Ecology

Ecosystems video

Ecosystems and Biomes

WHAT IS ECOLOGY?

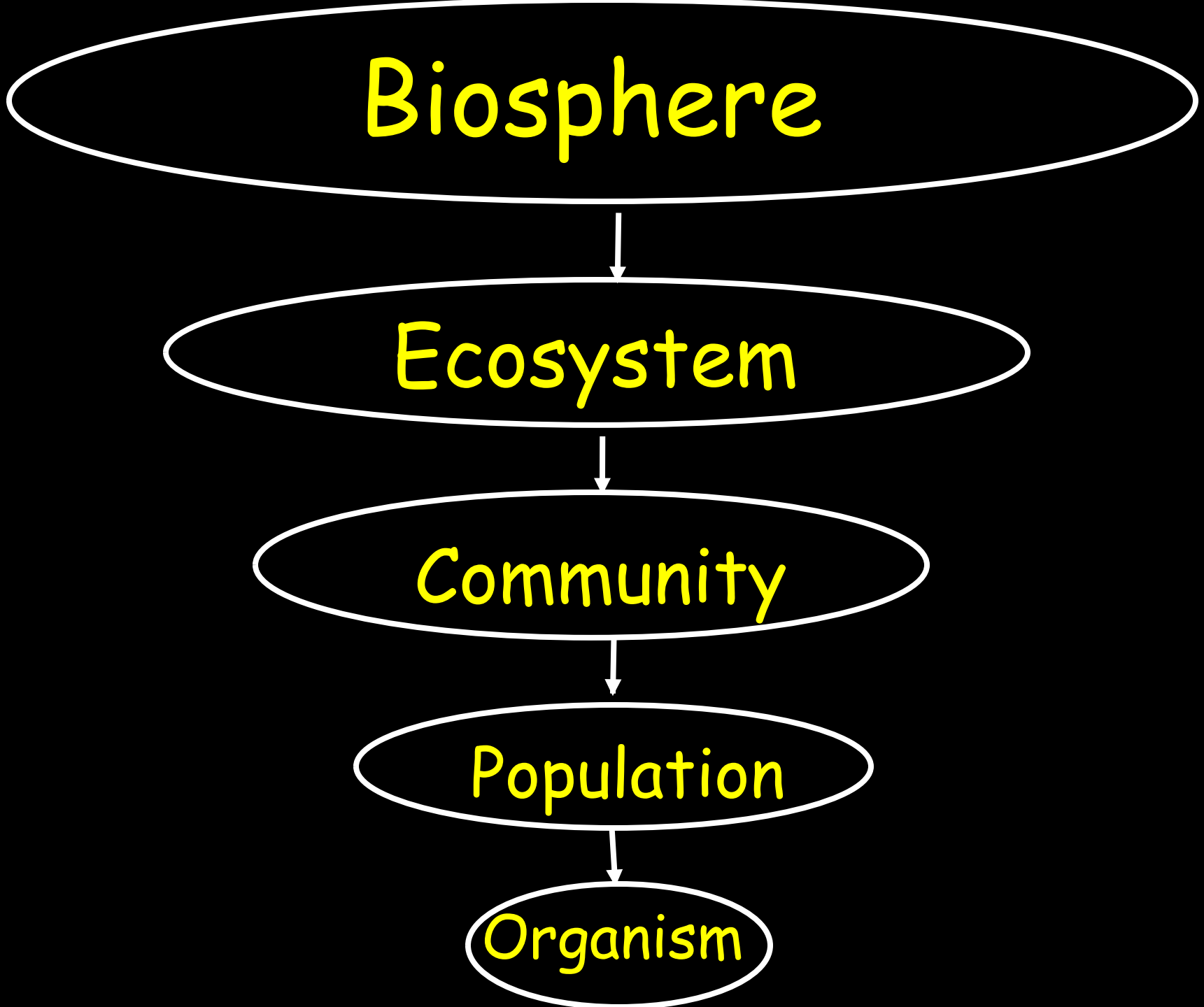
Ecology- the scientific study of interactions between **organisms and their environments,** focusing on energy transfer

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
Ecosystem
Community
Population
Organism

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

The lowest level of organization

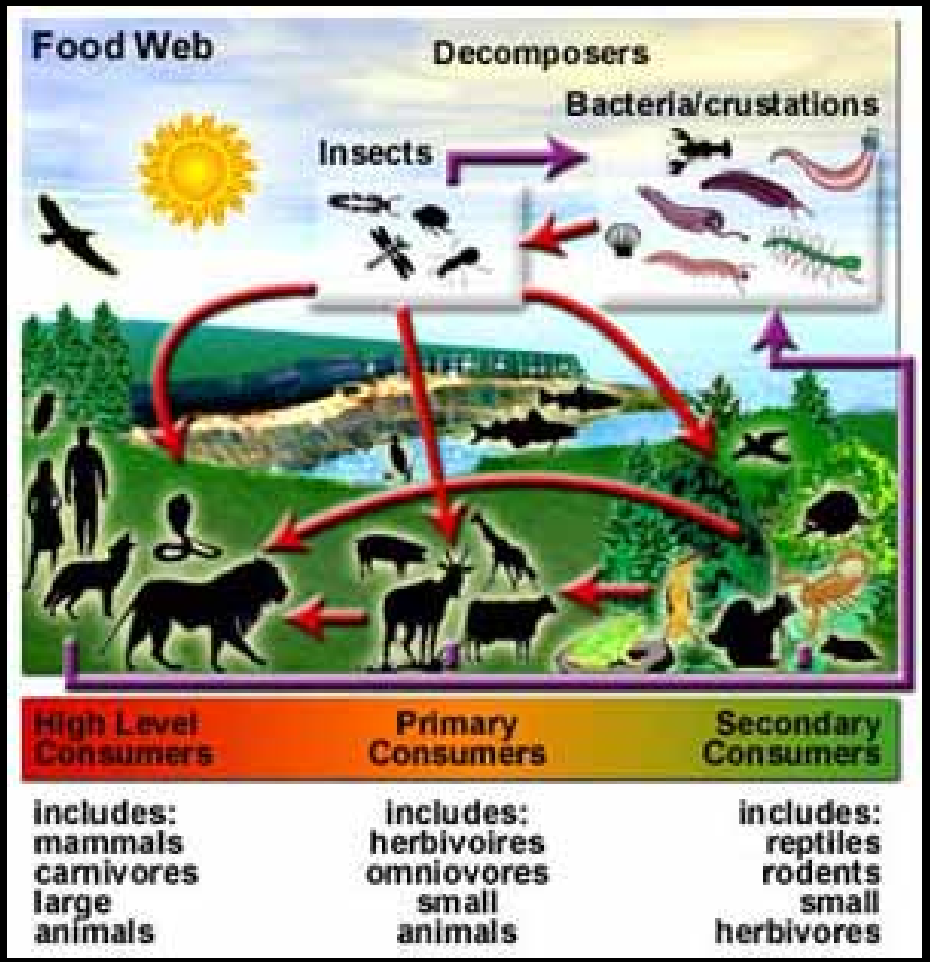
POPULATION

✓ 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

Zoology 9/29

- SZ4: Students will assess how animals interact with their environment
- Warm up:

1. What are the levels of organization from smallest to largest?
2. What makes an organism a producer?
3. What makes an organism a consumer?
4. How are niches and habitats different?

- Classwork: PPT notes.

Zoology 9/30

- SZ4: Students will assess how animals interact with their environment
- Warm up:

1. What are the levels of a food chain from bottom to top?
2. What are living things in an ecosystem?
3. What are the nonliving things in an ecosystem?

- Classwork: Ecology web quest; sign out a laptop and follow the instructions on the worksheet.

