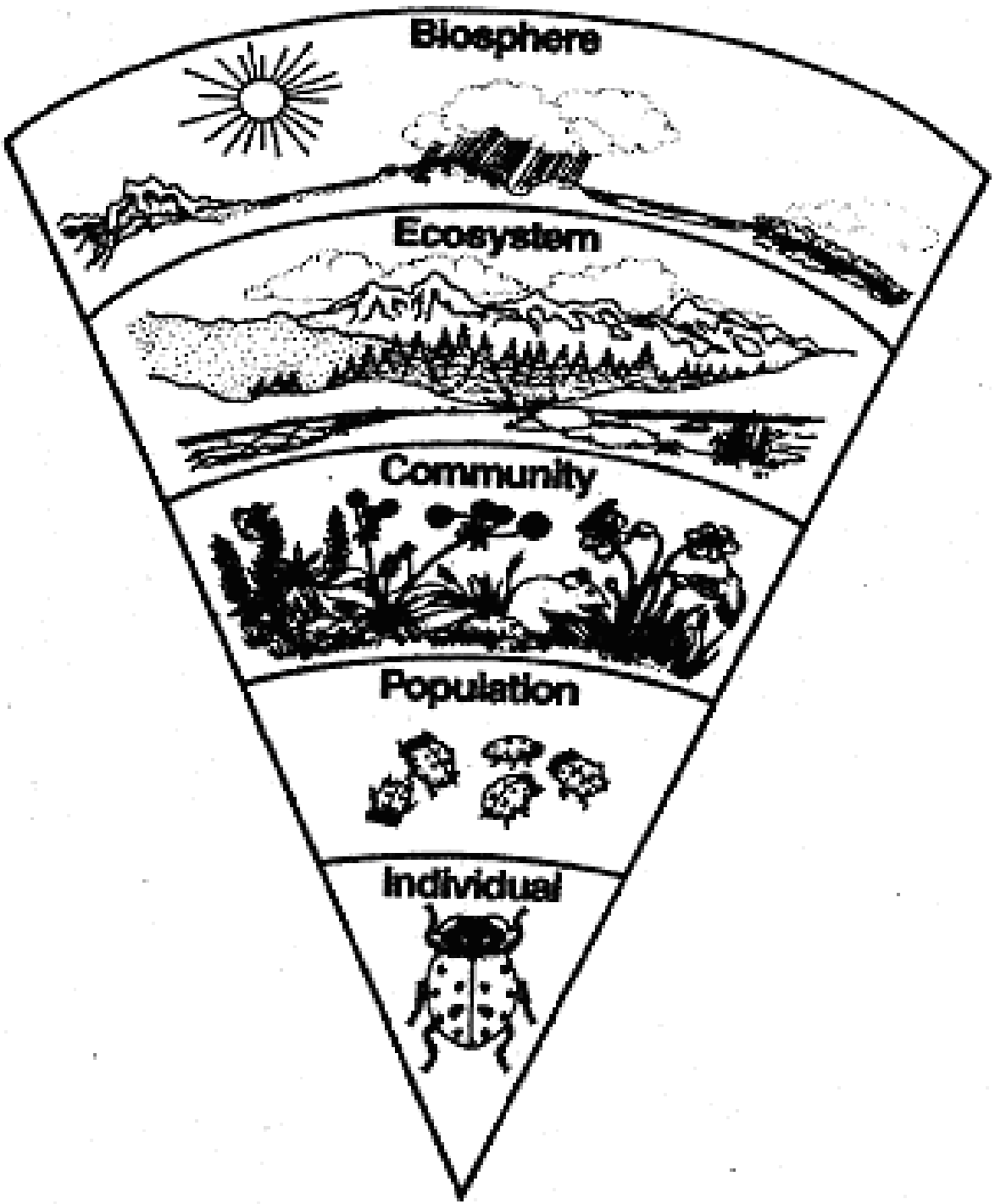
E. Community

All the populations of organisms living in a particular area.

F. Population

A group of organisms of the same species living in a particular area


Atoms
Biosphere
Molecule
Ecosystem
Cell
Community
Tissue
Organ
Population
Body system
Organism

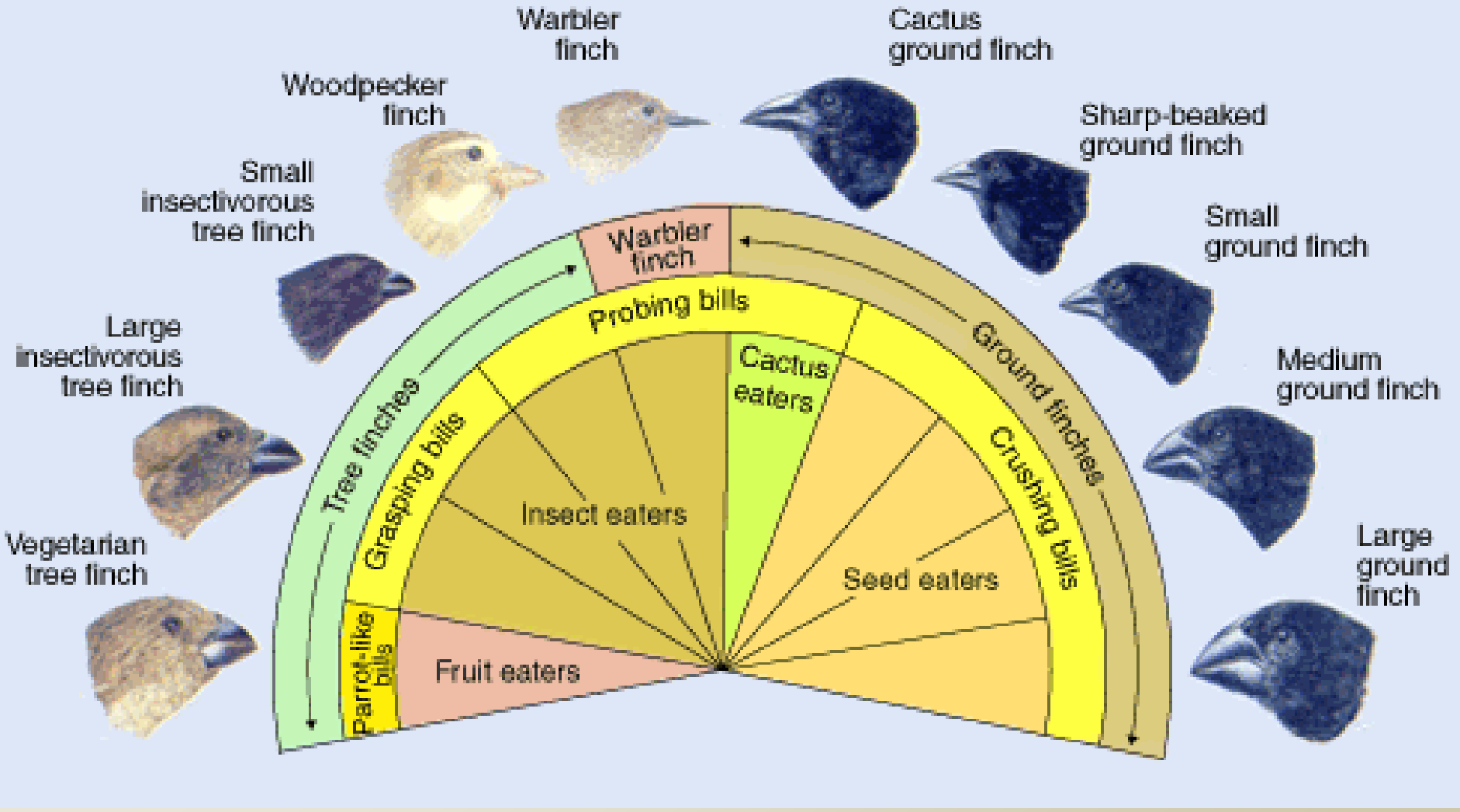

Biosphere
Ecosystem
Community
Population
Individual

II. Community Interactions

A. Competition

1. *Occurs when two organisms attempt to use an ecological resource in the same place at the same time*
2. *Resources include: light, water, space, nutrients, food*

