



Ecology

WHAT IS ECOLOGY?

Ecology- the scientific study of interactions between **organisms and their environments**, focusing on energy transfer

Ecology is a science of **relationships**

WHAT DO YOU MEAN BY ENVIRONMENT?

The environment is made up of two factors:

- **Biotic factors**- all living organisms inhabiting the Earth
- **Abiotic factors**- nonliving parts of the environment (i.e. temperature, soil, light, moisture, air currents)



Biosphere

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graph TD; A(Biosphere) --> B(Ecosystem); B --> C(Community); C --> D(Population); D --> E(Organism);
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Ecosystem

Community

Population

Organism

Organism - any unicellular or multicellular form exhibiting all of the characteristics of life, an individual.

- The lowest level of organization

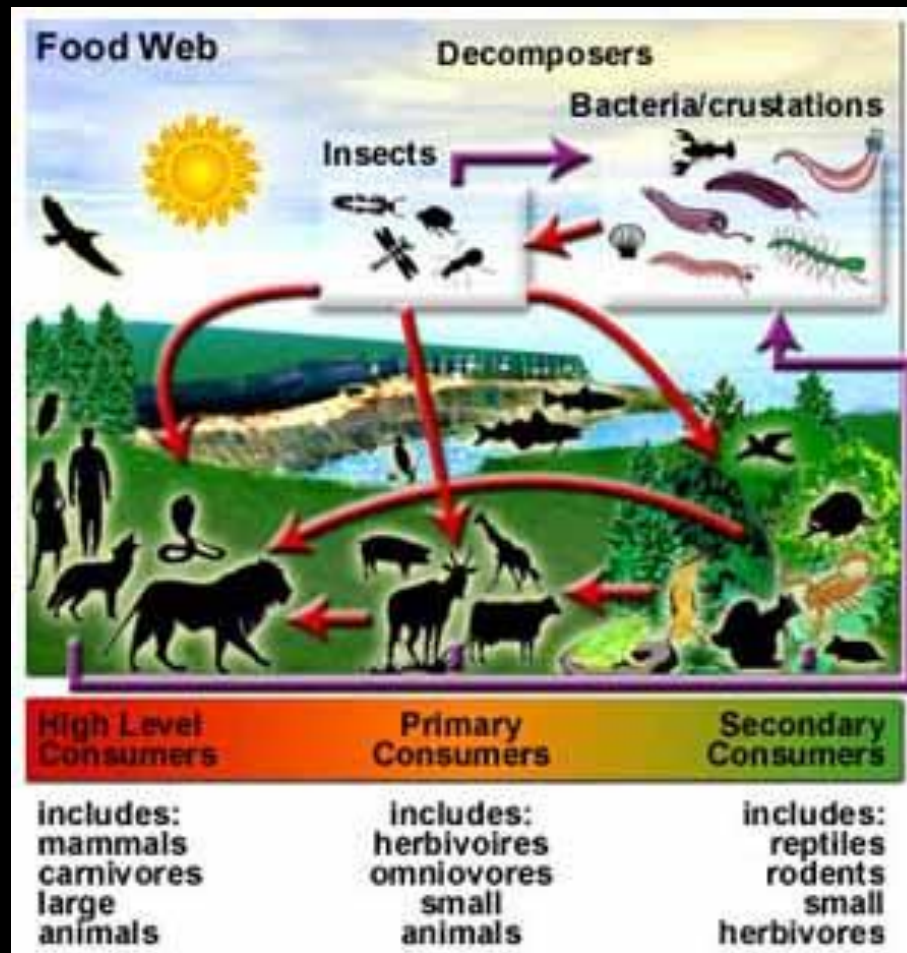


POPULATION

- ✓ a group of organisms of **one species** living in the same place at the same time that **interbreed**
- ✓ Produce **fertile** offspring
- ✓ **Compete** with each other for **resources** (food, mates, shelter, etc.)



Community - several interacting populations that inhabit a common environment and are interdependent.



Ecosystem - populations in a community and the abiotic factors with which they interact (ex. marine, terrestrial)



Biosphere - life supporting portions of Earth composed of air, land, fresh water, and salt water.

- The highest level of organization



Habitat vs. Niche

Niche - the role a species plays in a community; its total way of life

Habitat - the place in which an organism lives out its life

Habitat vs. Niche

A niche is determined by the tolerance limitations of an organism, or a limiting factor.

Limiting factor- any biotic or abiotic factor that restricts the existence of organisms in a specific environment.

Habitat vs. Niche

Examples of limiting factors -

- Amount of water
- Amount of food
- Temperature
- Amount of space
- Availability of mates

Feeding Relationships

- There are 3 main types of feeding relationships
 1. Producer - Consumer
 2. Predator - Prey
 3. Parasite - Host

Feeding Relationships

- Producer** - all autotrophs (plants), they trap energy from the sun
- Bottom of the food chain



Feeding Relationships

Consumer - all heterotrophs: they ingest food containing the sun's energy

- Herbivores
- Carnivores
- Omnivores
- Decomposers

Feeding Relationships

CONSUMERS

1. Primary consumers

- Eat plants
- Herbivores

• Secondary, tertiary ... consumers

- Prey animals
- Carnivores



Feeding Relationships

Consumer-Carnivores-eat meat

- Predators
 - Hunt prey animals for food.



Feeding Relationships

Consumer - Carnivores - eat meat

- Scavengers
 - Feed on carrion, dead animals



Feeding Relationships

Consumer- Omnivores -eat both plants
and animals



Feeding Relationships

Consumer-

Decomposers

- Breakdown the complex compounds of dead and decaying plants and animals into simpler molecules that can be absorbed



Symbiotic Relationships

Symbiosis- two species living together

3 Types of symbiosis:

1. Commensalism
2. Parasitism
3. Mutualism



Symbiotic Relationships

Commensalism-

one species benefits and the other is neither harmed nor helped

Ex. orchids on a tree

Epiphytes: A plant, such as a tropical orchid or a bromeliad, that grows on another plant upon which it depends for mechanical support but not for nutrients. Also called *xerophyte*, *air plant*.