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

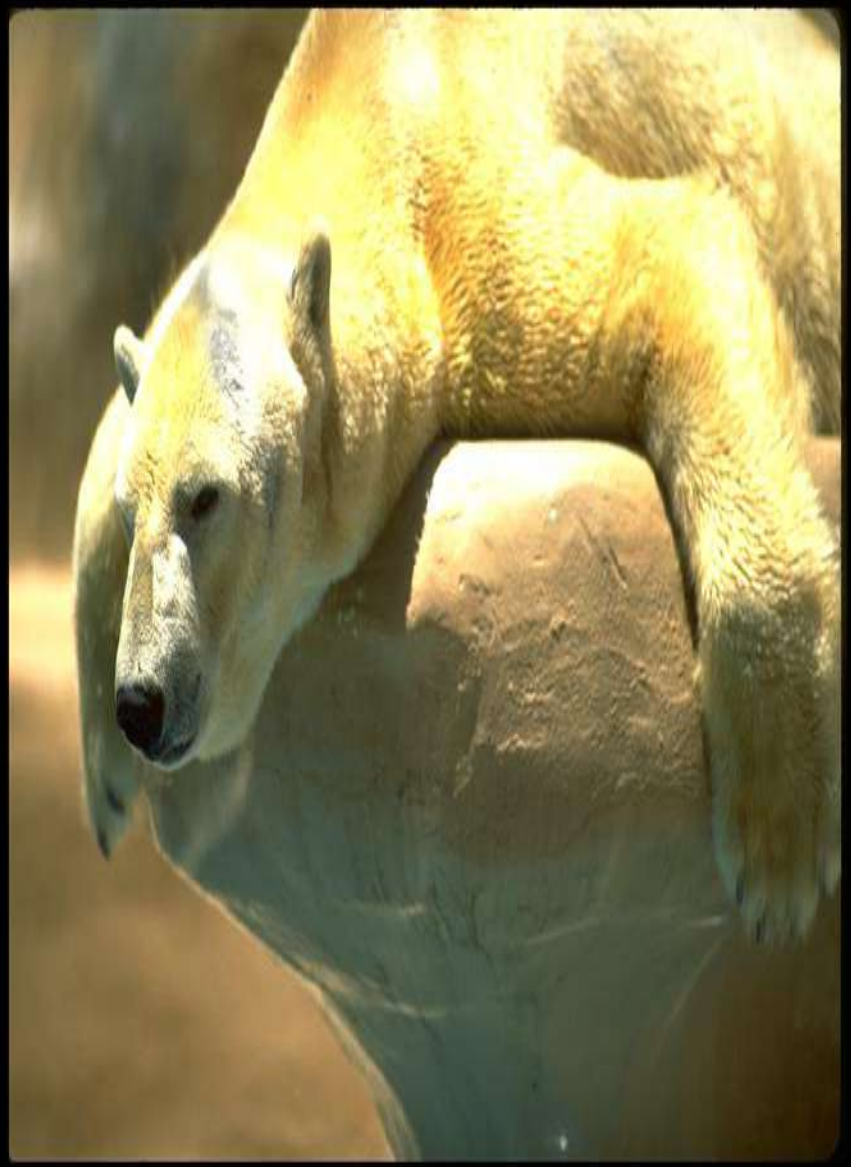
Epiphytes: A plant, such as a tropical orchid or a bromeliad, that grows on another plant upon which it depends for mechanical support but not for nutrients. Also called *xerophyte*, *air plant*.

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-

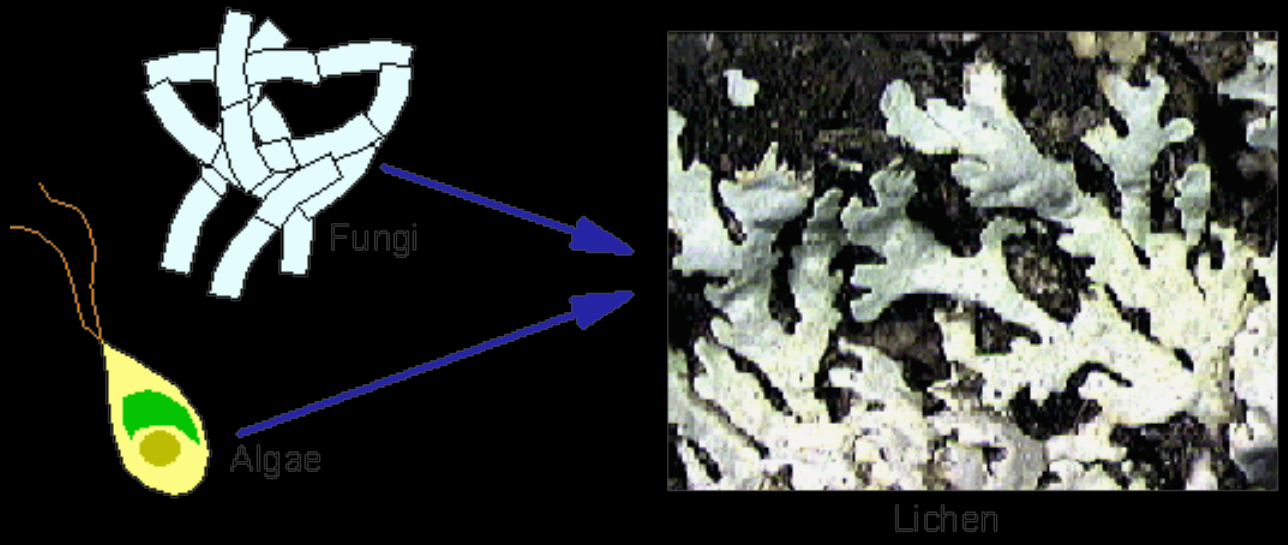
beneficial to both species

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

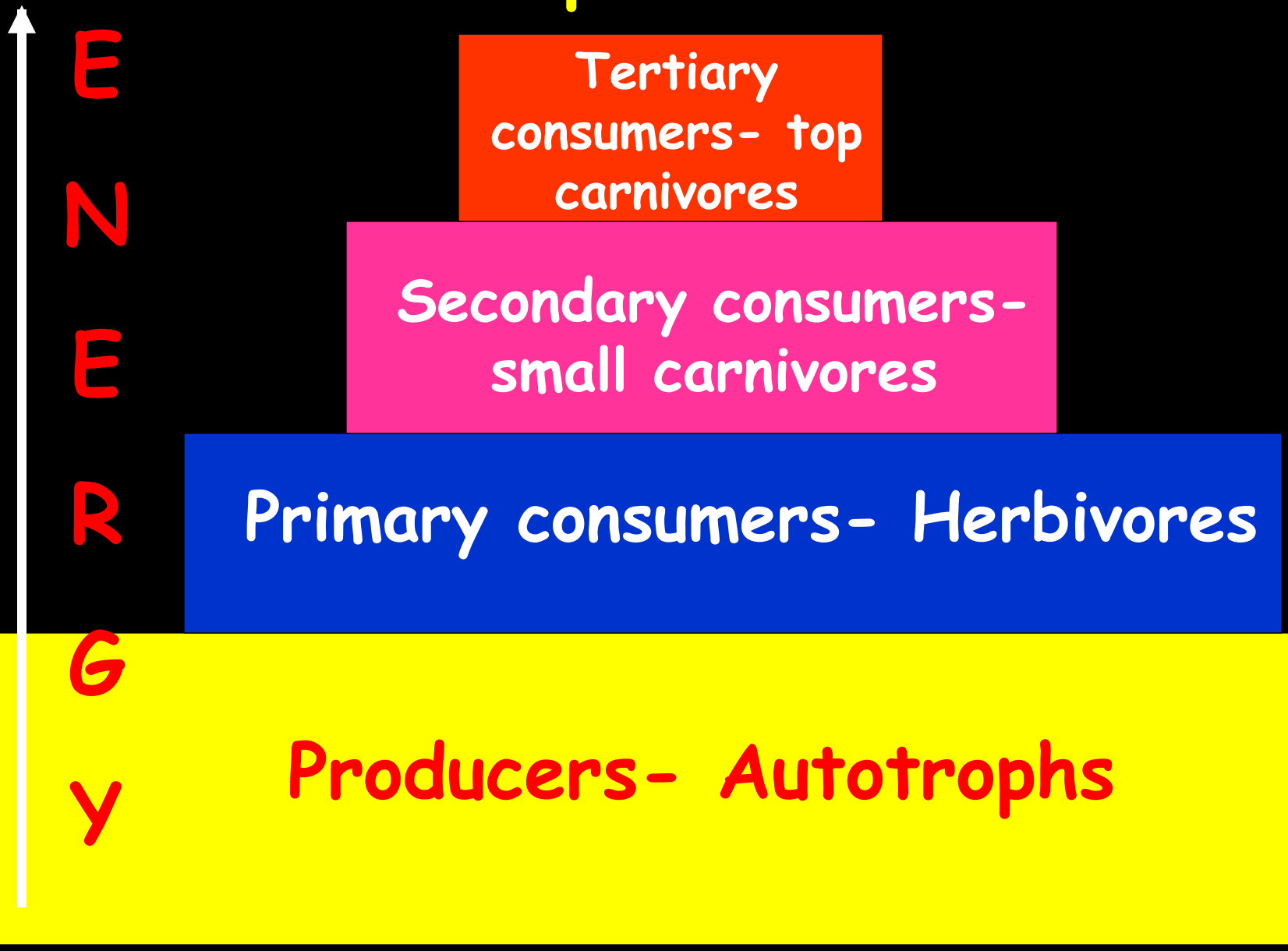
- Each link in a food chain is known as a trophic level.
- Trophic levels represent a **feeding step** in the transfer of energy and matter in an ecosystem.