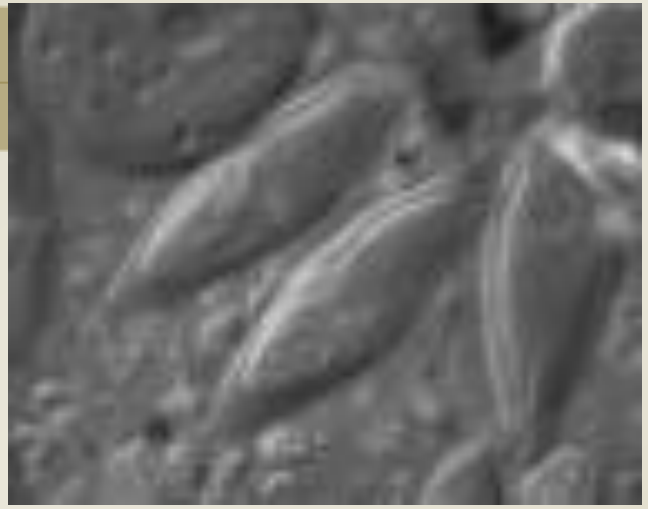
3. ***competitive exclusion principle***: *no two species can occupy the same niche in the same habitat at the same time*
   - ***a)Habitat***: *The surroundings in which a particular population is located*
   - ***b)Niche***: *The way of life a species pursues within its habitat*


Warbler finch
Cactus ground finch
Woodpecker finch
Sharp-beaked ground finch
Small insectivorous tree finch
Small ground finch
Large insectivorous tree finch
Medium ground finch
Vegetarian tree finch
Large ground finch
Warbler finch
Probing bills
Tree finches
Ground finches
Grasping bills
Cactus eaters
Crushing bills
Insect eaters
Seed eaters
Parrot-like bills
Fruit eaters

B. Symbiotic Relationship: two organisms living in close association; at least one of the organisms benefits from the relationship. 3 types:

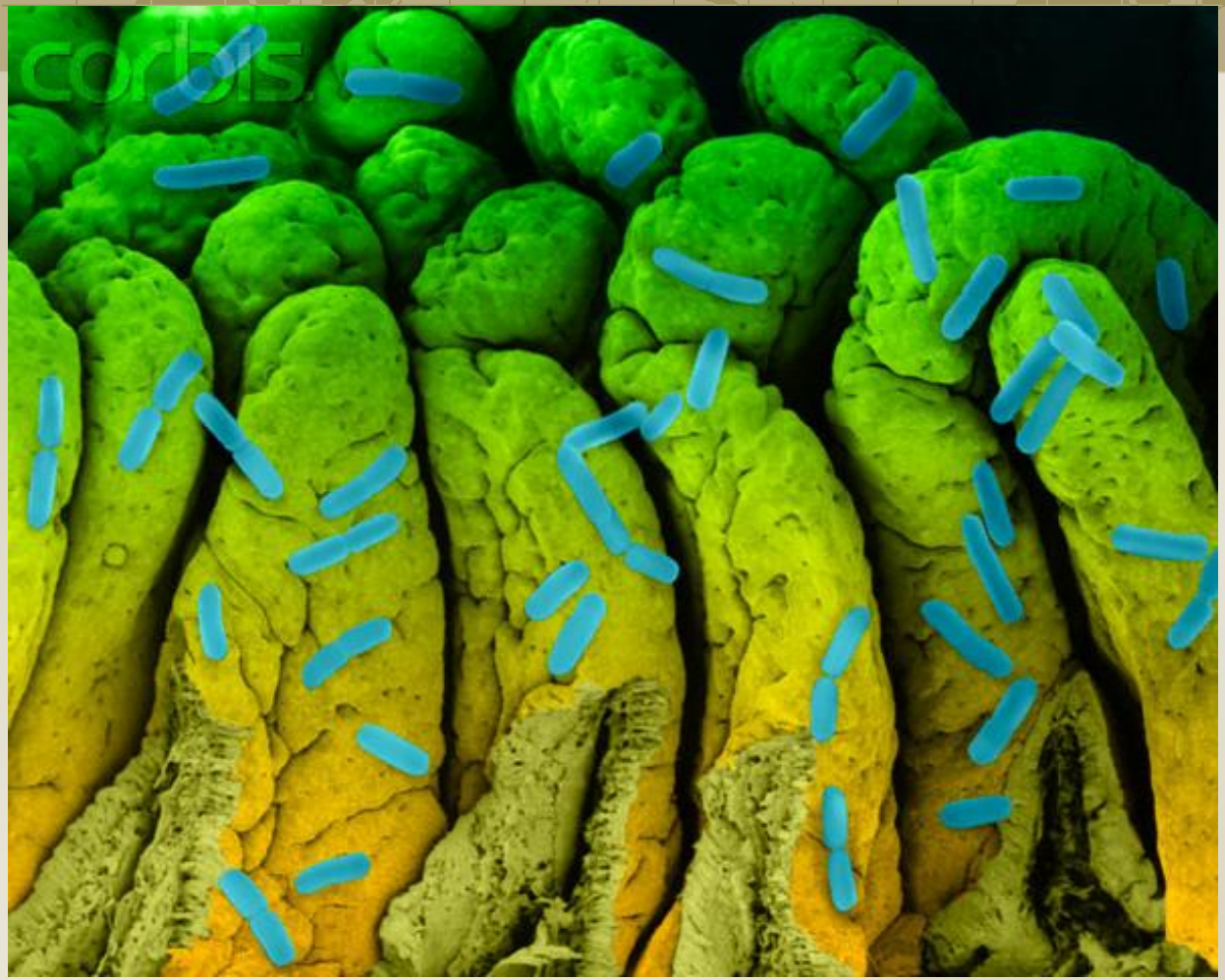
1. *Mutualism*

Both organisms benefit from the relationship



<u>Ex</u>: A termite has a protozoan living in its intestine. The protozoan benefits because the termite brings food to it (cellulose). The termite benefits because it can't break down cellulose.