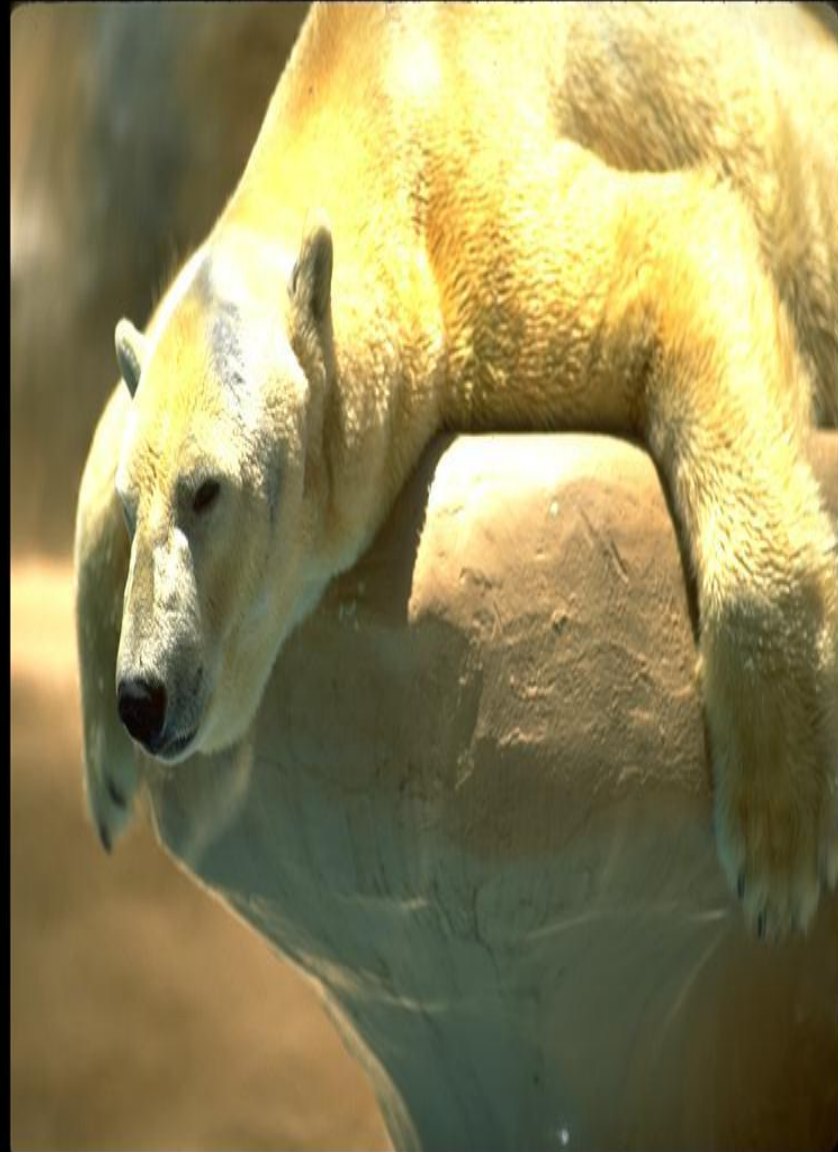


Symbiotic Relationships

Commensalism-

one species benefits
and the other is
neither harmed nor
helped

Ex. polar bears and
cyanobacteria



Symbiotic Relationships

Parasitism-

one species benefits (parasite) and the other is harmed (host)

- Parasite-Host relationship



Symbiotic Relationships

Parasitism- parasite-host

Ex. lampreys,
leeches, fleas,
ticks, tapeworm



Symbiotic Relationships

Mutualism-

beneficial to
both species

Ex. cleaning birds
and cleaner
shrimp

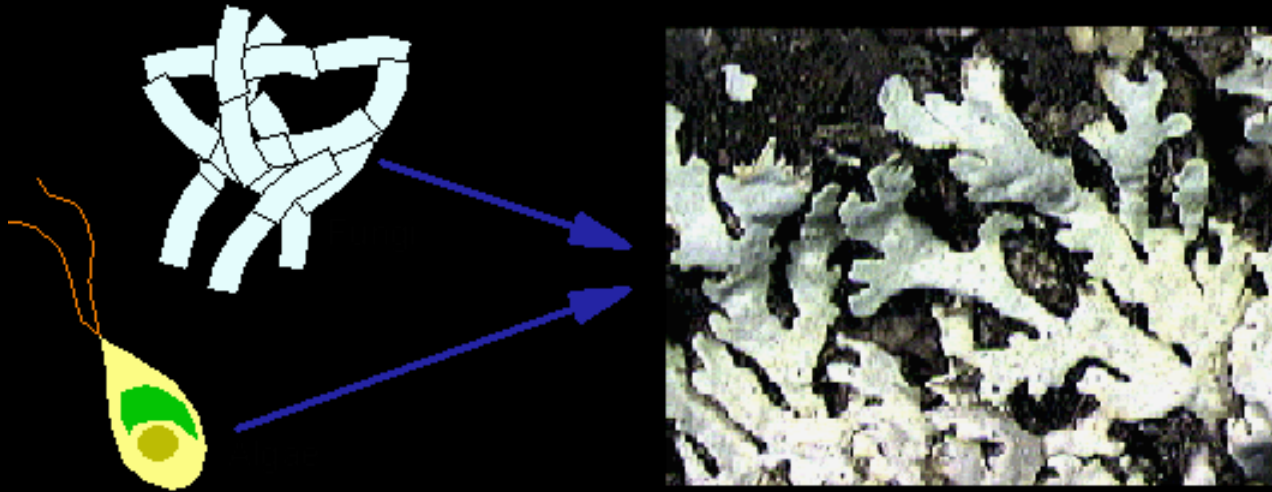


Symbiotic Relationships

Mutualism-

beneficial to both species

Ex. lichen





Type of relationship	Species harmed	Species benefits	Species neutral
Commensalism		●	●
Parasitism	●	●	
Mutualism		● ●	

● = 1 species

Trophic Levels

- Each link in a food chain is known as a trophic level.
- Trophic levels represent a **feeding step** in the transfer of energy and matter in an ecosystem.

Trophic Levels

Biomass- the amount of organic matter comprising a group of organisms in a habitat.

- As you move up a food chain, both available energy and biomass decrease.
- Energy is transferred upwards but is diminished with each transfer.