Trophic Levels

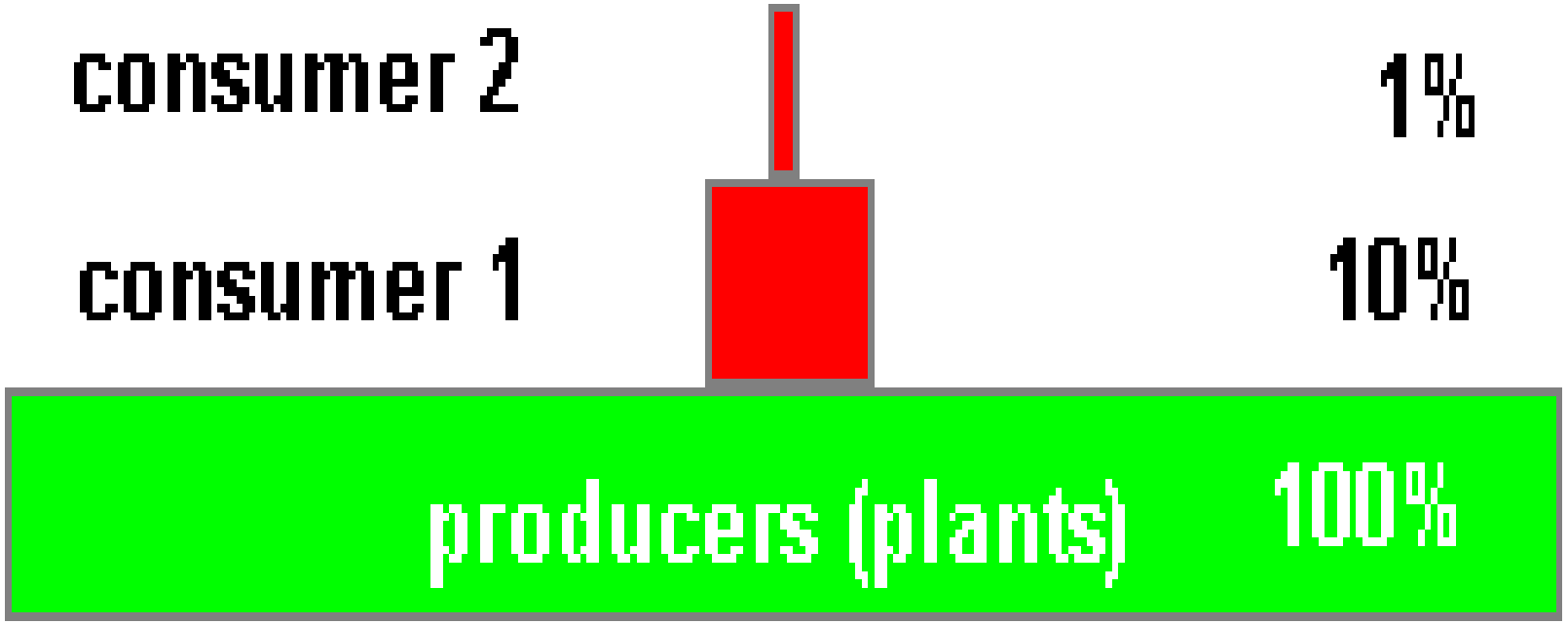
Biomass- the amount of organic matter comprising a group of organisms in a habitat.