Zebra and Oxpecker Bird



Human Intestine and E.Coli

2. *Commensalism*

One organism benefits and the other is not affected.

<u>Example</u>: An orchid is a tropical flower that lives in the branches of trees. It benefits by getting higher up where it receives more light. The tree is not affected.

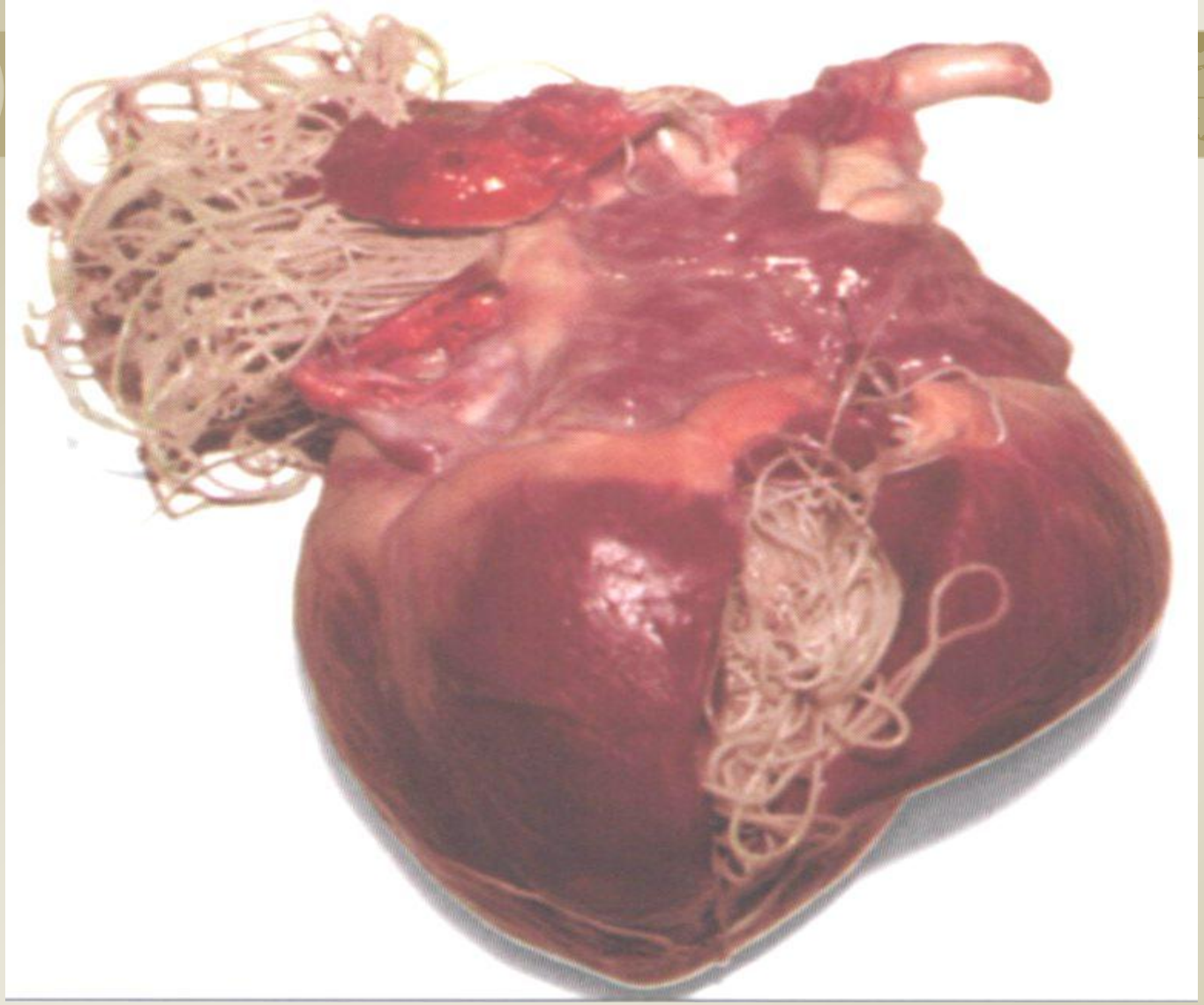
Barnacles and Whales

Shark and Pilot Fish

3. *Parasitism*

One organism benefits and the other is harmed.

<u>Example</u>: A tapeworm is a parasite that lives in the intestines of many mammals. It steals food that is eaten (ingested) by the animal. The animal gets less of its food for its own use.



Heartworm and Dogs

Mistletoe and Mesquite Tree

III. Flow of Energy in an Ecosystem

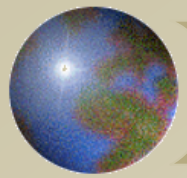
*A. **Producers**: Autotrophs (Primarily plants, some protists & bacteria) make food for the entire ecosystem*

*B. **Consumers**: heterotrophs, must take in food*

- *Consumers are classified by what they eat:*
  1. *Herbivores: feed only on plants*
  2. *Carnivores: feed only on meat*
     a) *Predators: attack & kill prey*
     b) *Scavengers: eat dead animals*
  3. *Omnivores: eat both plants & animals*
  4. *Detritivores: eat dead matter*

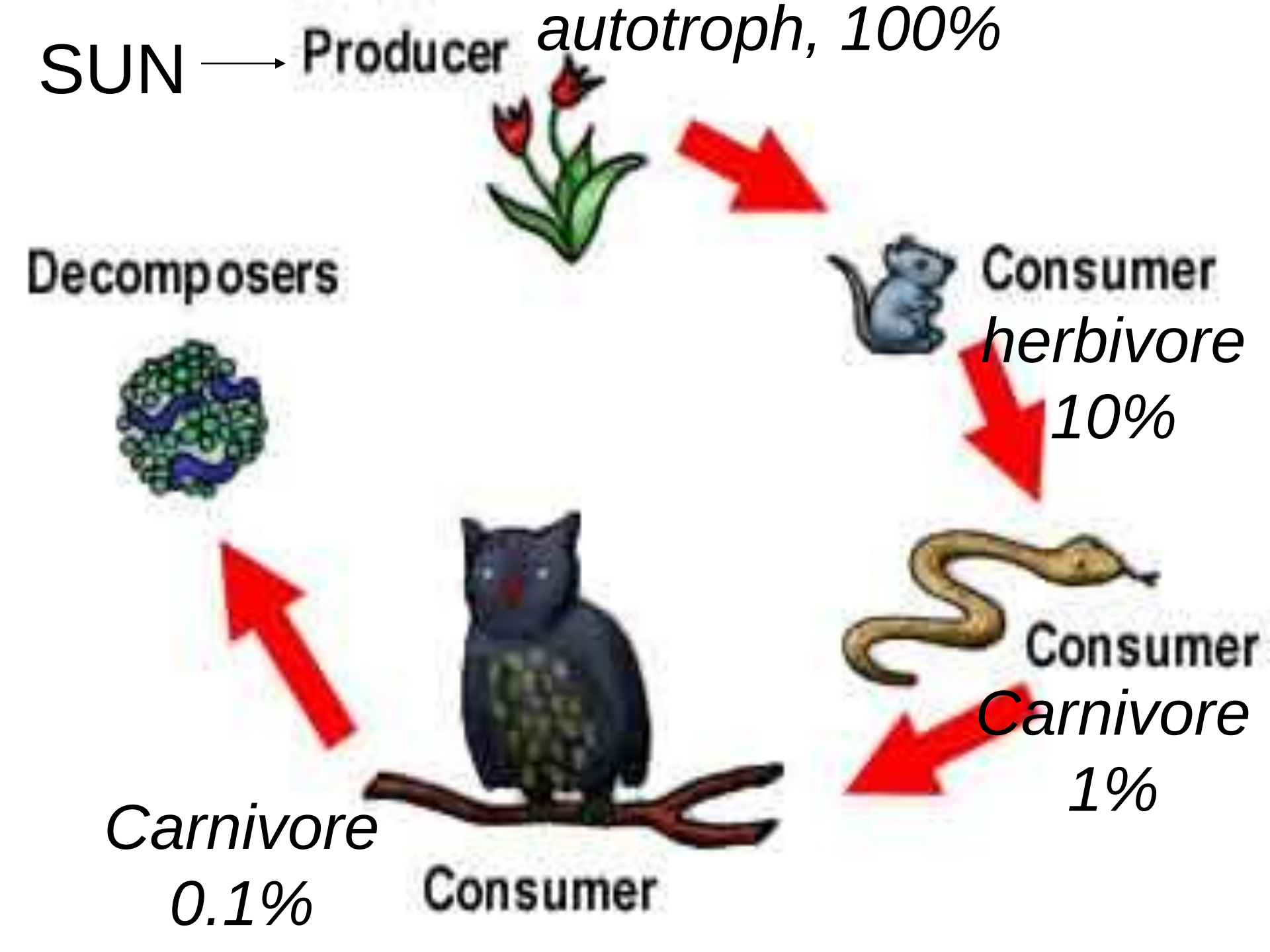
C. Decomposers: *obtain food by breaking down the remains of dead plants and animals*