Trophic Levels

E
N
E
R
G
Y

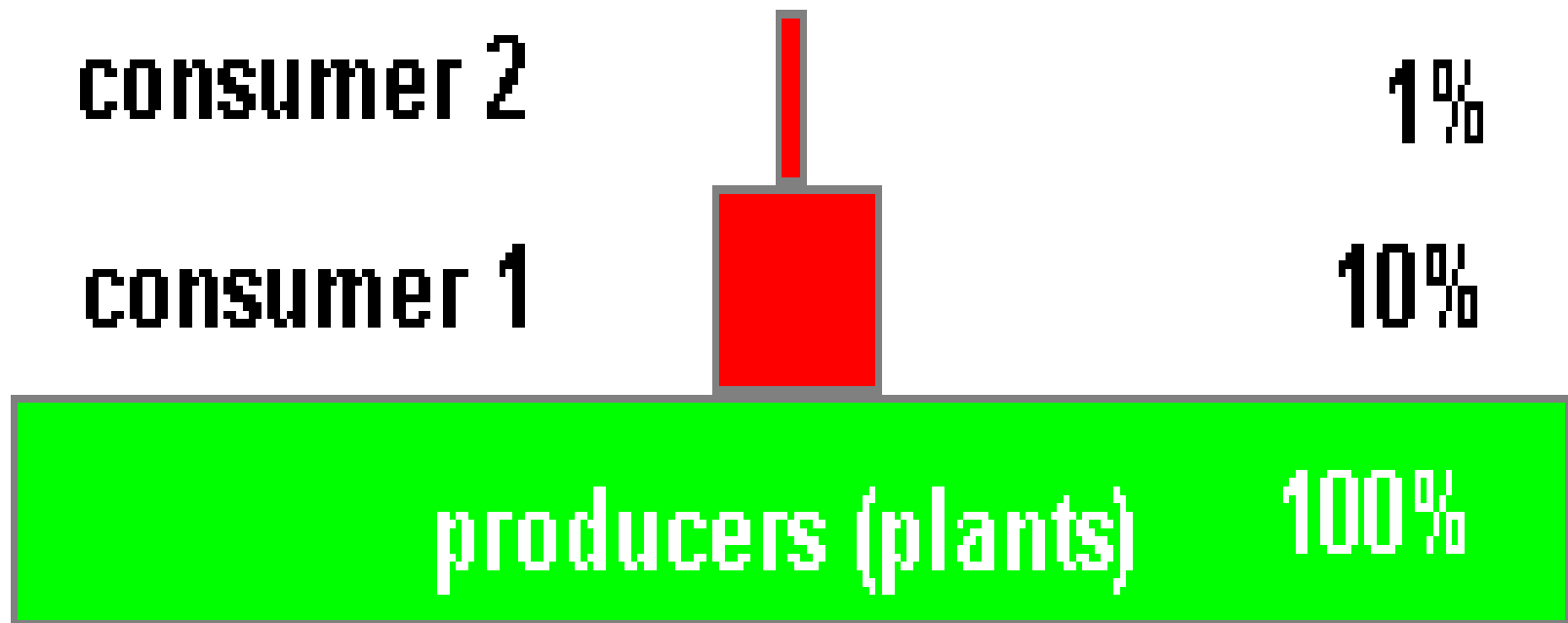
Tertiary
consumers- top
carnivores

Secondary consumers-
small carnivores

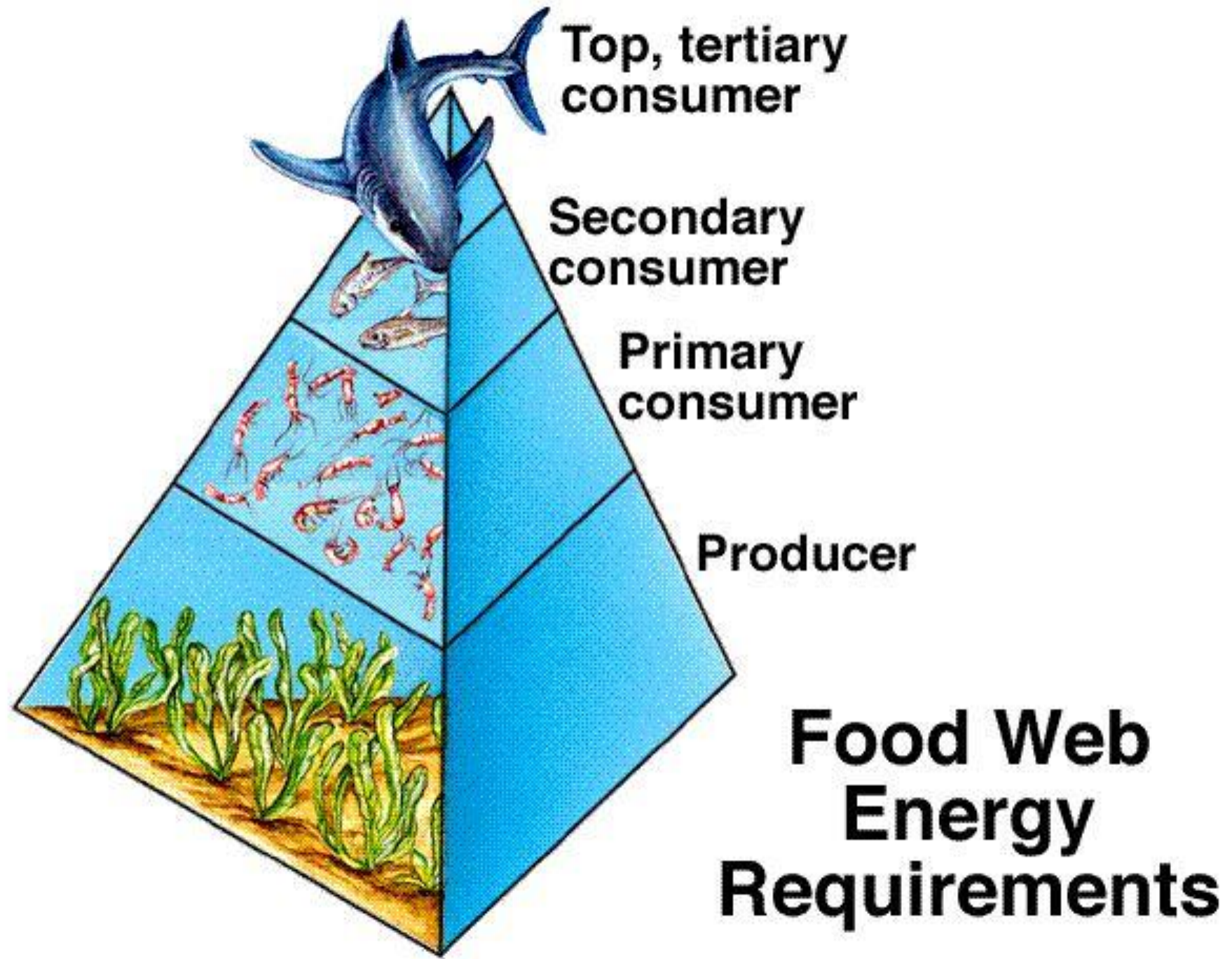
Primary consumers- Herbivores

Producers- Autotrophs

Typical ecosystem

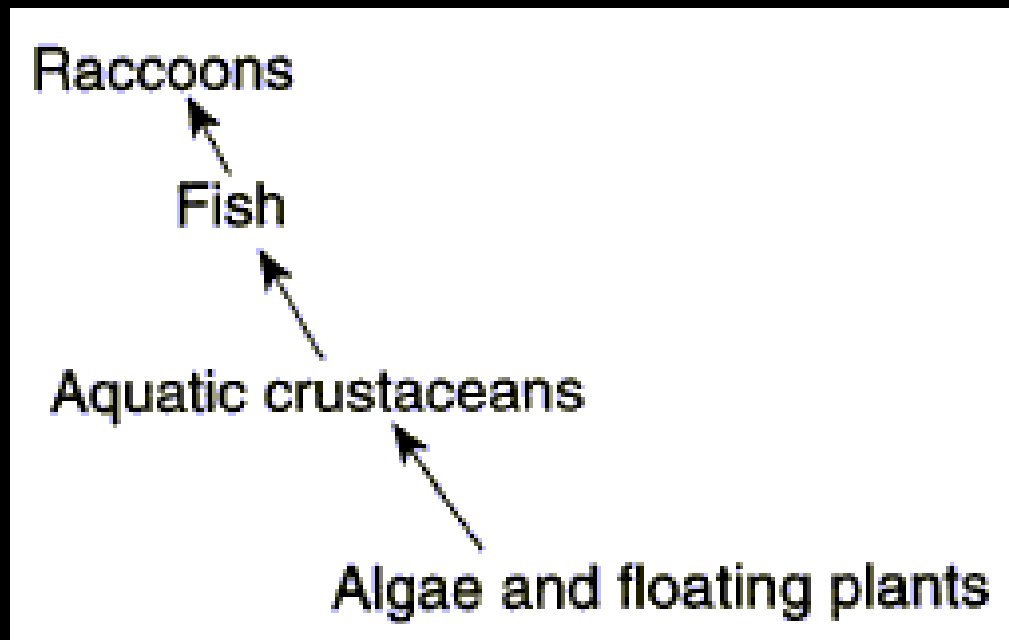


energy/biomass



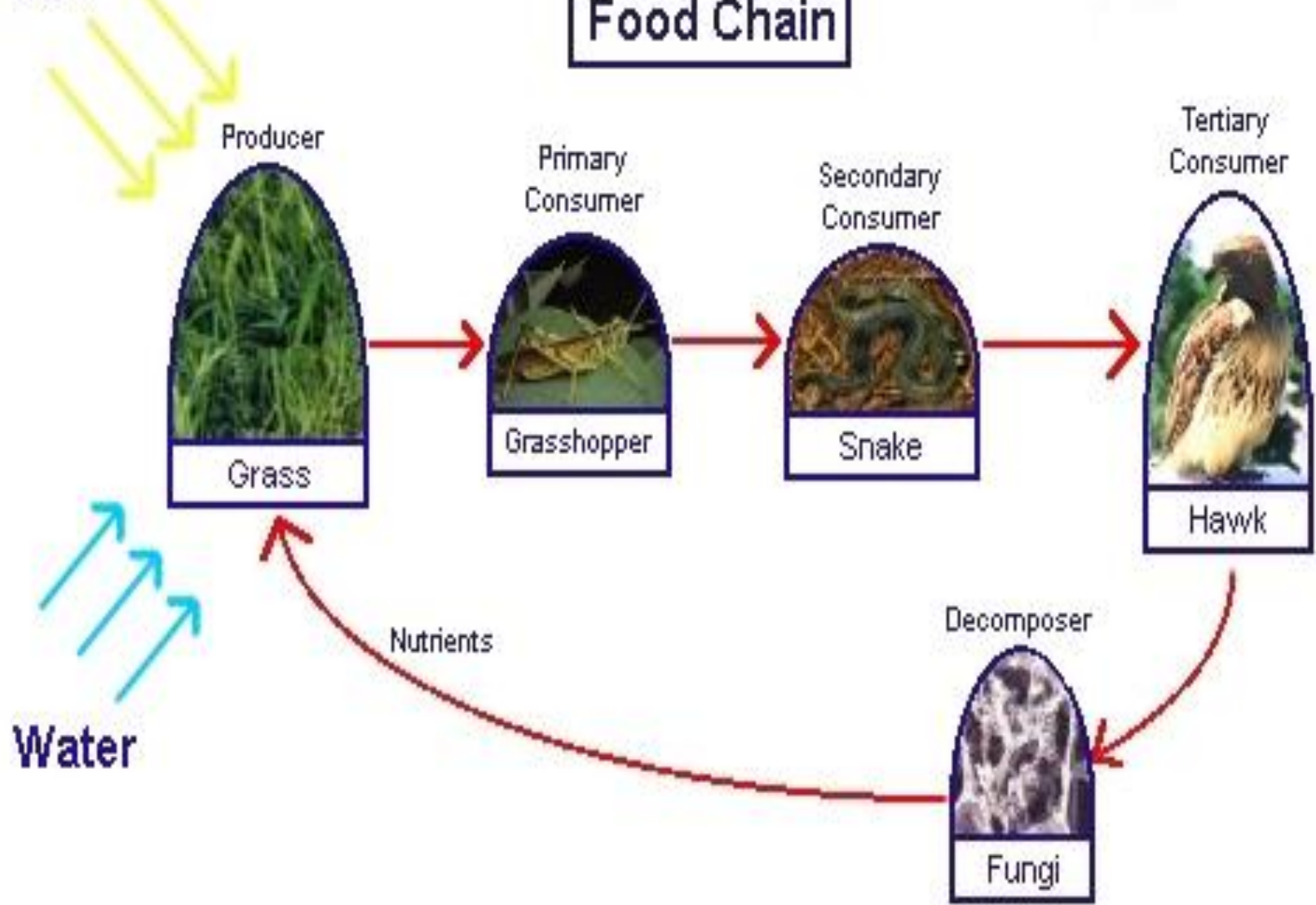
