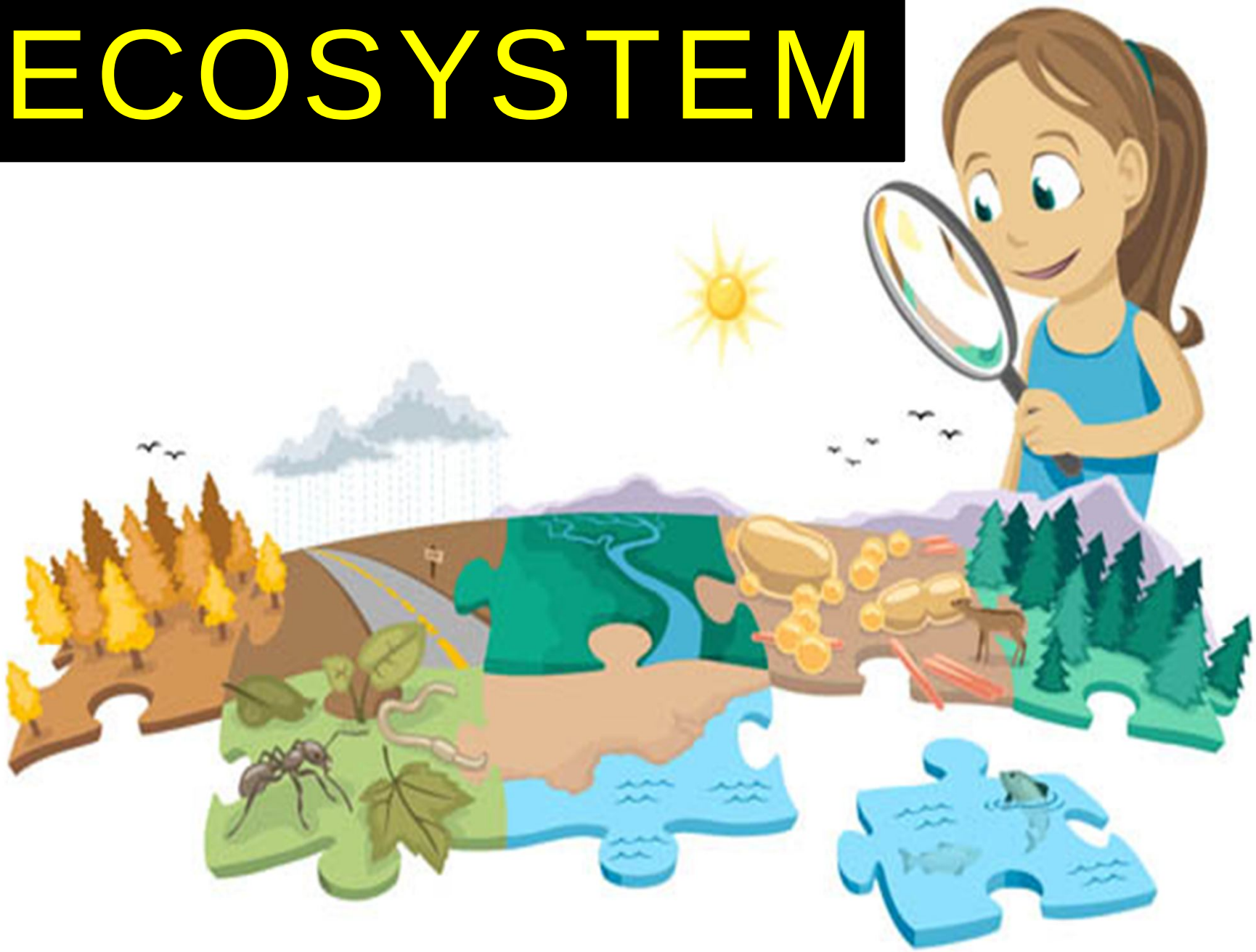