What would happen to this ecosystem if there were no decomposers to break down the fallen trees, leaves, and needles?



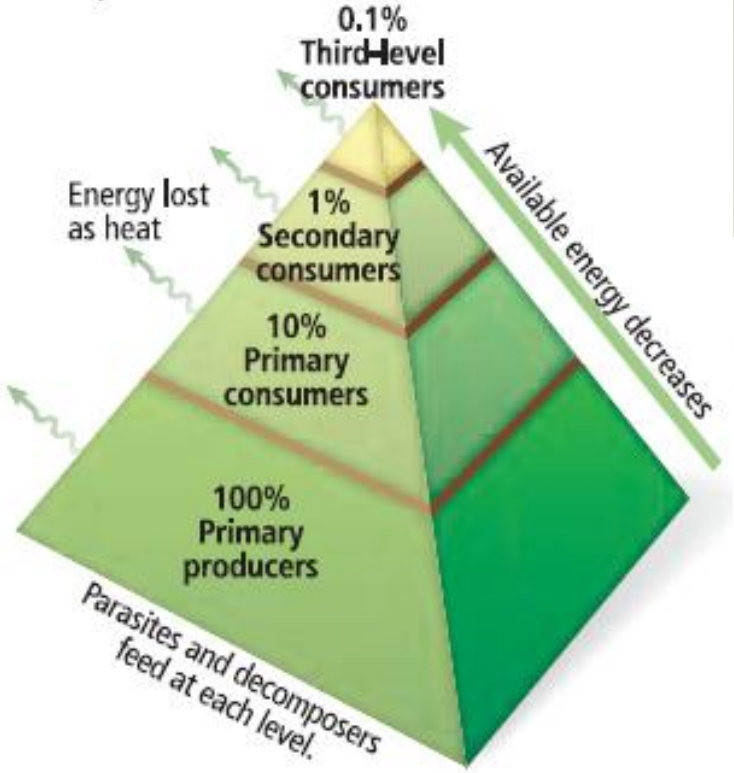
D. ***Food Chain****: feeding relationship where food energy is passed through a series of organisms*

1. *As you move from one trophic level to the next the available energy decreases*
2. *10% is used for growth, 90% is used for daily life processes*


SUN
Producer
autotroph, 100%
Consumer
herbivore
10%
Consumer
Carnivore
1%
Consumer
Carnivore
0.1%
Decomposers

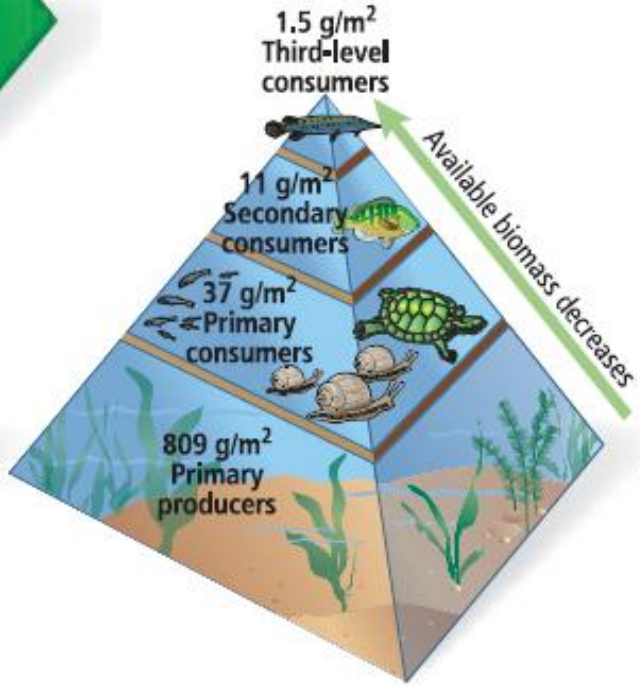
Pyramid of Energy

In a pyramid of energy, each level represents the amount of energy that is available to that trophic level. With each step up, there is an energy loss of 90 percent.



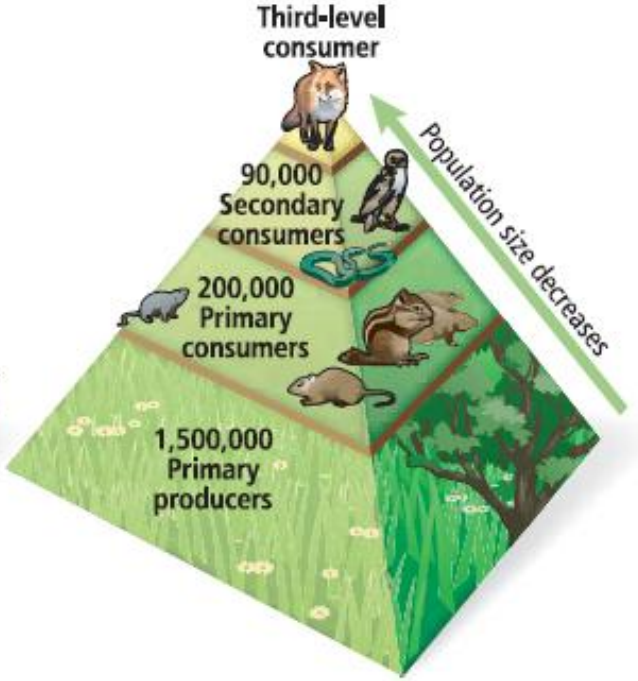
Pyramid of Biomass

In a pyramid of biomass, each level represents the amount of biomass consumed by the level above it.