Trophic Levels

Food chain- simple model that shows how matter and energy move through an ecosystem



Sun

Food Chain



Water

Trophic Levels

Food web - shows all possible feeding relationships in a community at each trophic level

- Represents a network of interconnected food chains

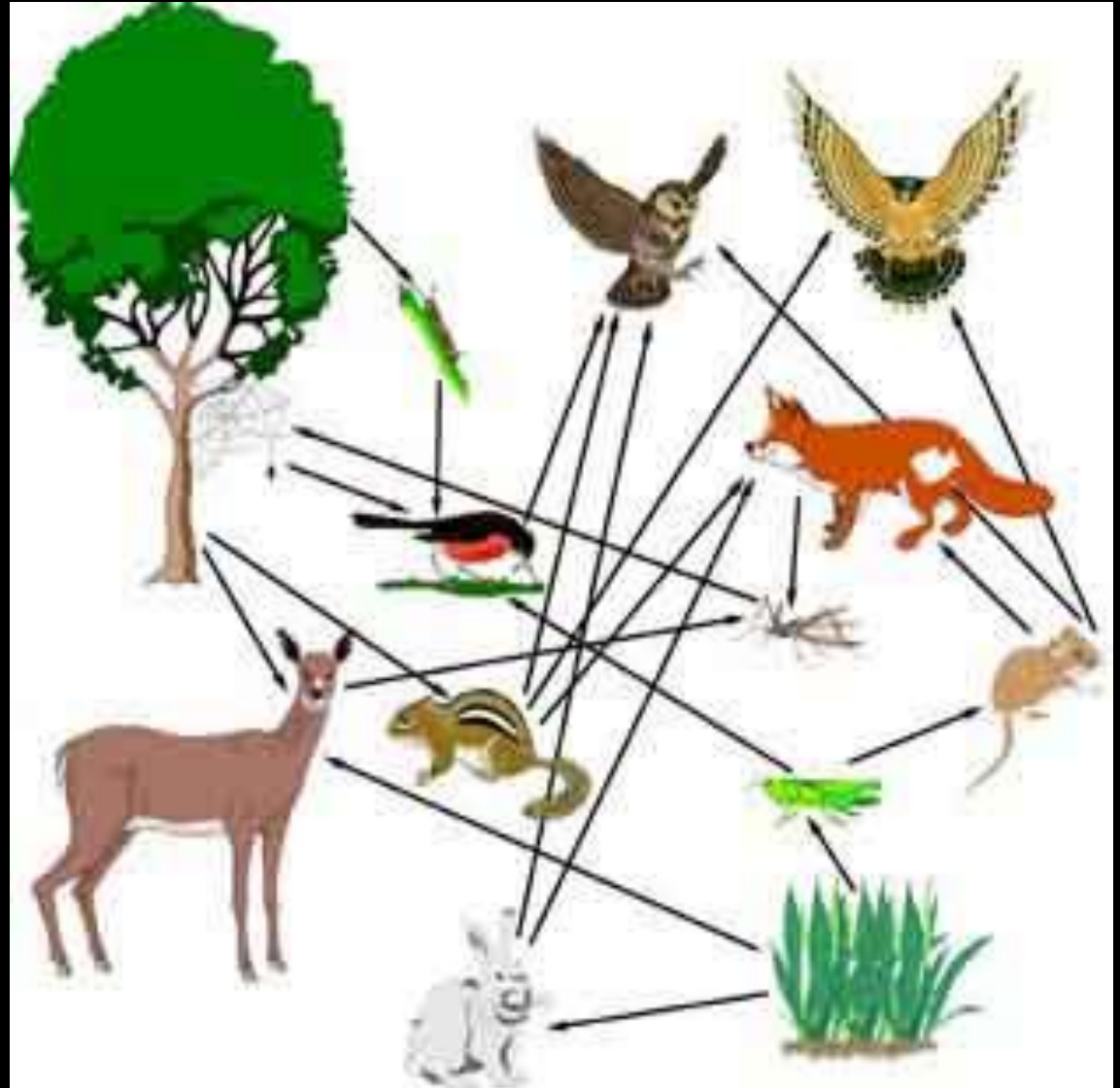
Food chain

(just 1 path of energy)