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

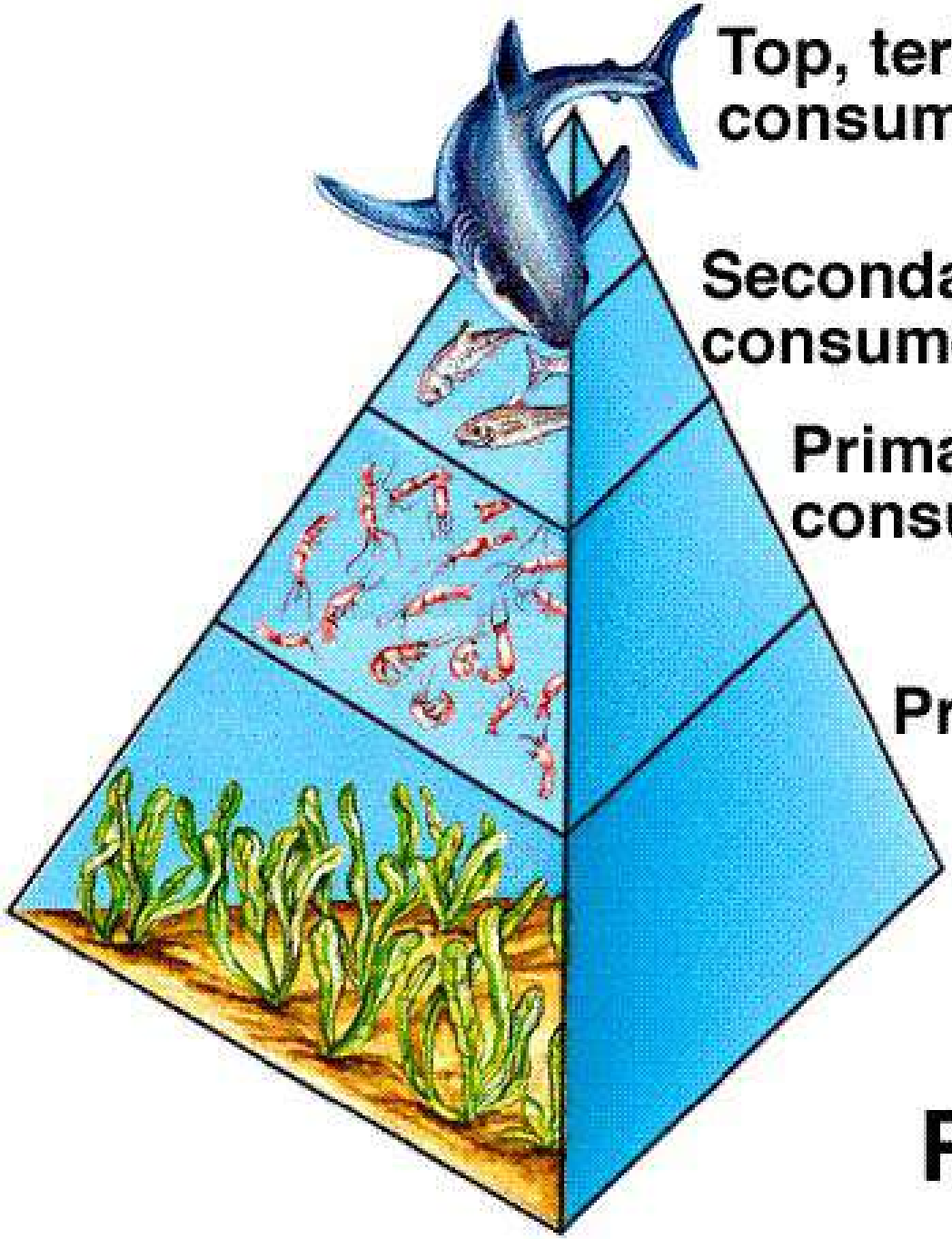
Trophic Levels



Typical ecosystem



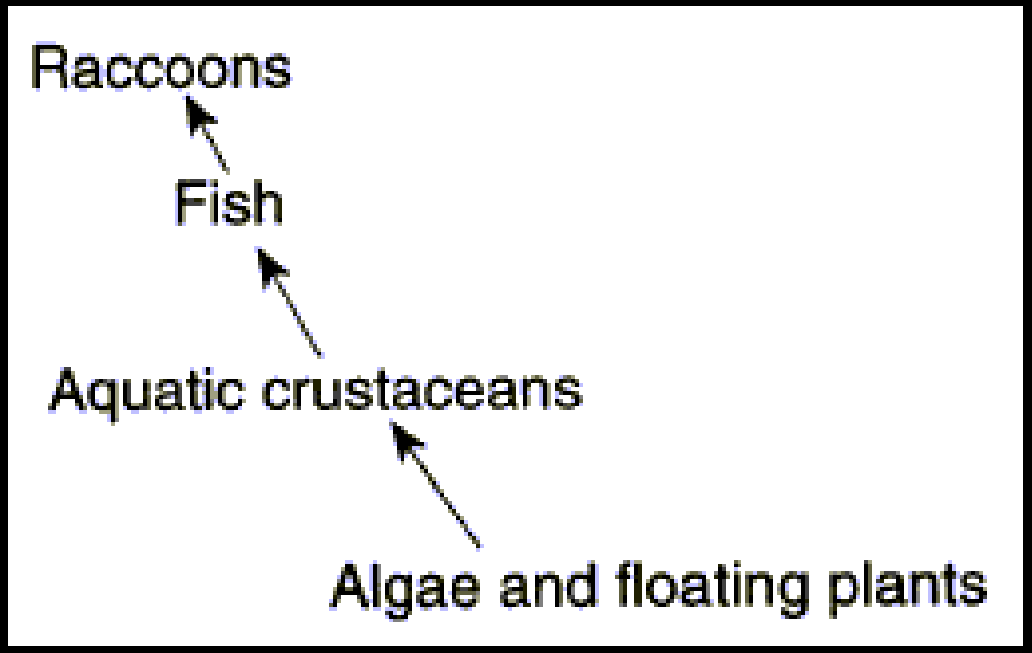
energy/biomass

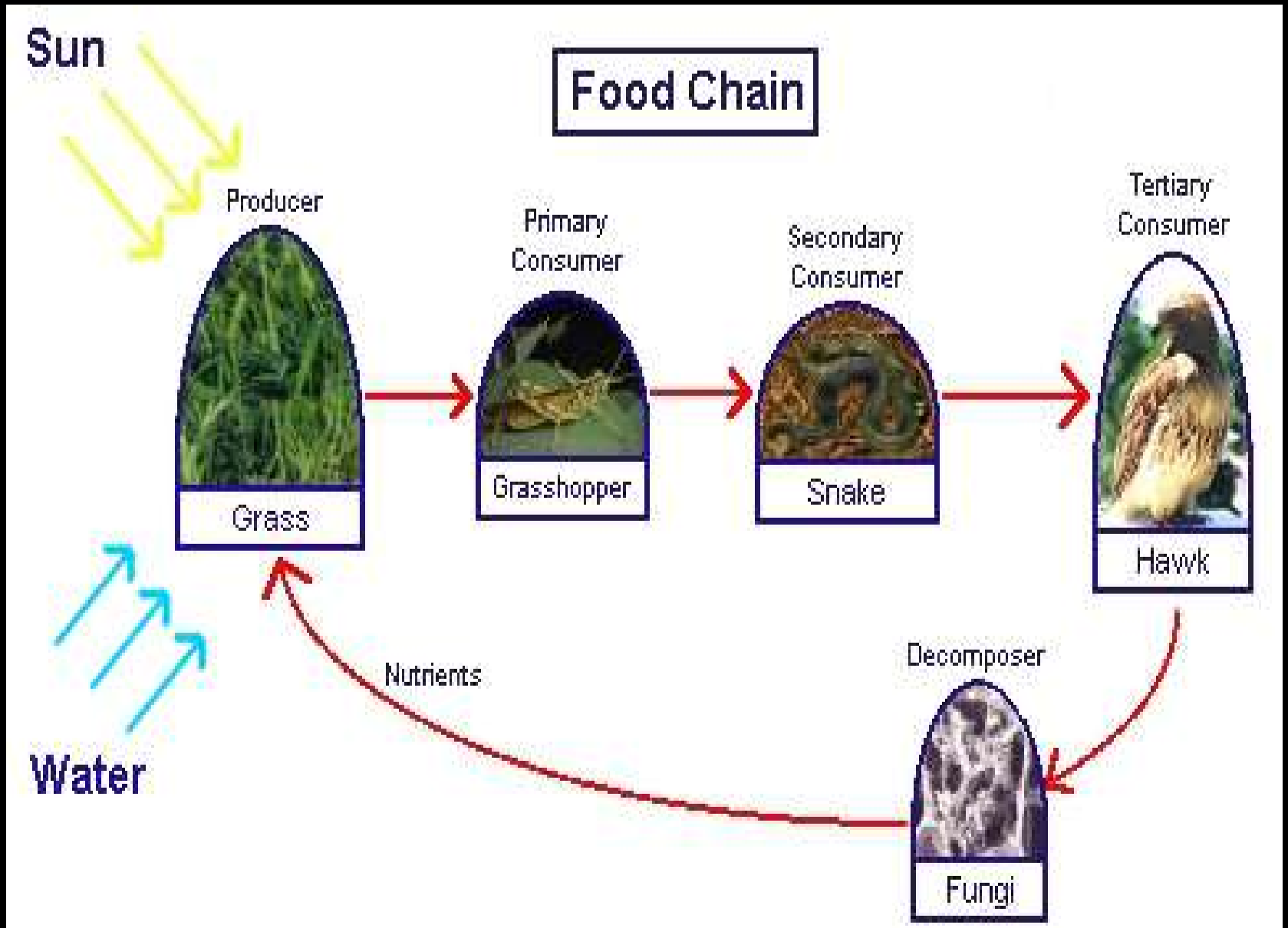


Food Web Energy Requirements

Trophic Levels

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




Sun
Food Chain
Producer
Primary Consumer
Secondary Consumer
Tertiary Consumer
Grass
Grasshopper
Snake
Hawk
Nutrients
Decomposer
Fungi
Water