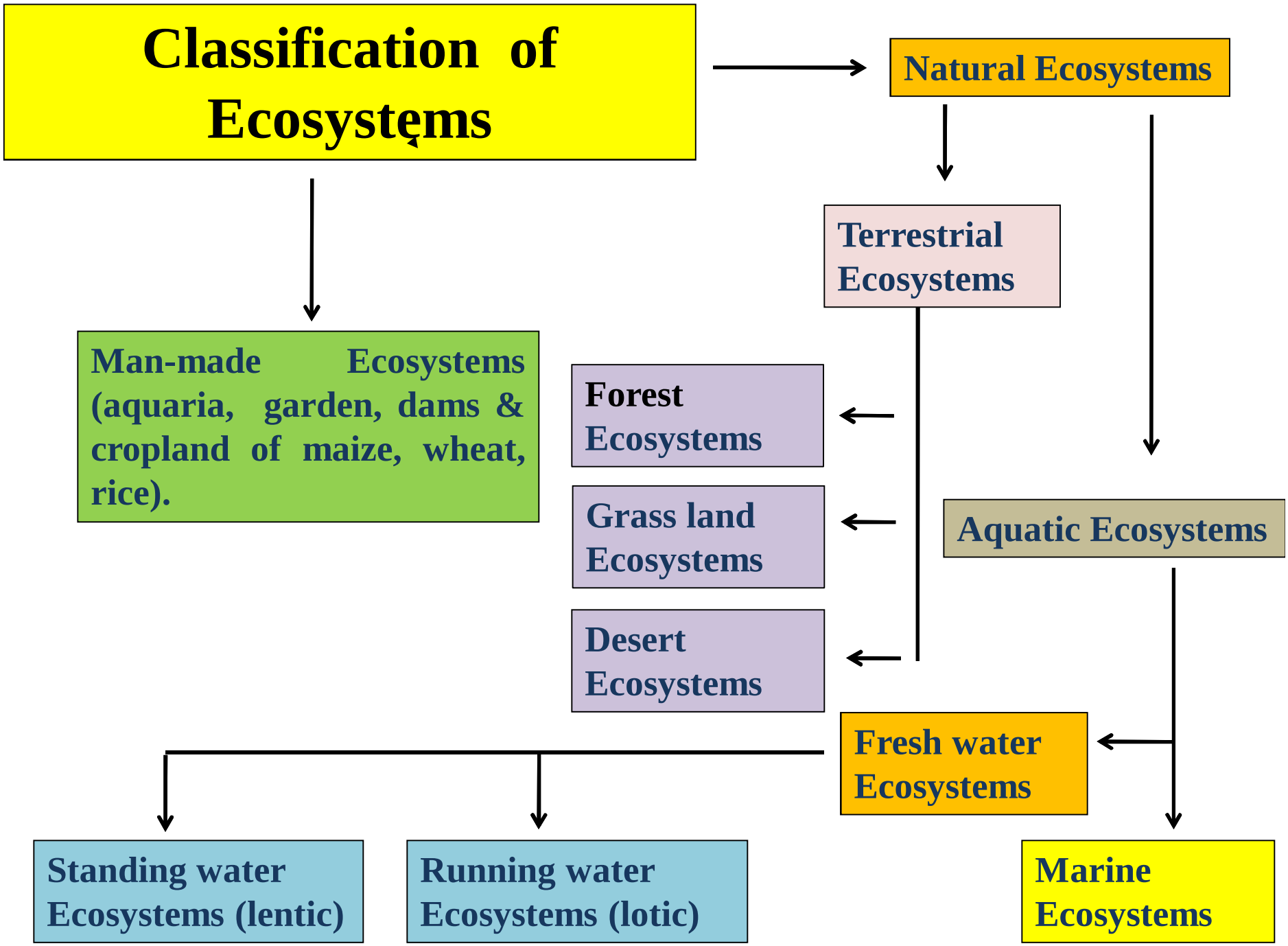
ECOSYSTEM