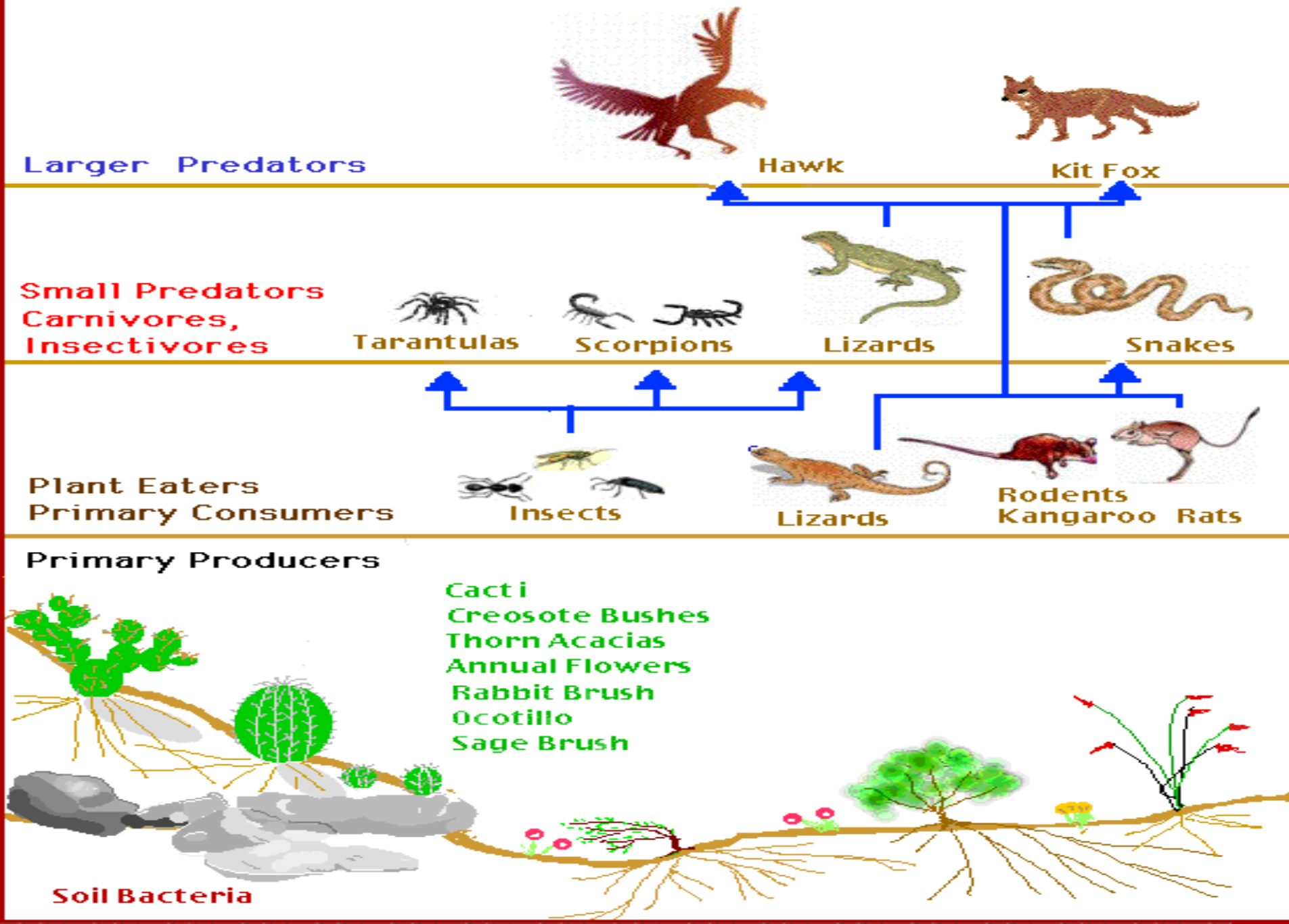


Food web

(all possible energy paths)



A Food Web in the Desert Biome



A Food Chain in the Temperate Rain Forest Biome

Tertiary Consumers



Lynx



Wolf



Bear



Cougar

Secondary Consumers



Shrew



Amphibians



Weasel



Raccoon



Insects



Birds



Primary Consumers



Small Mammals



Salmon



Insects



Deer



Elk



Birds

Primary Producers

Ferns Mosses Shrubs
Shrubs Flowers

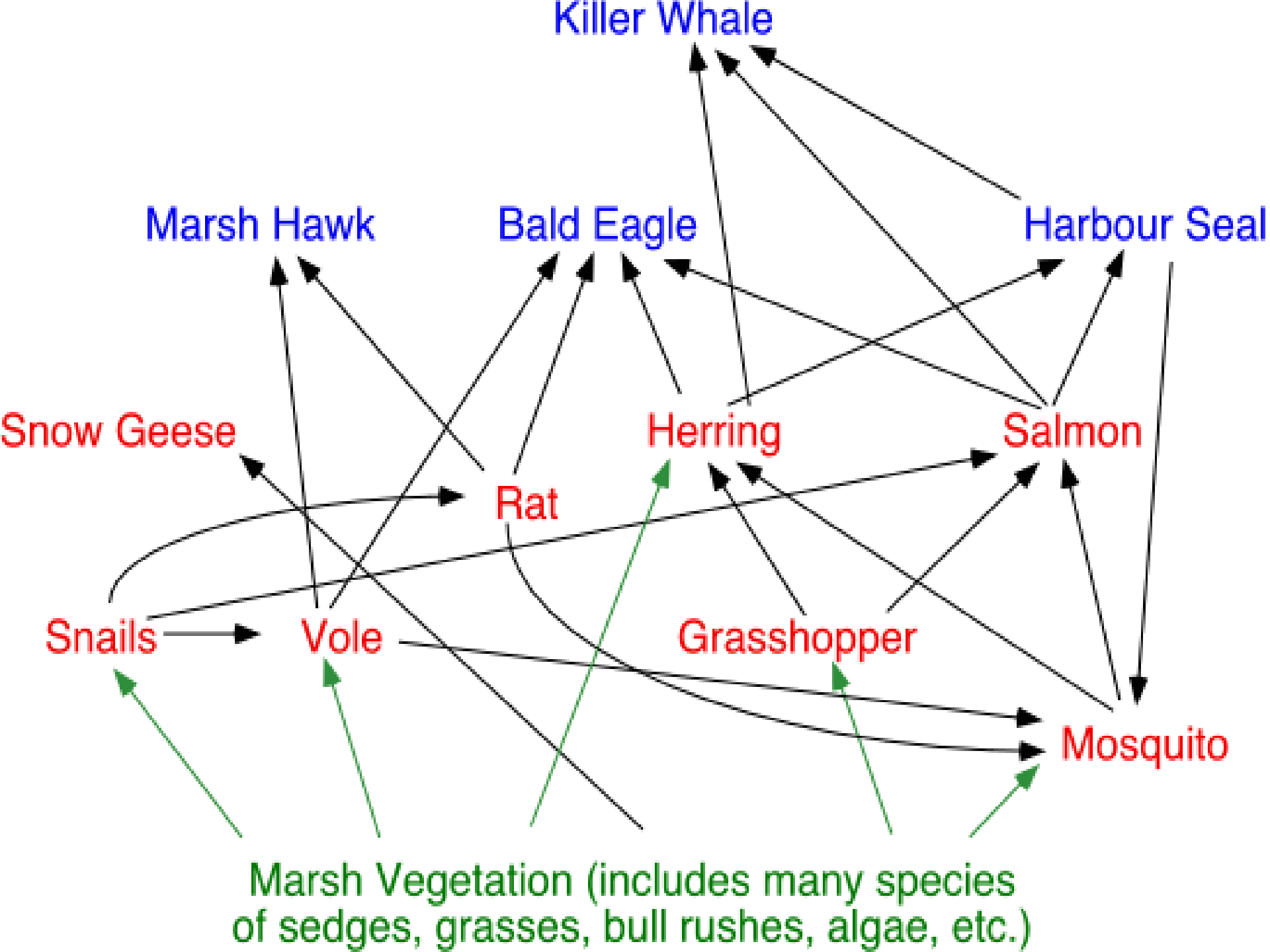
Canopy level trees: Conifers: Fir Hemlock Cedar Spruce
Understory trees: Vine Maples Dogwood