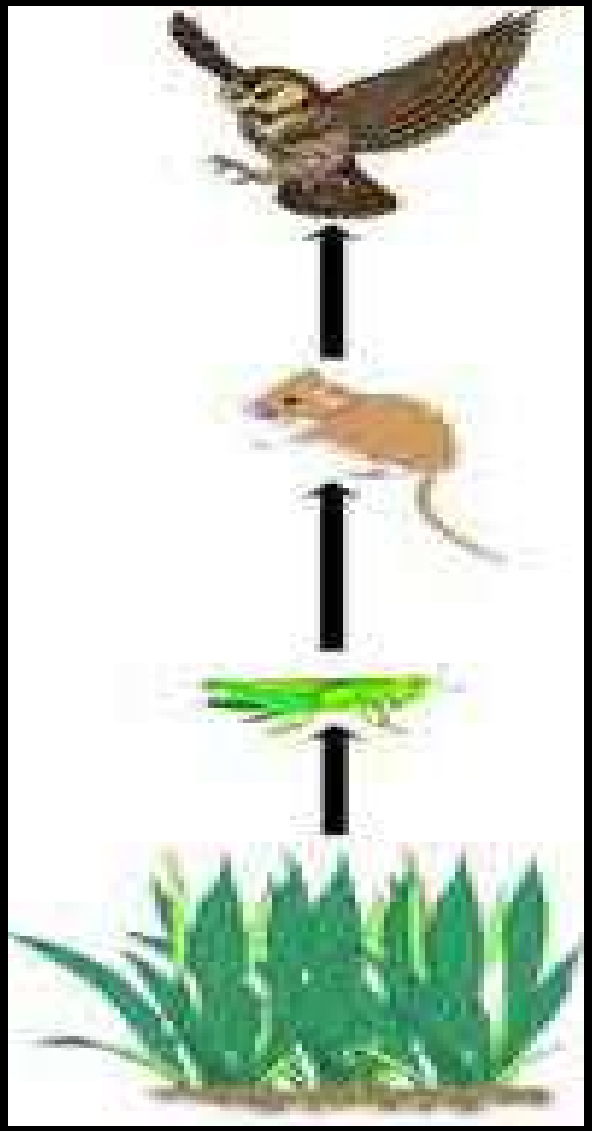
Trophic Levels

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

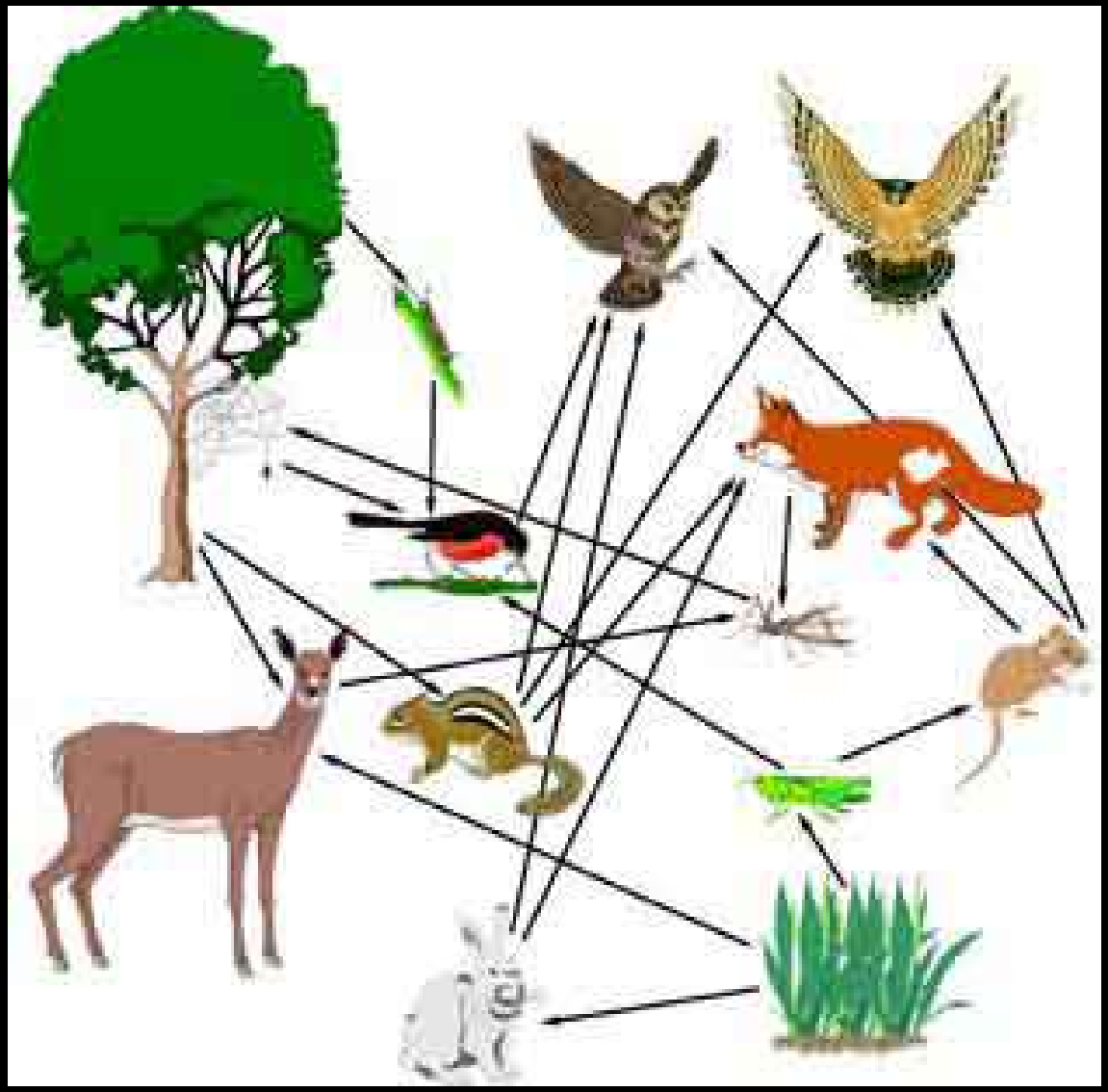
- Represents a network of interconnected food chains

Food chainFood web

(just 1 path of energy)



(all possible energy paths)



A Food Web in the Desert Biome

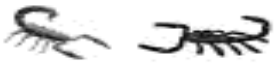
Larger Predators

Hawk

Kit Fox

Small Predators
Carnivores,
Insectivores

Tarantulas



Scorpions

Lizards

Snakes

Plant Eaters
Primary Consumers

Insects

Lizards

Rodents
Kangaroo Rats

Primary Producers

Cacti
Creosote Bushes
Thorn Acacias
Annual Flowers
Rabbit Brush
Ocotillo
Sage Brush