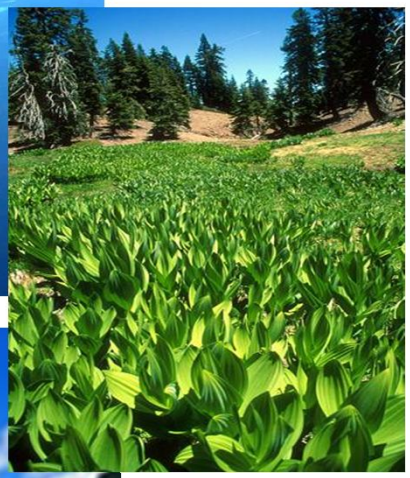
An ***ecosystem*** is a natural unit consisting of all plants, animals, and micro-organisms in an area functioning together with all the non-living physical factors of the environment.

According to British ecologist Arthur Tansley (1935), an ecosystem is a system that arises from the integration of all living and non-living factors of the environment.

Classification of Ecosystems



Natural Ecosystems



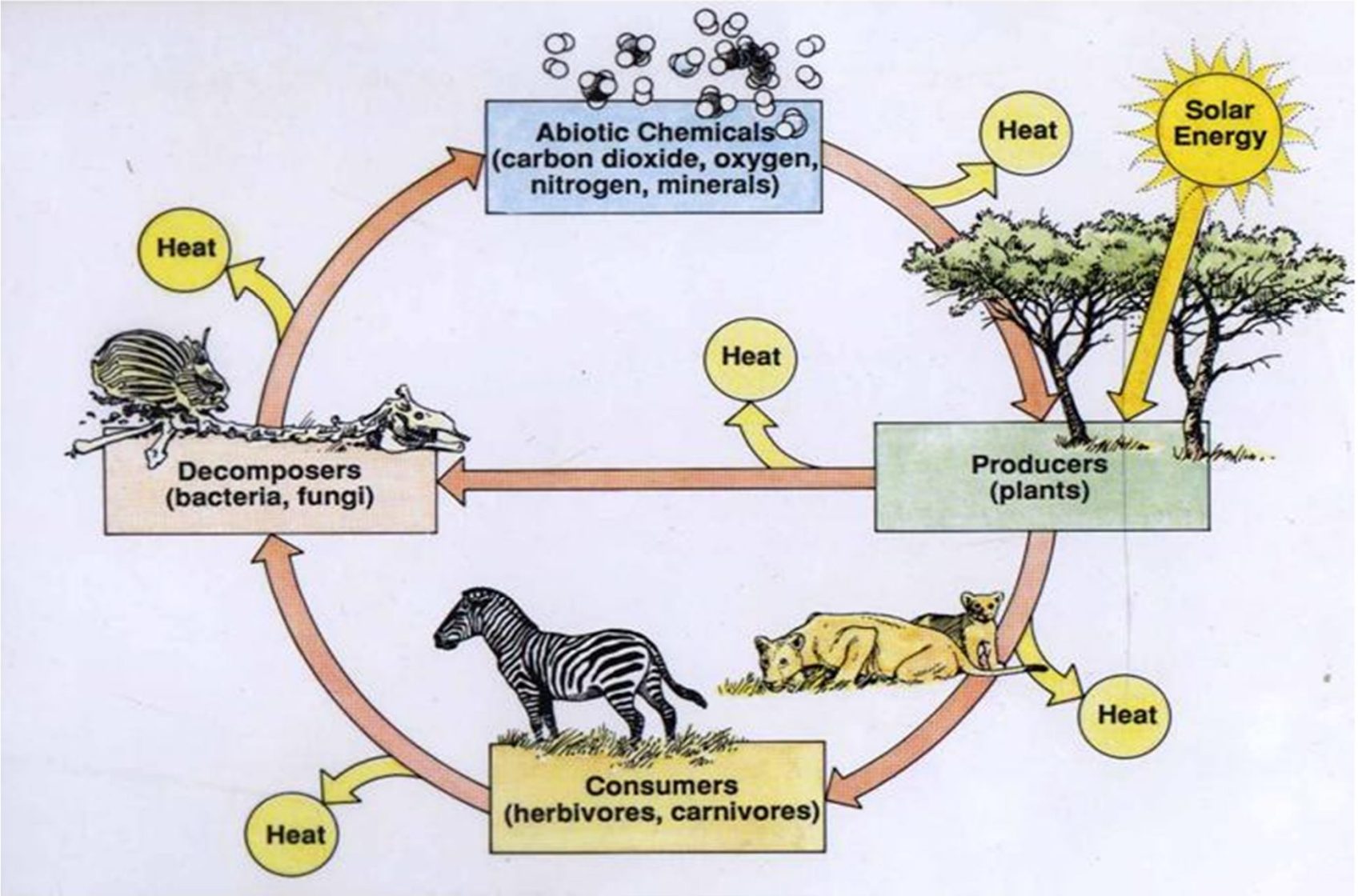
Man-made Ecosystems

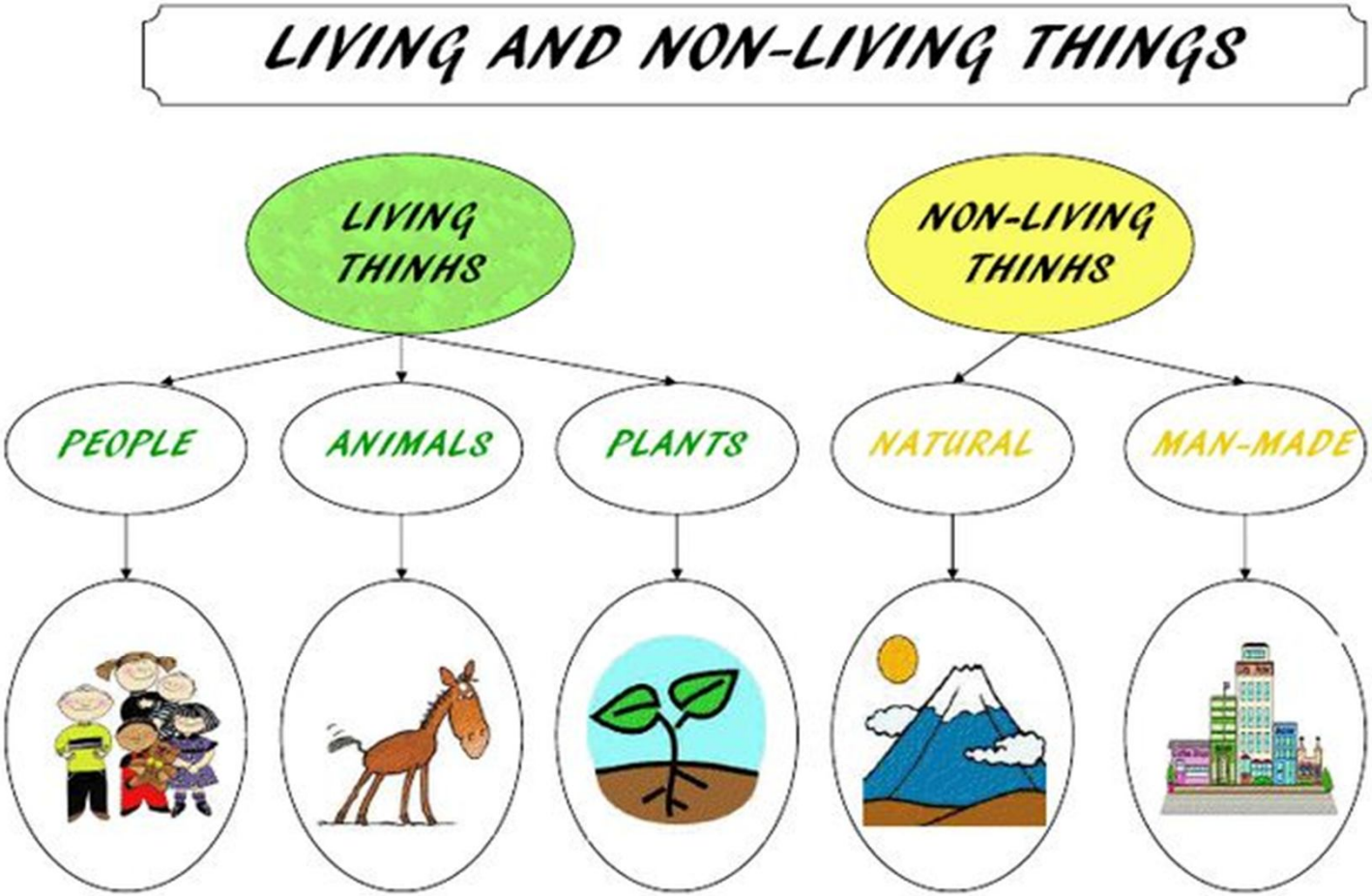
What is the different between natural and man Made ecosystem?

Natural Vs Artificial Ecosystems

Natural Ecosystem	Artificial Ecosystem
Plants of one species are often scattered	Plants of the small species grow in close proximity
Natural ecosystems usually have alternate sources of food available if one fails.	Artificial ecosystems usually contain less food choices.
Natural ecosystem is developed under natural conditions.	Artificial ecosystem is created and manipulated by human activities.
In a natural ecosystem the inorganic nutrients are returned to the soil from which they were taken.	In artificial ecosystems, the inorganic nutrients do not return to the soil but are carried away at some other places.
Natural ecosystems have no distinct boundaries.	Artificial ecosystems have distinct boundaries.