Canopy Layer

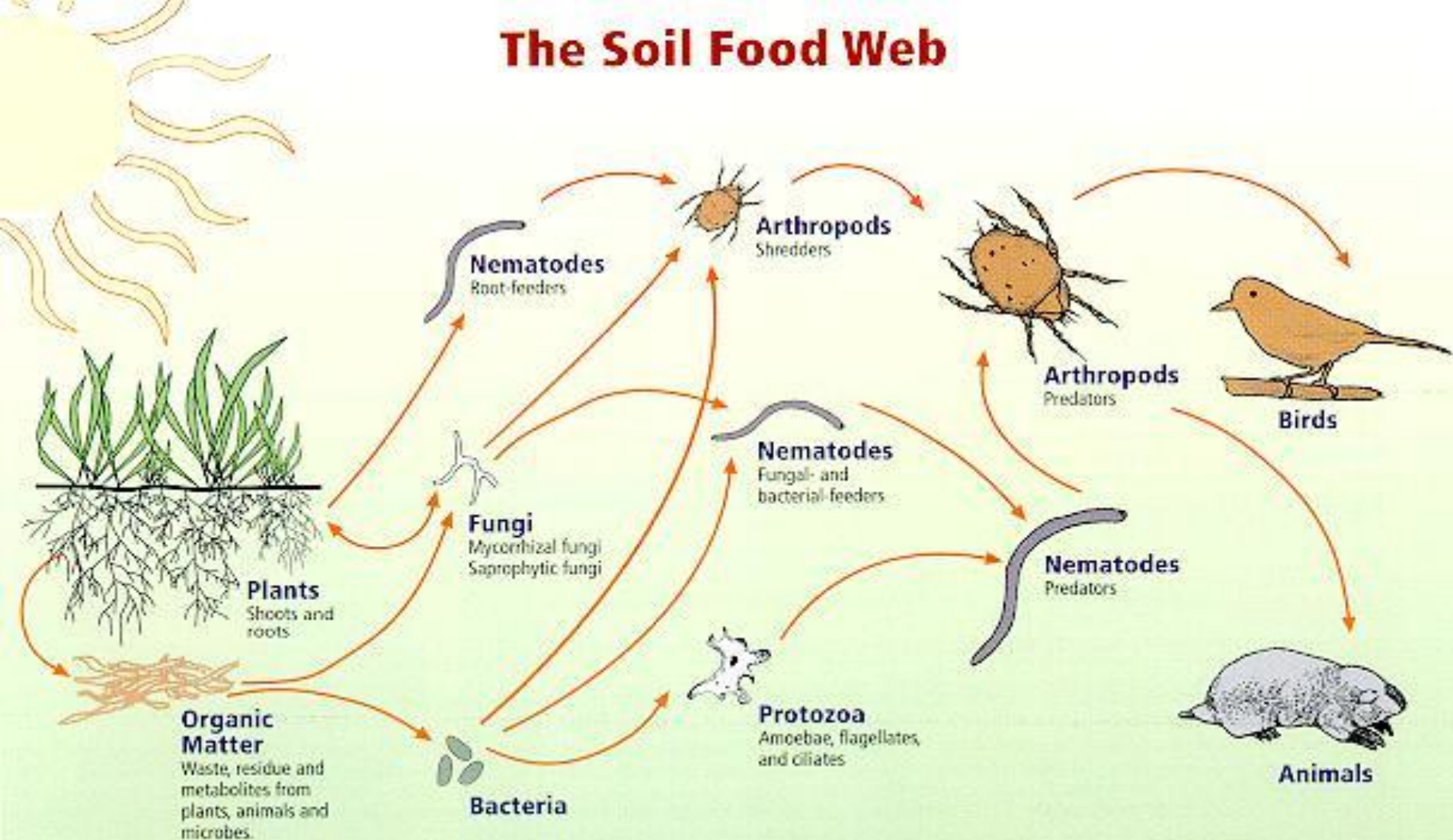
Understory Layer

Ground Layer

Ferns, grasses, moss, small flowering plants, fungi, small leafy plants.
Bacteria, protozoans, fungi, detritivores digest dead matter.



The Soil Food Web



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators

Nutrient Cycles

Cycling maintains homeostasis (balance) in the environment.