Soil Bacteria

A Food Chain in the Temperate Rain Forest Biome

Tertiary Consumers


Lynx


Wolf


Bear


Cougar

Secondary Consumers


Shrew


Amphibians


Weasel


Racoon


Insects


Birds

Primary Consumers


Small Mammals


Salmon


Insects


Deer


Elk

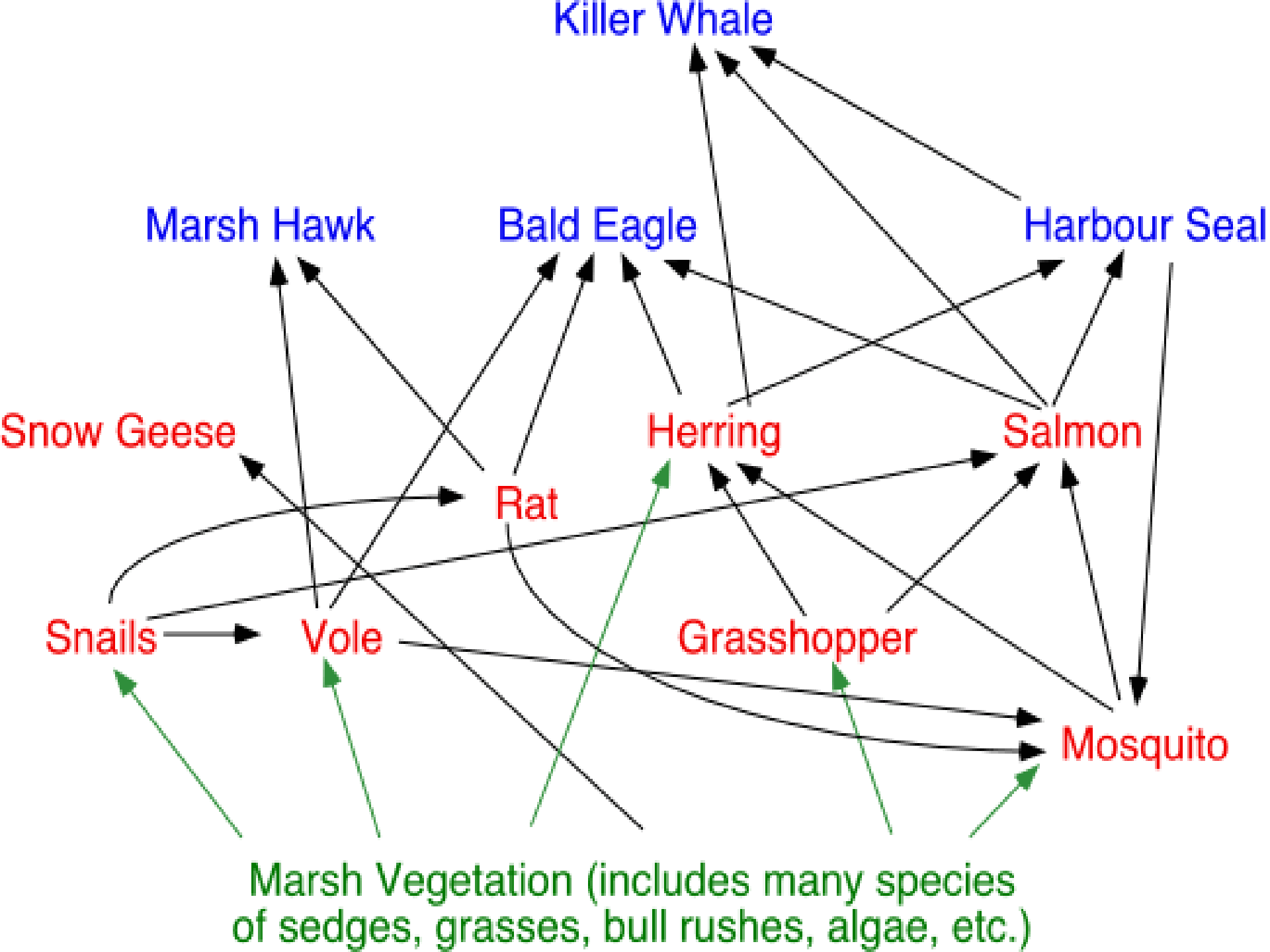

Birds

Primary Producers

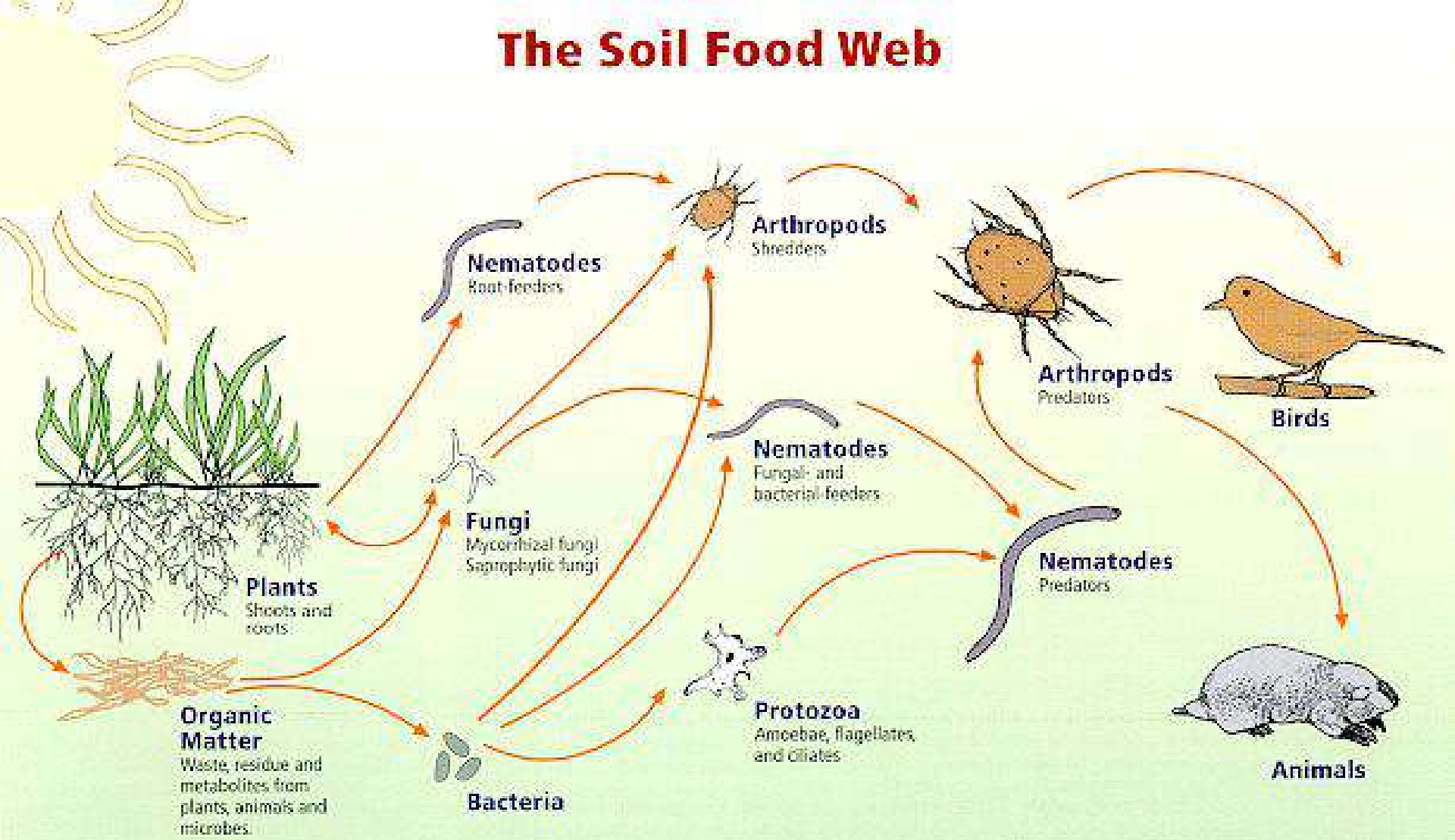
Ferns Mosses Shrubs
Shrubs Flowers

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

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


Killer Whale
Marsh Hawk
Bald Eagle
Harbour Seal
Snow Geese
Herring
Salmon
Rat
Snails
Vole
Grasshopper
Mosquito
Marsh Vegetation (includes many species
of sedges, grasses, bull rushes, algae, etc.)

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.

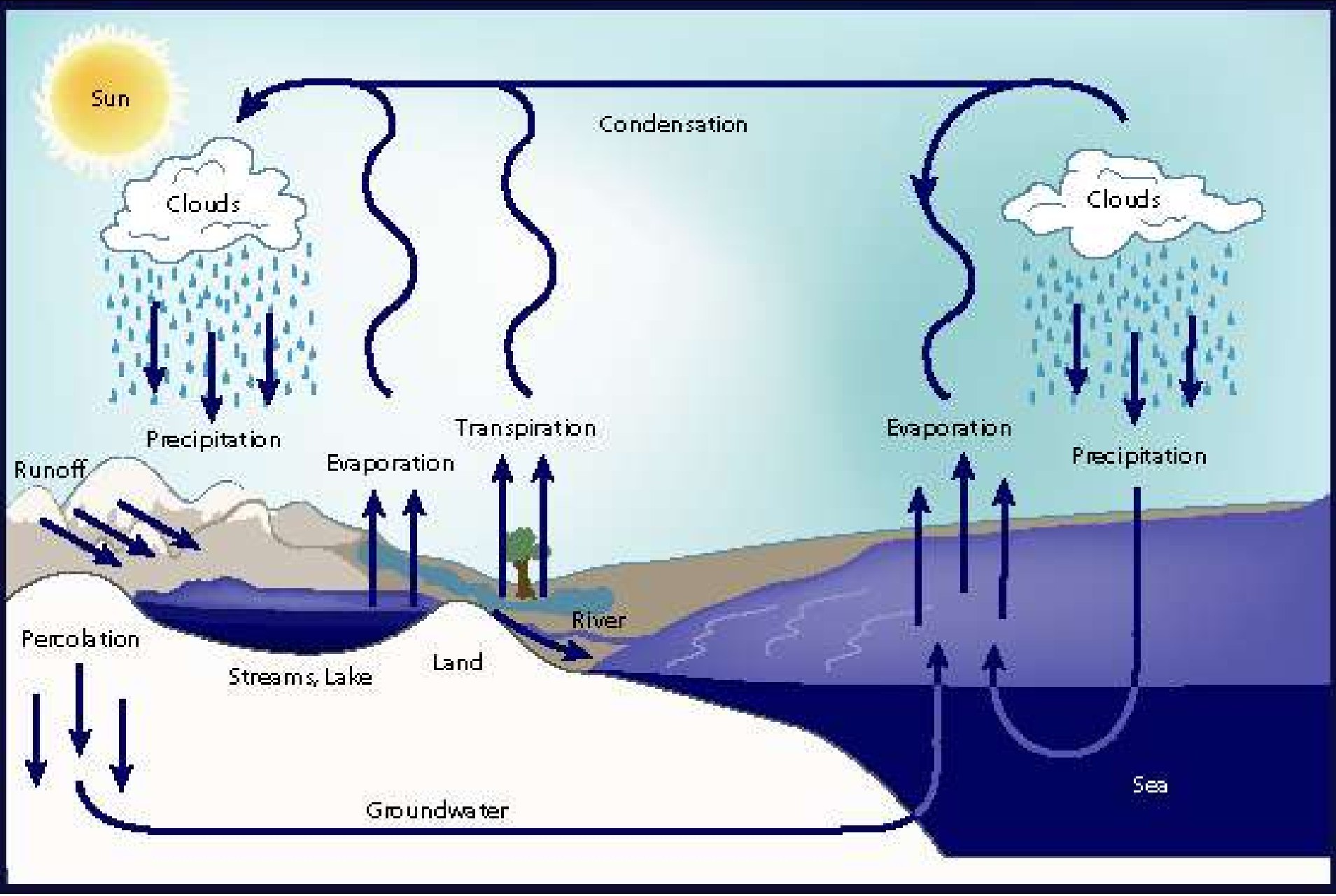
3 cycles to investigate:

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

Water cycle-

Evaporation, transpiration, condensation, precipitation

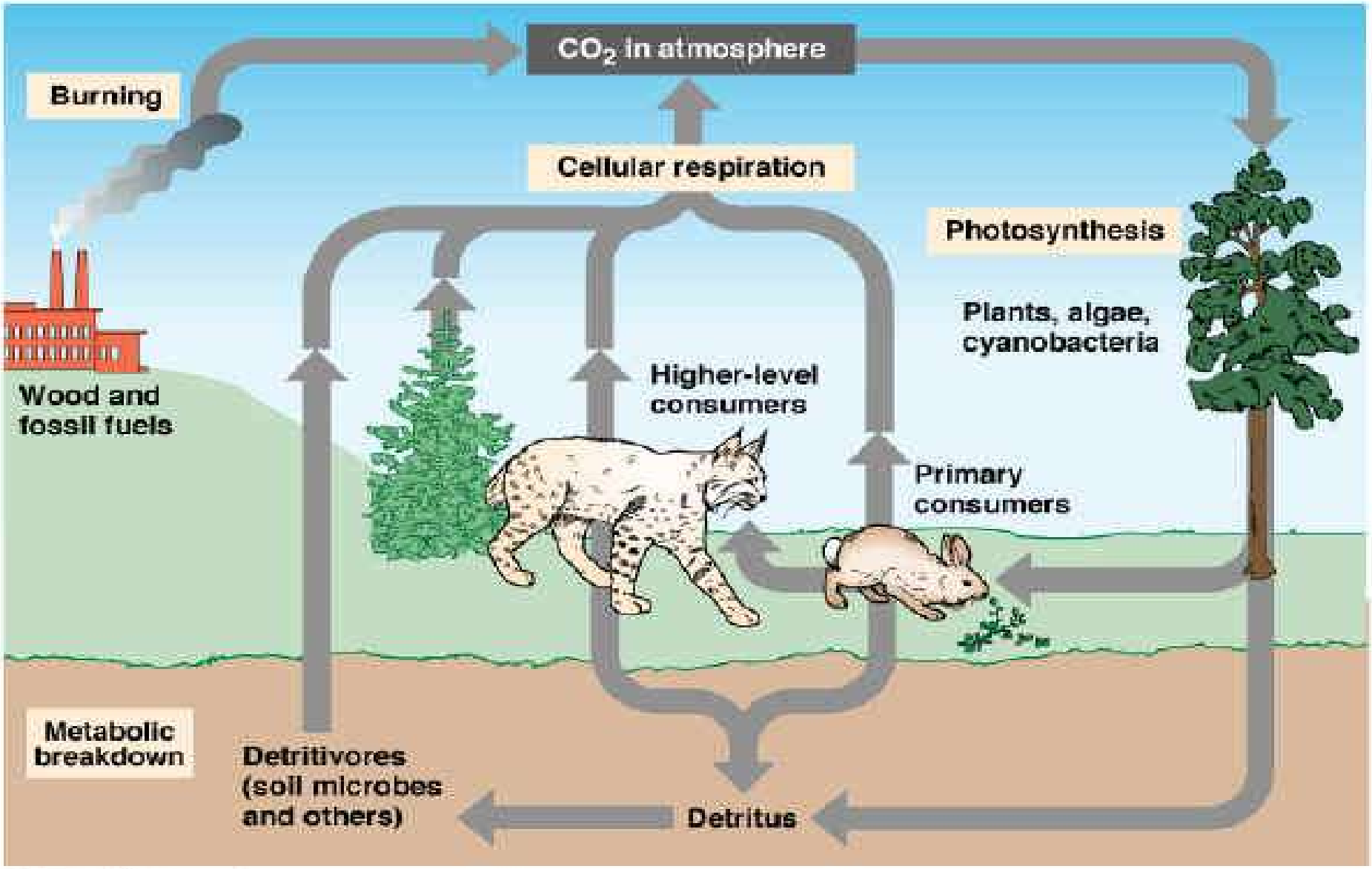
Water cycle-


Sun
Condensation
Clouds
Clouds
Precipitation
Transpiration
Evaporation
Evaporation
Precipitation
Runoff
River
Percolation
Land
Streams, Lake
Sea
Groundwater

Carbon cycle-

Photosynthesis and respiration cycle carbon and oxygen through the environment.

Carbon cycle-



Carbon Cycle

Carbon Cycle Video

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.

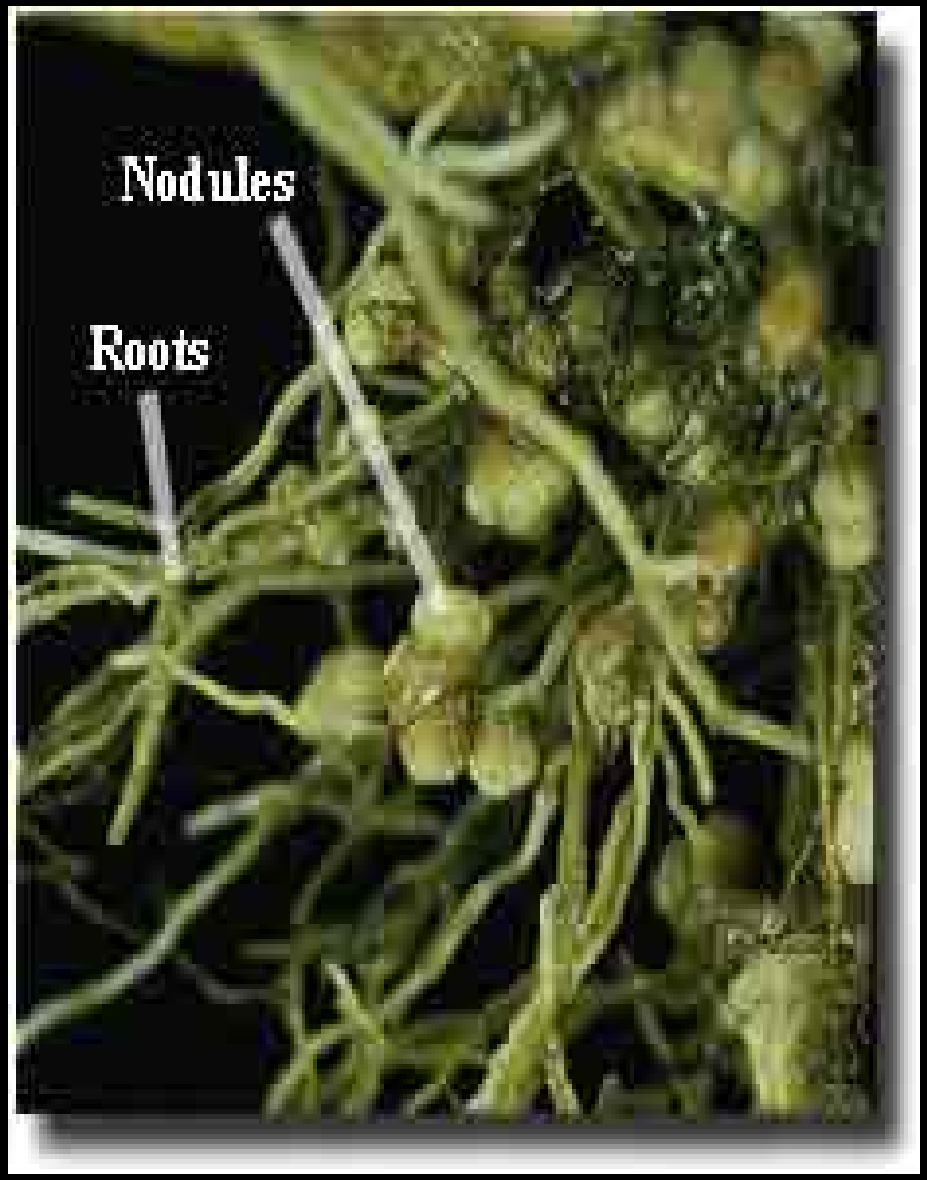
Nitrogen fixation-convert atmospheric nitrogen (N_2) into ammonium (NH_4^+) which can be used to make organic compounds like amino acids.