Structure of Ecosystem





Living (Biotic) Components

Producers

Consumers

Decomposers

Non-living (Abiotic) Components

Physical factors

Chemical factor

Limiting factors

Biotic Components of Ecosystems

Producers (or autotrophs)

Green plants and some bacteria which manufacture their own food.

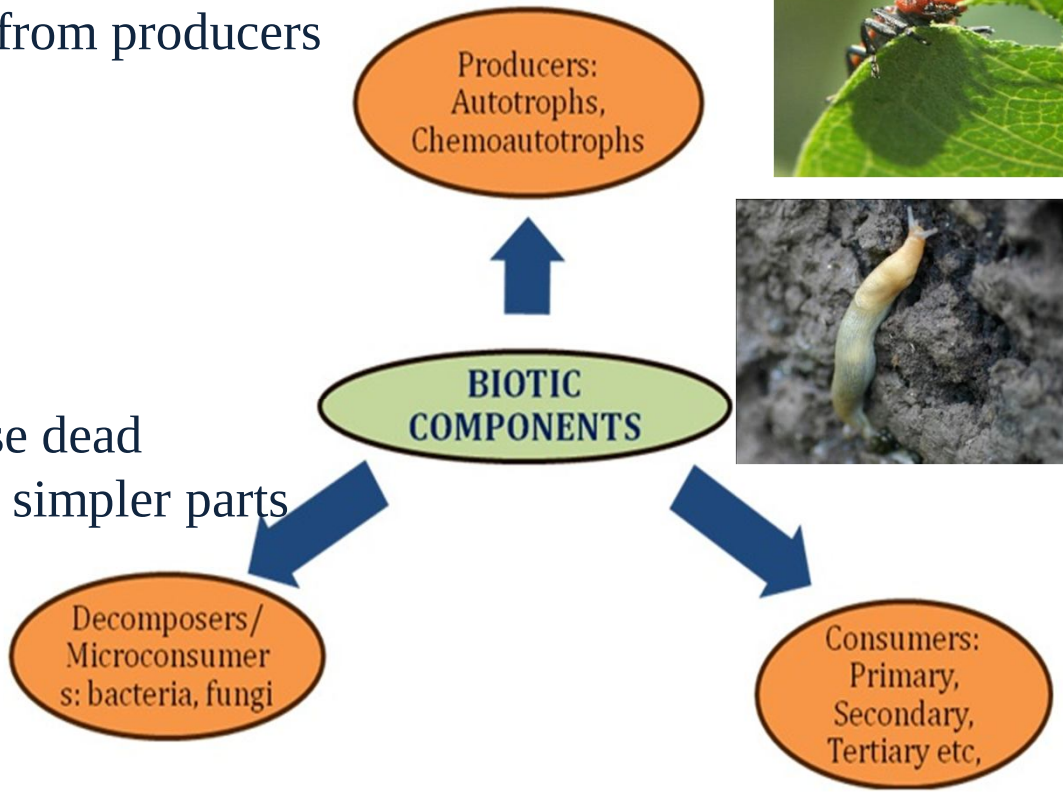
Consumers (or heterotrophs)

Animals which obtain their food from producers

- Primary consumers
- Secondary consumers
- Tertiary consumers

Decomposers

Bacteria and fungi that decompose dead organic matter and convert it into simpler parts



Abiotic Components of an Ecosystem

Physical Factors

Rainfall
Humidity
Temperature
Nature of soil
Water currents
Sunlight

Chemical Factors

%age of Water and air in soil
Salinity of Water
Oxygen dissolved in water
Nutrients present in soil