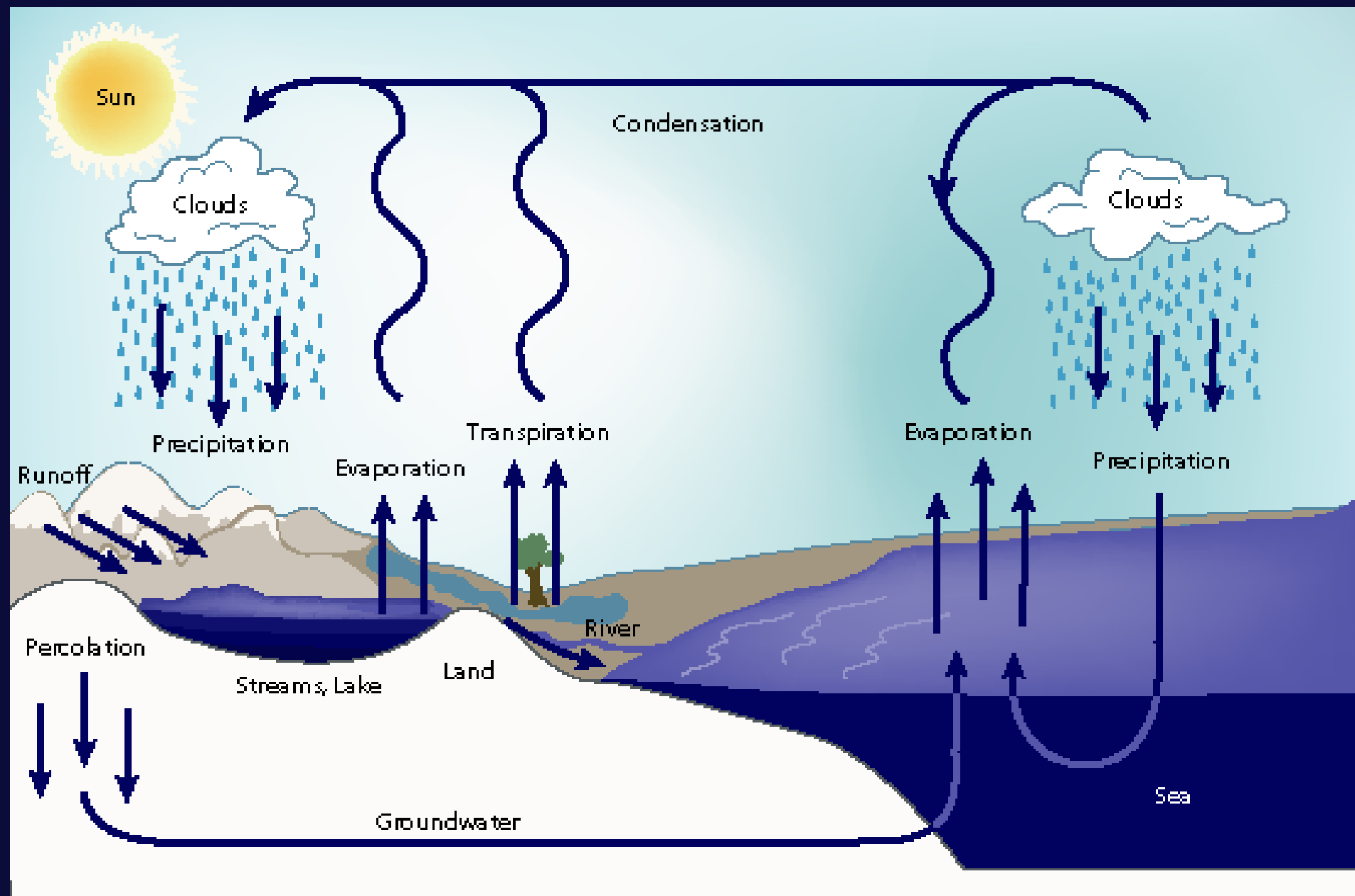
•3 cycles to investigate:

1. Water cycle
2. Carbon cycle
3. Nitrogen cycle

Water cycle-

- Evaporation, transpiration, condensation, precipitation

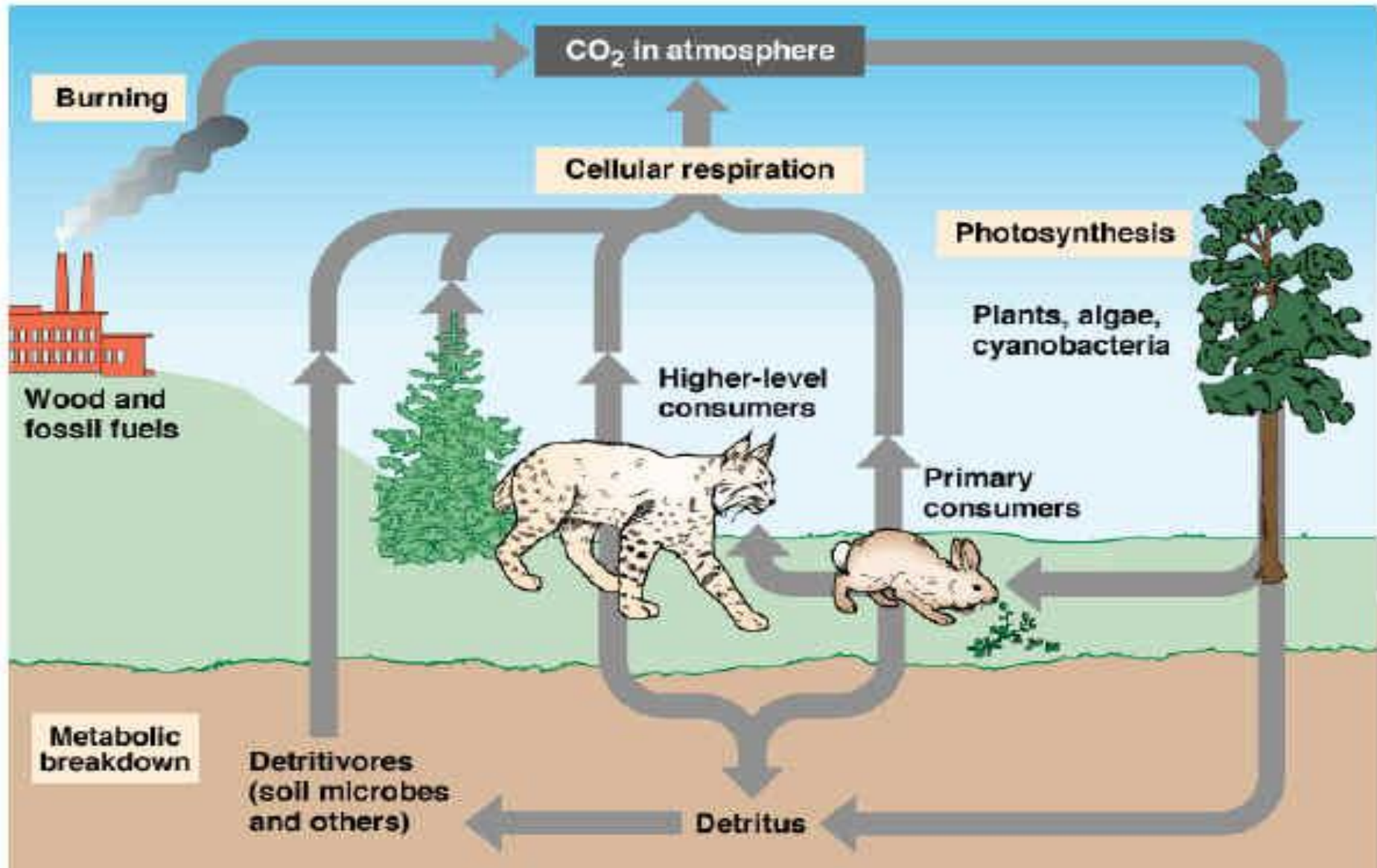
Water cycle-



Carbon cycle-

- Photosynthesis and respiration cycle carbon and oxygen through the environment.

Carbon cycle-



Nitrogen cycle-

Atmospheric nitrogen (N_2) makes up nearly 78%-80% of air.

Organisms can not use it in that form.

Lightning and bacteria convert nitrogen into usable forms.



Nitrogen cycle-

Only in certain bacteria and industrial technologies can fix nitrogen.