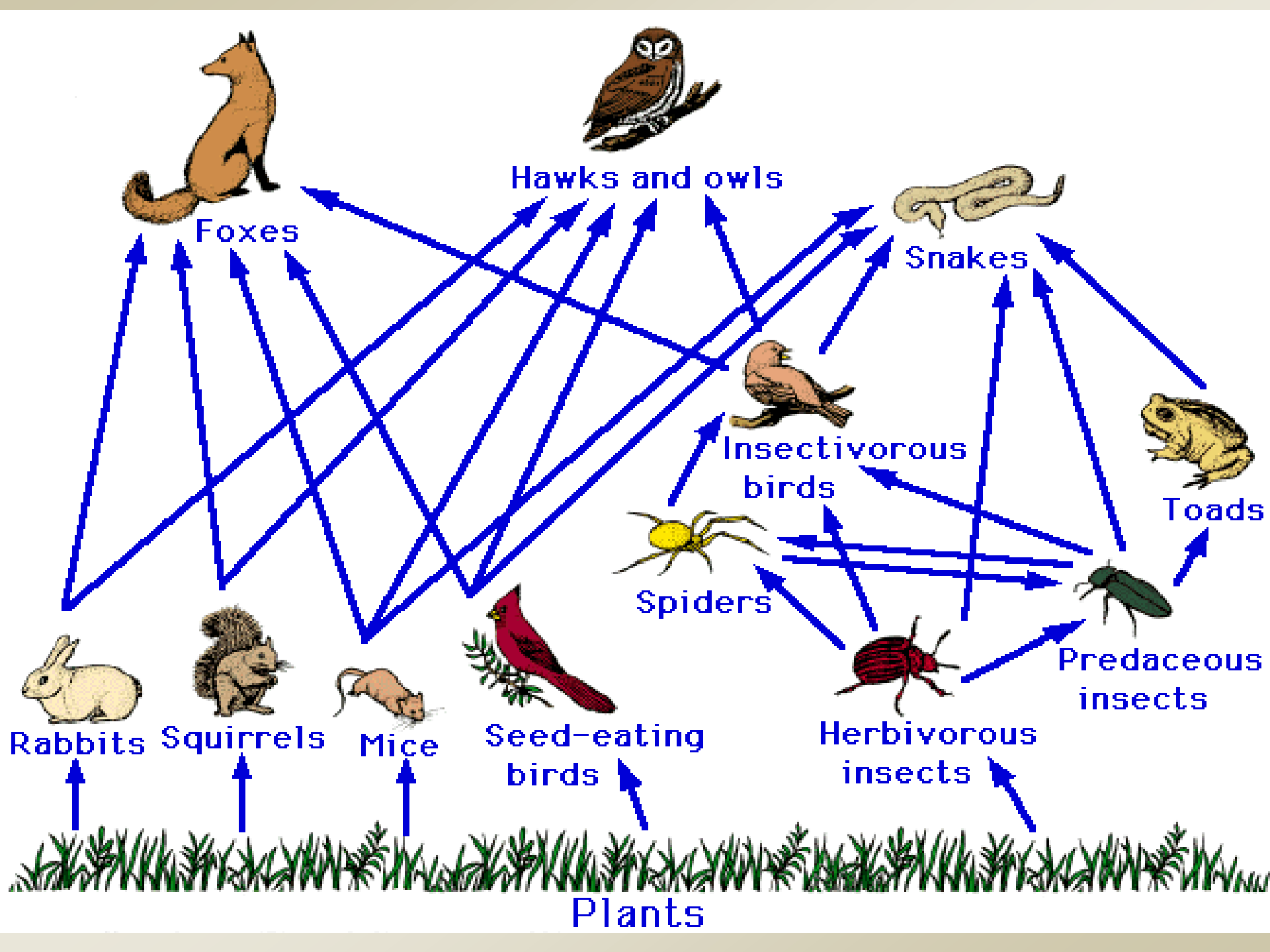


Pyramid of Numbers

In a pyramid of numbers, each level represents the number of individual organisms consumed by the level above it.



E. ***<u>Food Web:</u>*** *a complex interaction of many food chains.*


Foxes
Hawks and owls
Snakes
Insectivorous birds
Toads
Spiders
Predaceous insects
Rabbits
Squirrels
Mice
Seed-eating birds
Herbivorous insects
Plants

***IV. Biogeochemical Cycles**: The movement of materials between living things and the environment*

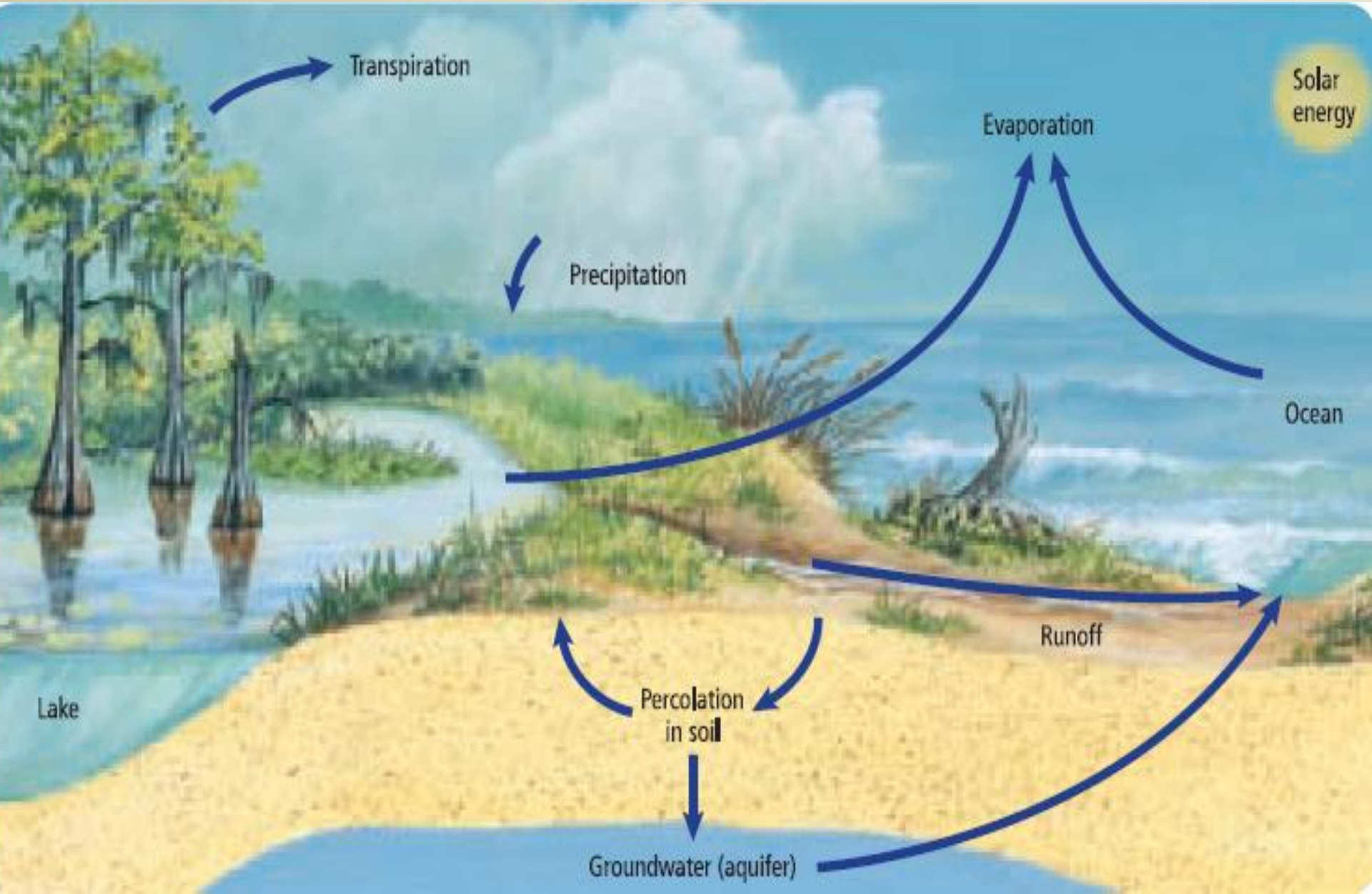
Four important substances that are involved in these cycles:

***water**: needed for chemical reactions in living things*

***nitrogen**: used to make proteins and chlorophyll*

***carbon**: a basic element needed to make organic compounds*

***oxygen**: used by living things to release energy from food (respiration)*


Transpiration
Solar energy
Evaporation
Precipitation
Ocean
Runoff
Lake
Percolation in soil
Groundwater (aquifer)

B. Nitrogen Cycle

1. Nitrogen Fixation

Bacteria in the roots of legumes convert atmospheric nitrogen into nitrates, a form of nitrogen plants can use

2. Ammonification

Dead plants and animal wastes decompose, producing ammonia which is toxic to most organisms.

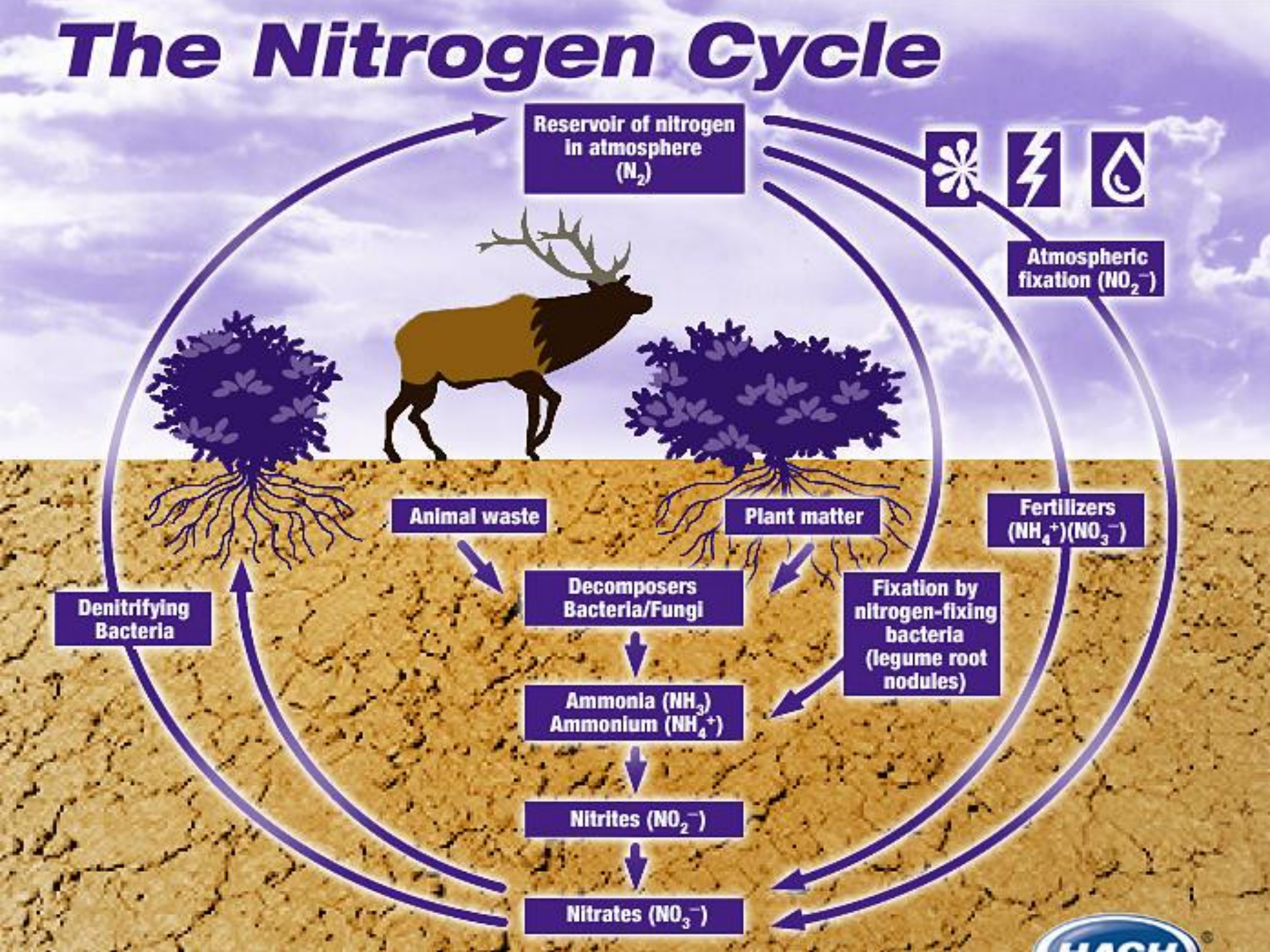
3. Nitrification

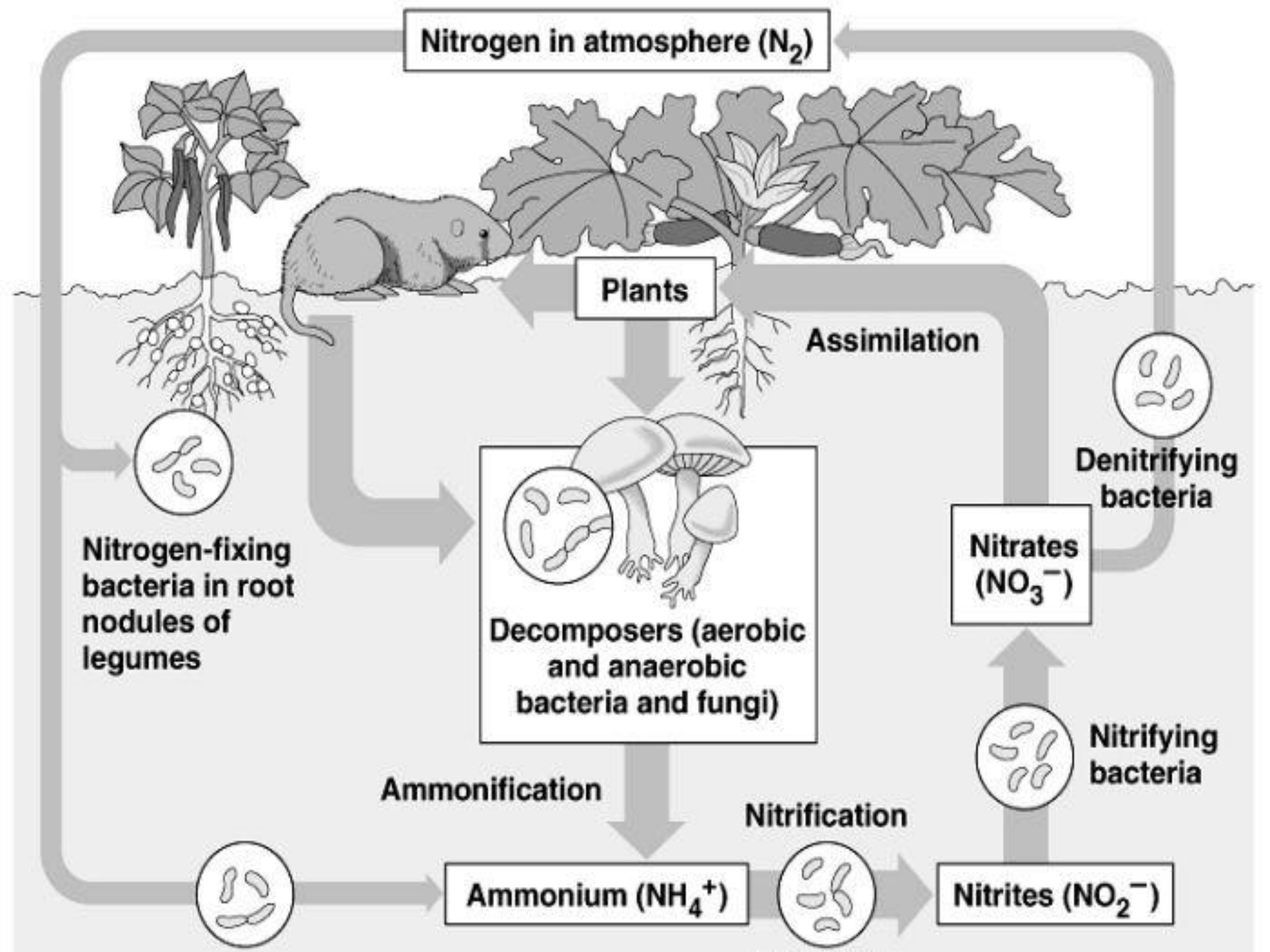
Ammonia is converted into nitrates by bacteria.