Limiting Factors

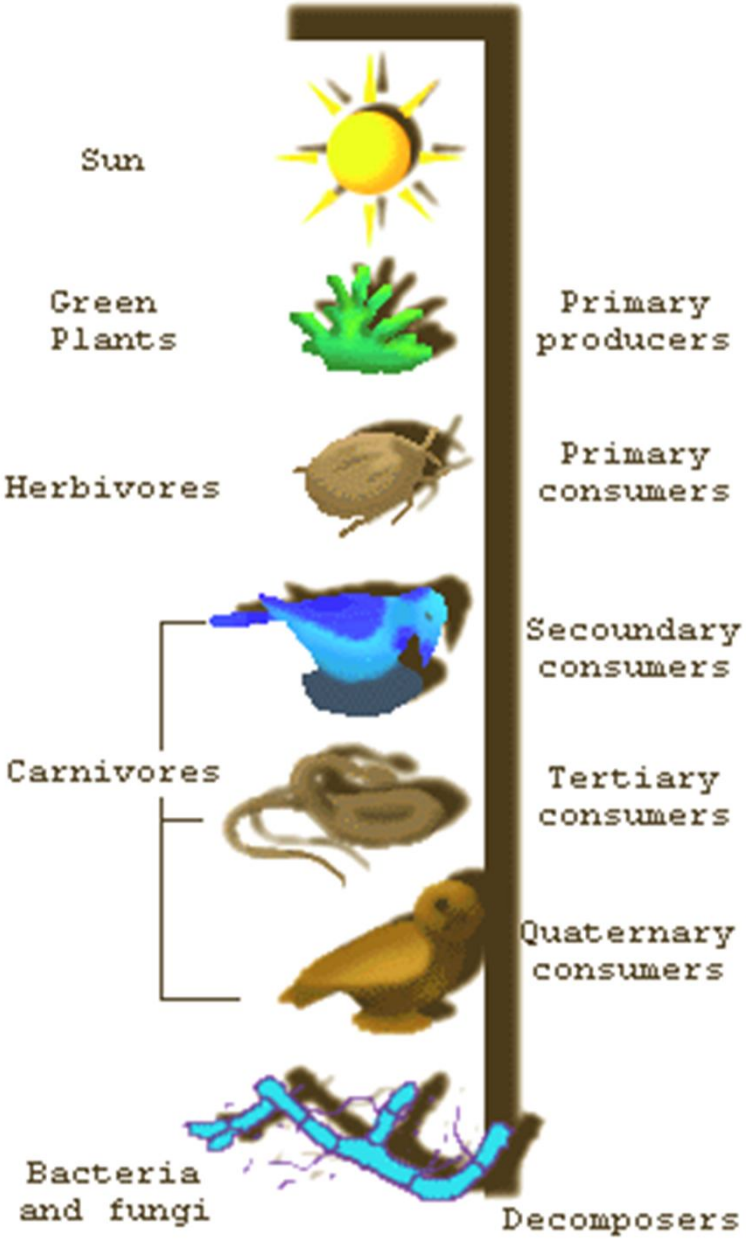
Food, water, shelter and space are limiting factors for the growth of population of human and animals.

Functions of an Ecosystem

- **Food chain and food web**
- **Energy flow**
- **Ecological pyramids**

Food Chain

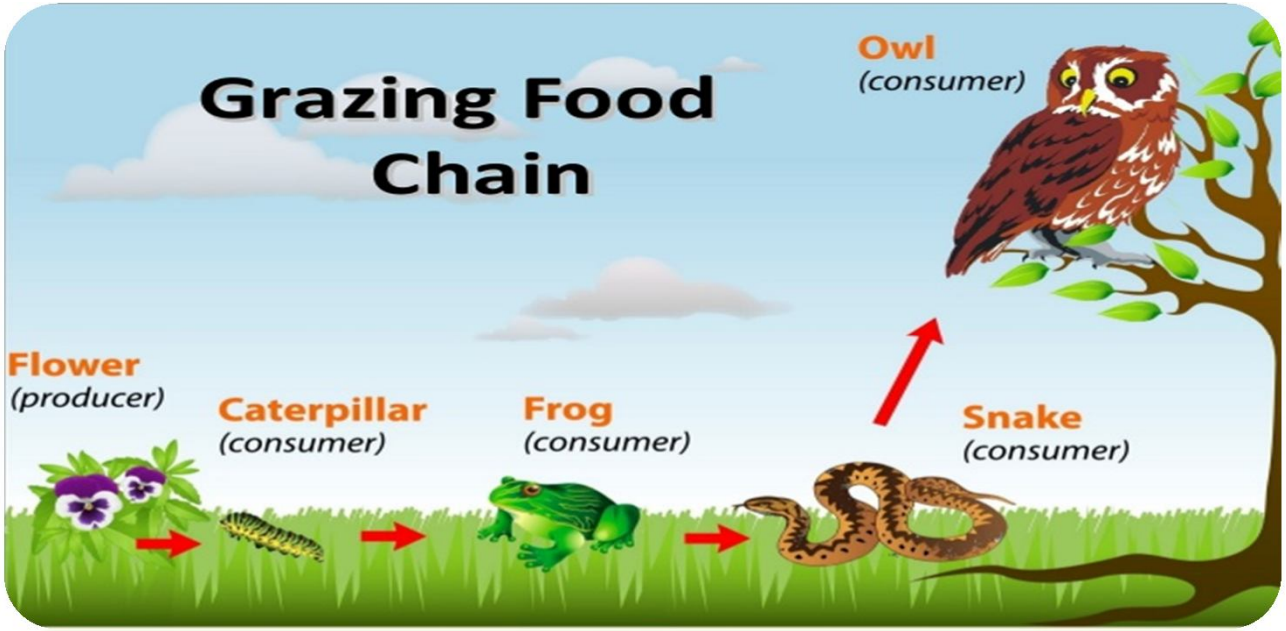
The transfer of food energy from the source (plants) through a series of organisms by repeated eating and being eaten up is referred to as *food chain*.