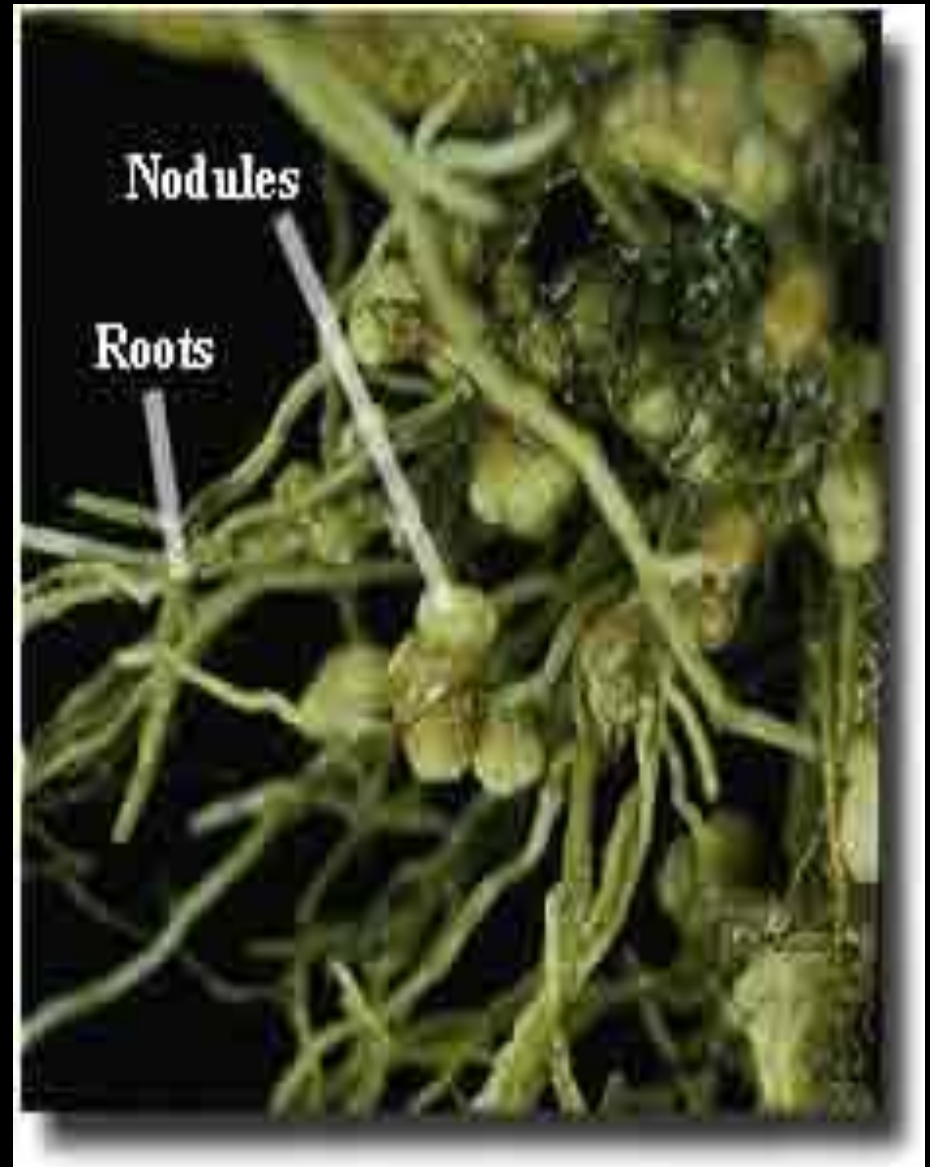
Nitrogen fixation-convert atmospheric nitrogen (N_2) into ammonium (NH_4^+) which can be used to make organic compounds like amino acids.



Nitrogen cycle-

Nitrogen-fixing
bacteria:

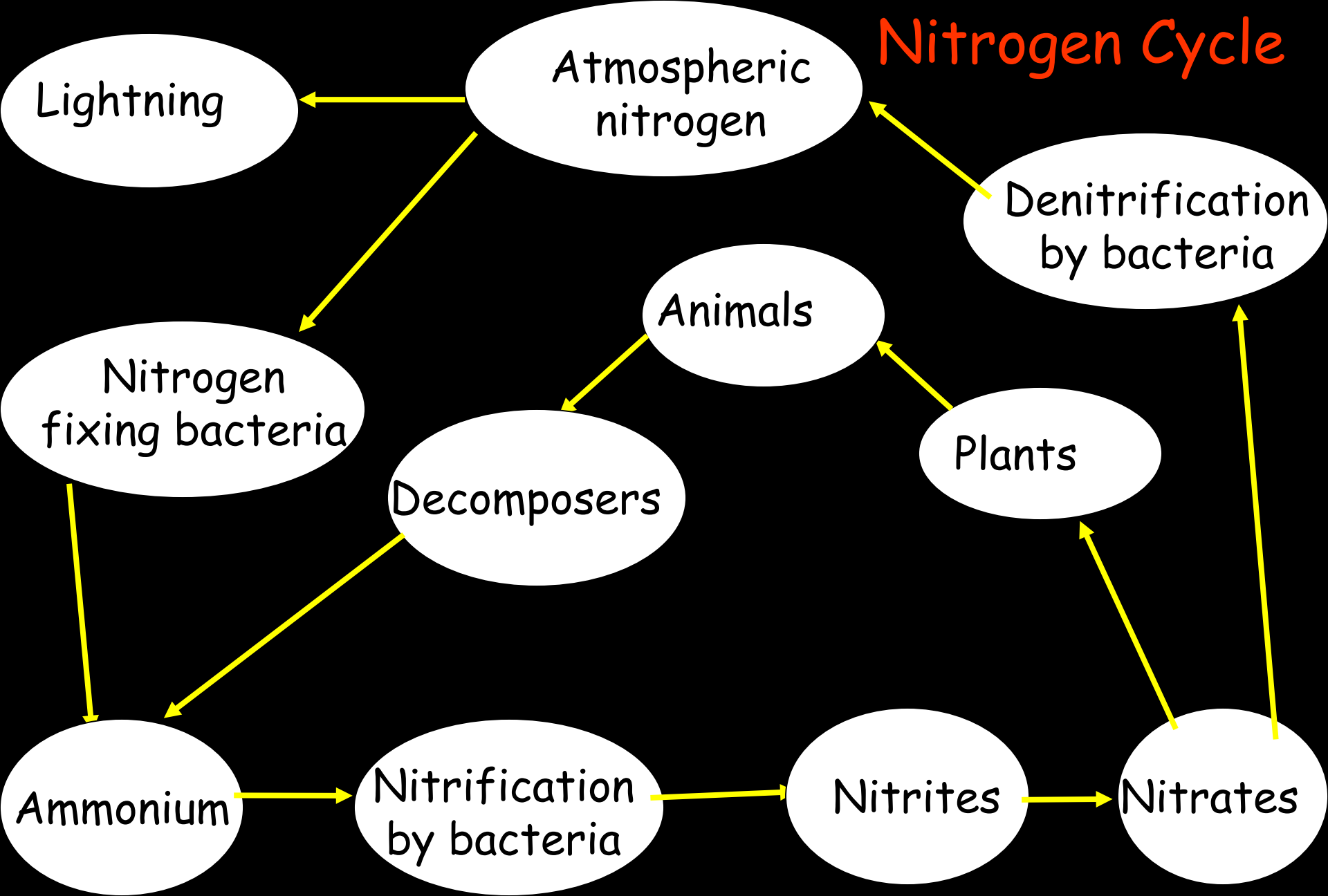
Some live in a
symbiotic
relationship with
plants of the legume
family (e.g.,
soybeans, clover,
peanuts).



Nitrogen cycle-

- Some nitrogen-fixing bacteria live free in the soil.
- Nitrogen-fixing cyanobacteria are essential to maintaining the fertility of semi-aquatic environments like rice paddies.

Nitrogen Cycle



Toxins in food chains-

While energy decreases as it moves up the food chain, toxins increase in potency.

- This is called biological magnification

Ex: DDT & Bald Eagles