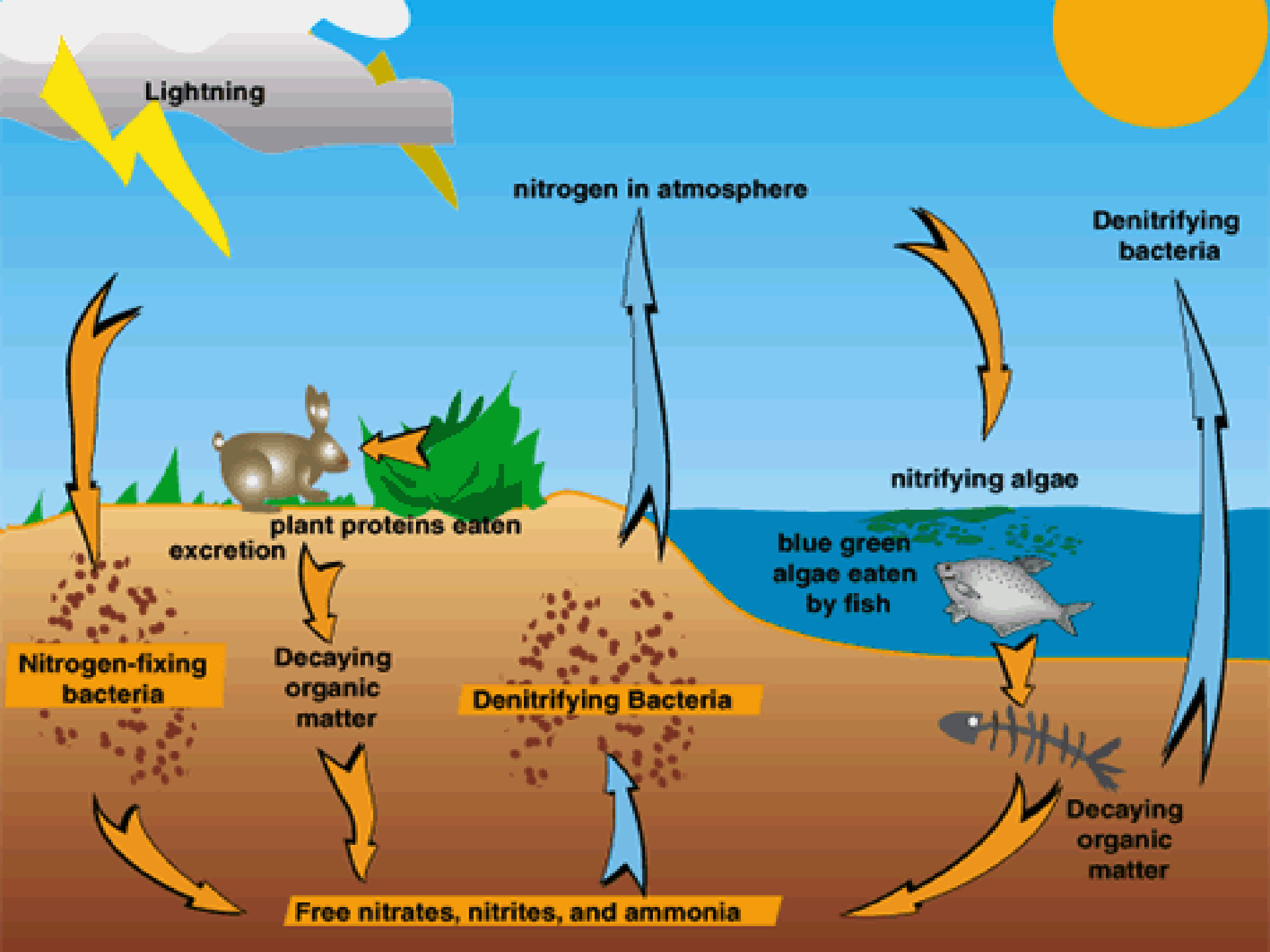
4. Denitrification

Bacteria change nitrates in the soil into nitrogen gas in the atmosphere

The Nitrogen Cycle



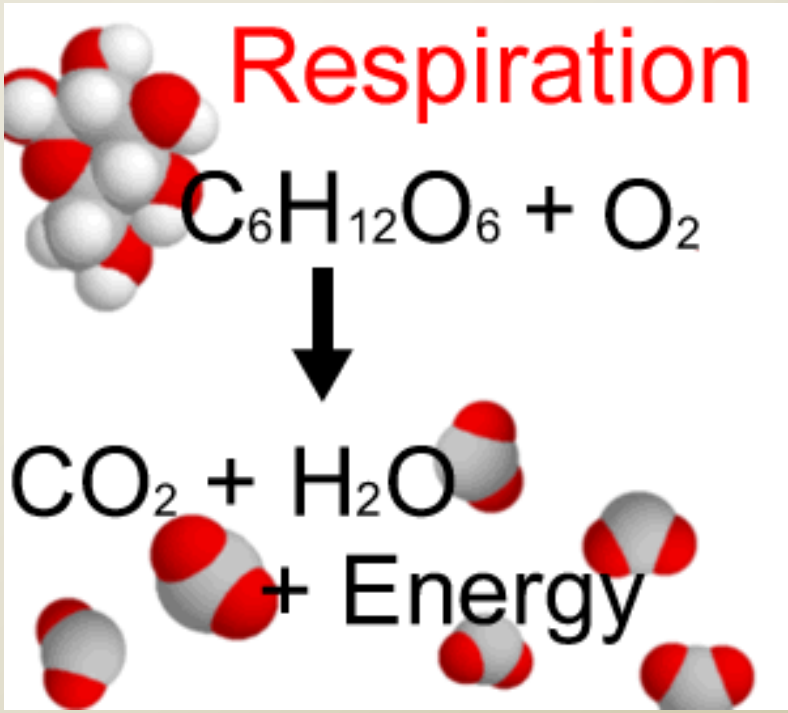

Nitrogen in atmosphere (N_2)
Plants
Assimilation
Denitrifying bacteria
Nitrogen-fixing bacteria in root nodules of legumes
Decomposers (aerobic and anaerobic bacteria and fungi)
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)


Lightning
nitrogen in atmosphere
Denitrifying bacteria
nitrifying algae
plant proteins eaten
excretion
blue green algae eaten by fish
Nitrogen-fixing bacteria
Decaying organic matter
Denitrifying Bacteria
Decaying organic matter
Free nitrates, nitrites, and ammonia

C. Carbon-Oxygen Cycle

1. Respiration