Types:

- **<u>Grazing food chain</u>**-a common chain

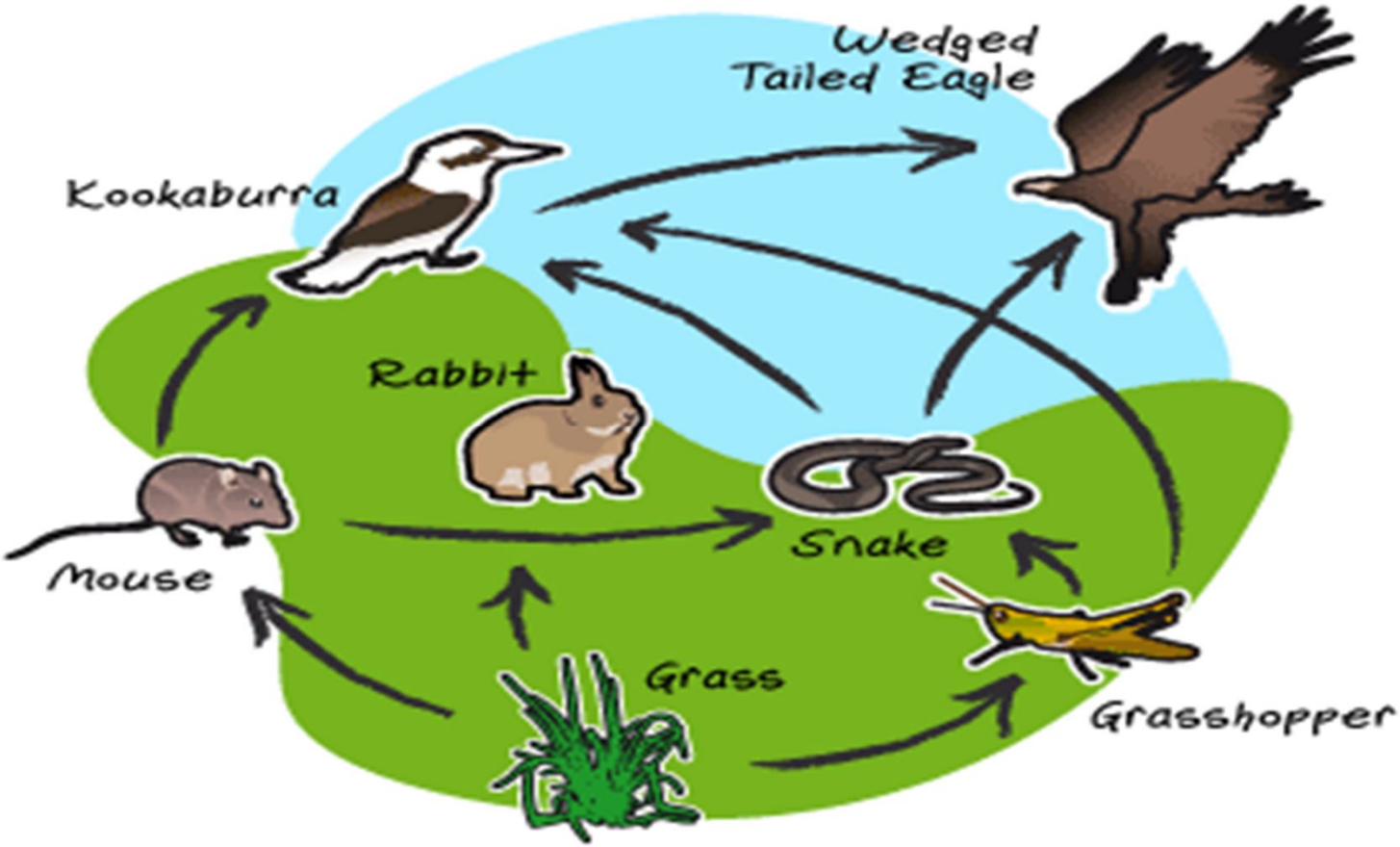
- **<u>Detritus food chain</u>**-chain derived by the organic wastes and dead matter from grazing food chains