N_2 NH_4^+ ⟶

Nitrogen cycle-

Nitrogen-fixing bacteria:

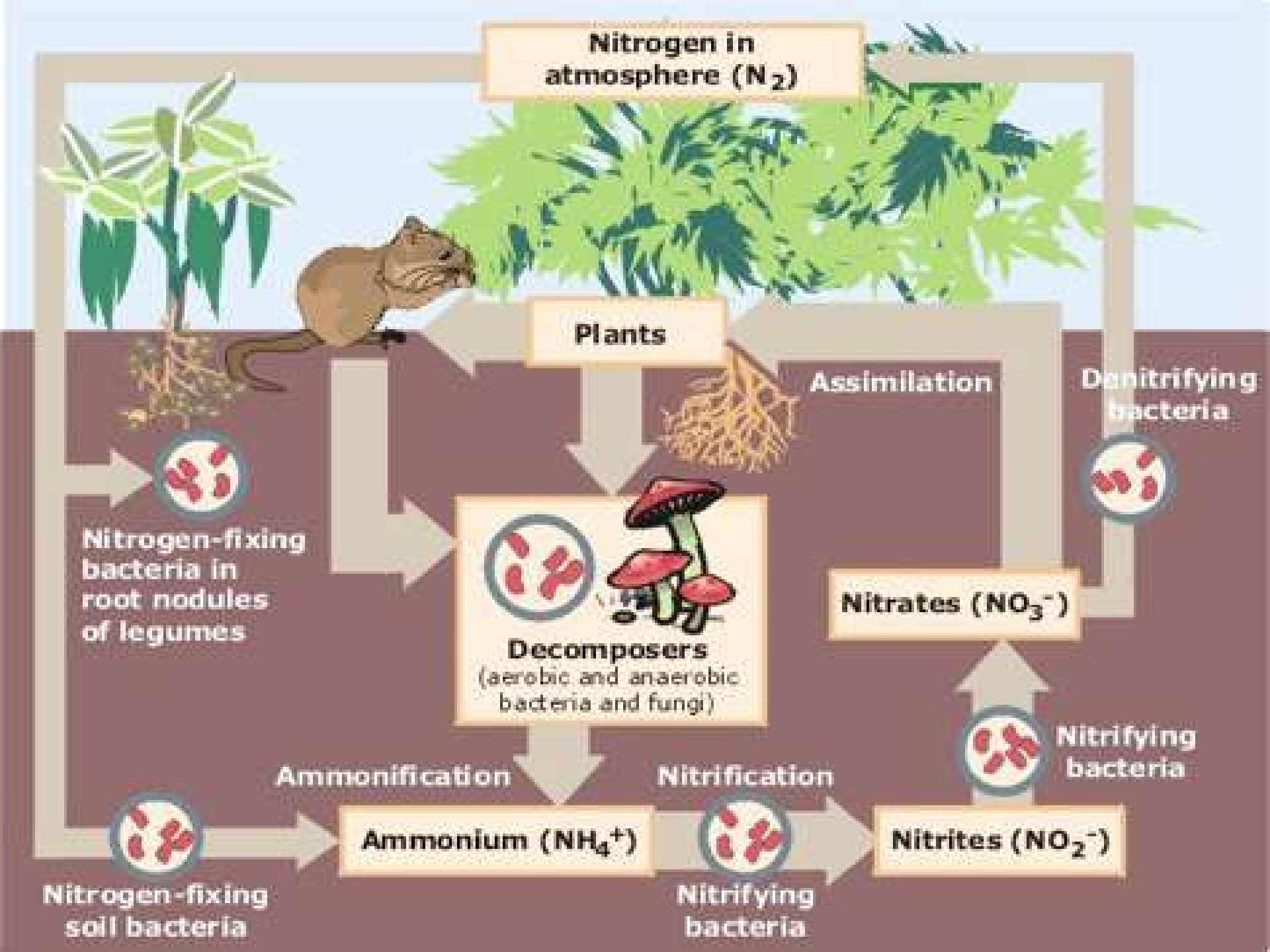
Some live in a symbiotic relationship with plants of the legume family (e.g., soybeans, clover, peanuts).

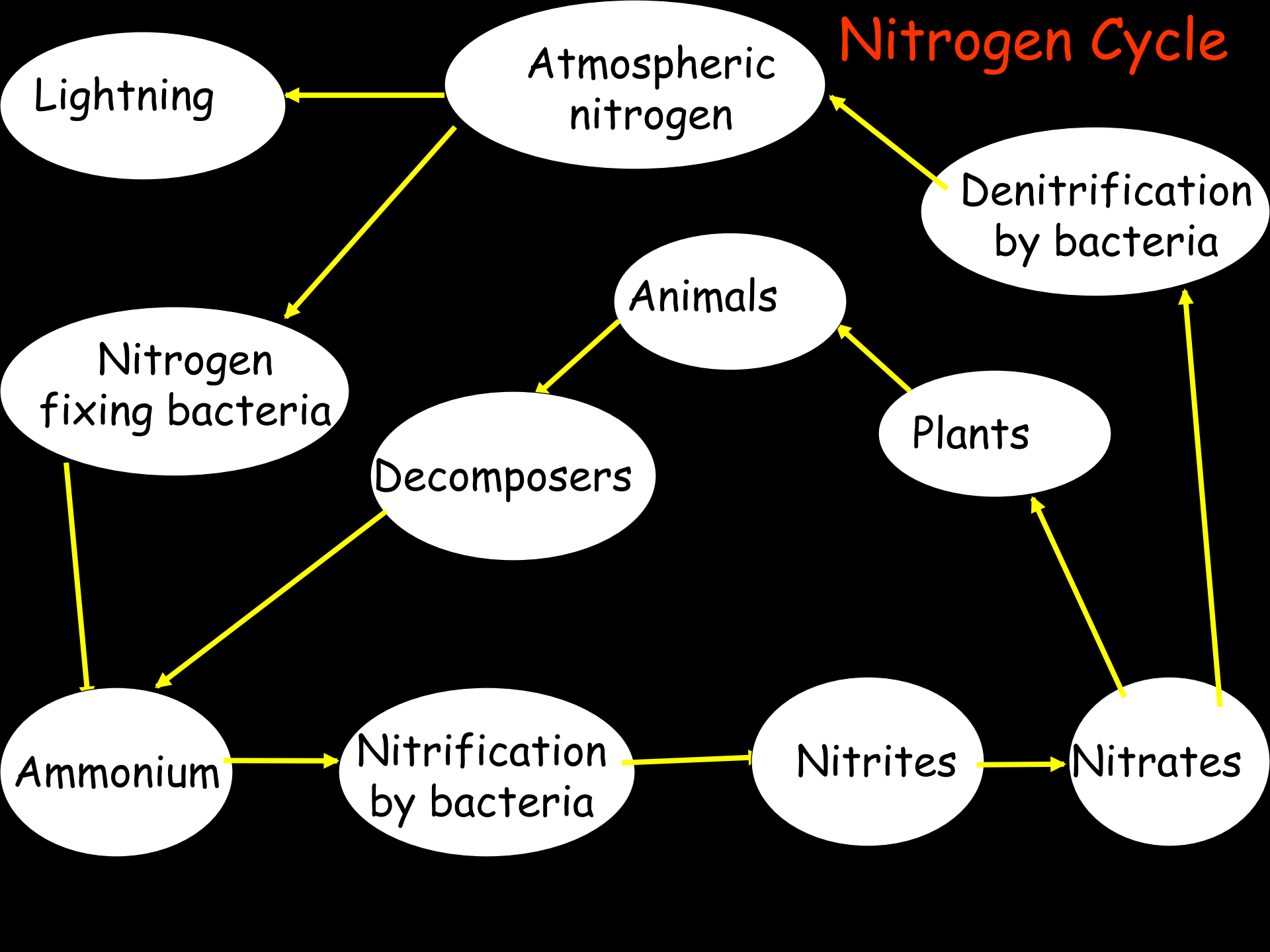


Nitrogen cycle-

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 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^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria


Nitrogen Cycle
Lightning
Atmospheric nitrogen
Denitrification by bacteria
Animals
Nitrogen fixing bacteria
Decomposers
Plants
Ammonium
Nitrification by bacteria
Nitrites
Nitrates

Nitrogen Cycle

Nitrogen Cycle Video

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