Living things use oxygen to release energy from food. CO_2 is a byproduct.



2. ***Photosynthesis***

Plants use CO_2, water, and energy from the sun to create food.

Oxygen and water are given off as byproducts.

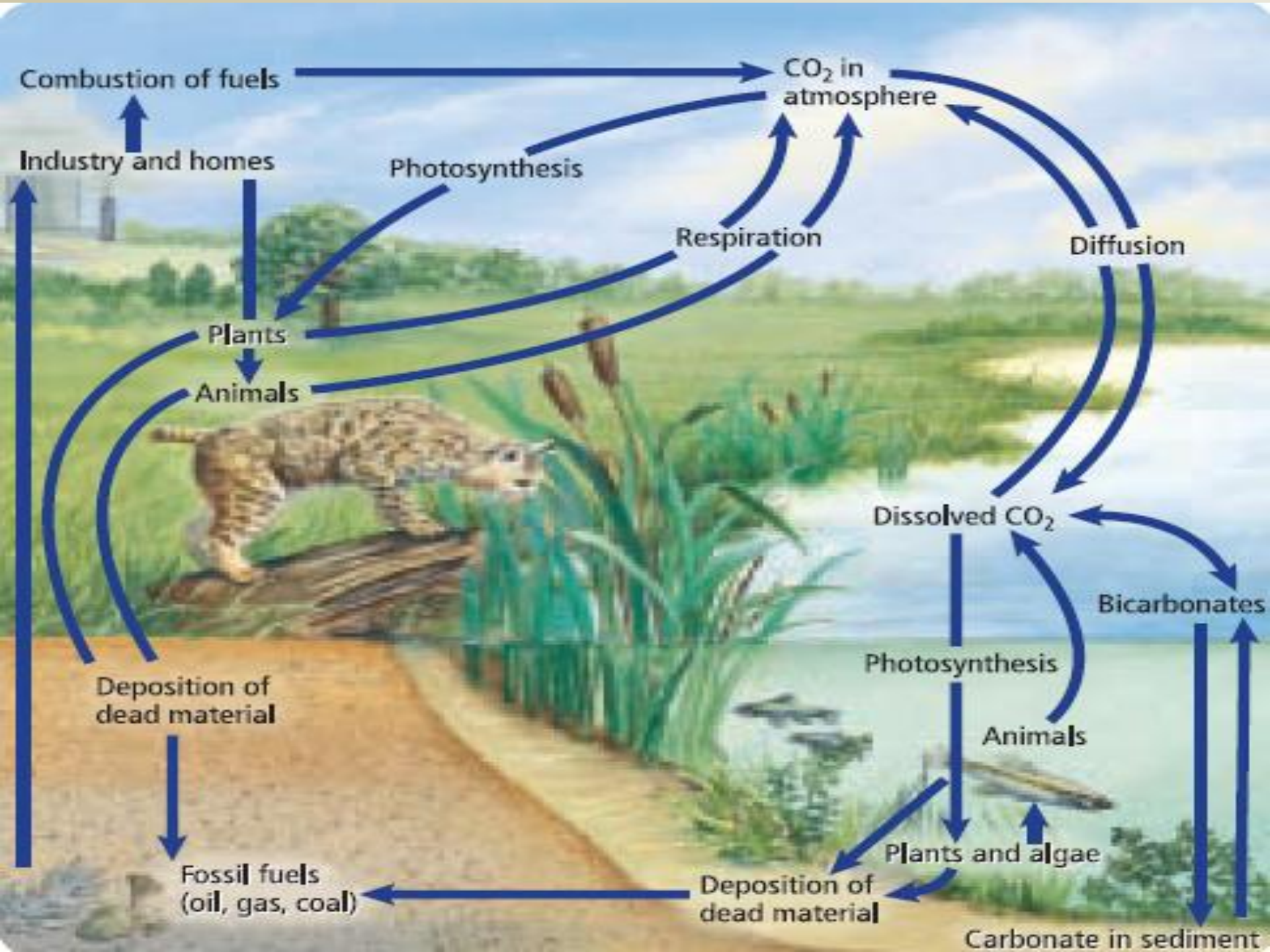
$$CO_2 + H_2O + energy \rightarrow C_6H_{12}O_6 + H_2O + O_2$$

3. Decomposition

Bacteria and fungi cause a breakdown of plant and animal materials and release CO_2.

4. Combustion

Burning fossil fuels releases CO_2.


Combustion of fuels
CO_2 in atmosphere
Industry and homes
Photosynthesis
Respiration
Diffusion
Plants
Animals
Dissolved CO_2
Bicarbonates
Photosynthesis
Deposition of dead material
Animals
Plants and algae
Fossil fuels (oil, gas, coal)
Deposition of dead material
Carbonate in sediment