Detritus → Primary Detritus Feeder → Secondary Detritus Feeder

Food web

The interlocking pattern formed by several food chains that are linked together is called a *food web*.



Energy Flow in Ecosystems

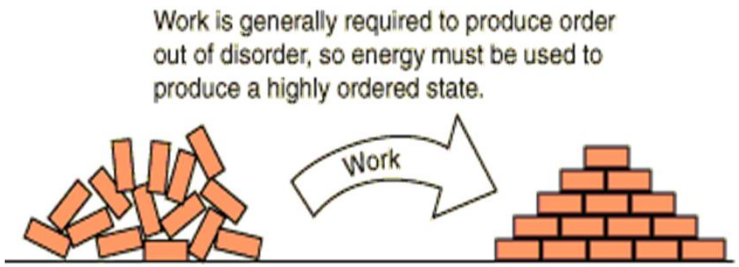
First Law of Thermodynamics

energy can neither be created nor destroyed but only is transformed from one form to another.

The First In-law of Thermodynamics.

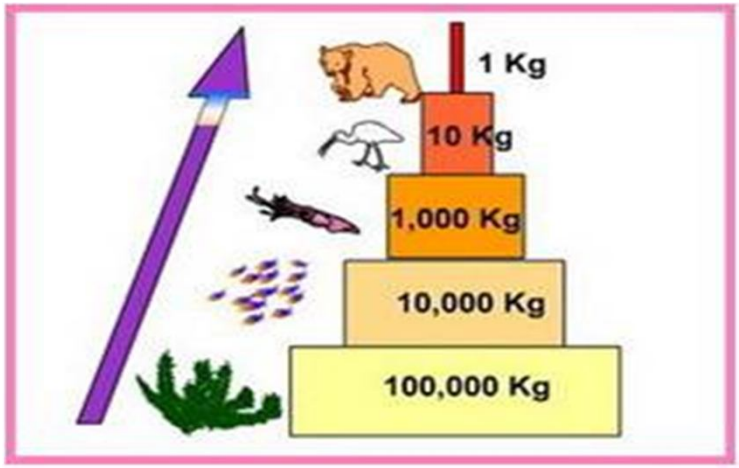
Second Law of Thermodynamics

The second law of thermodynamics states that no energy transformations are 100% efficient.



10 Percent Rule of Energy

As a rule of thumb, 90 percent of the energy involved is degraded at each tropic transfer and only 10 percent of the energy is conserved in the organism's tissue.



Ecological Pyramid

The graphical representations of different tropic levels in an ecosystem where producers occupy the base and the top consumer occupy the apex of the pyramid, is known as ***ecological pyramid*** .

They are used to illustrate the feeding relationships between organisms.

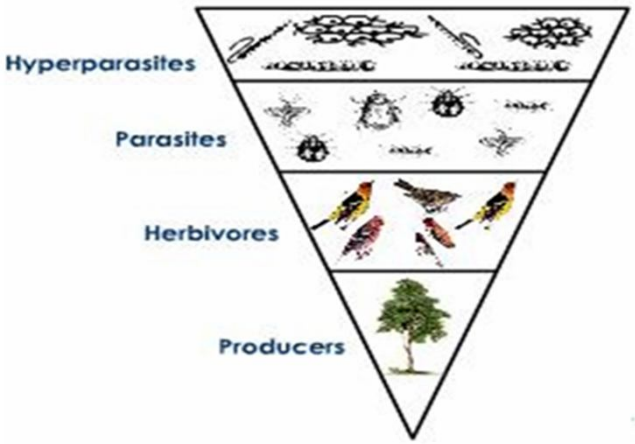
Types of Ecological Pyramids

- Pyramid of number
- Pyramid of biomass
- Pyramid of energy

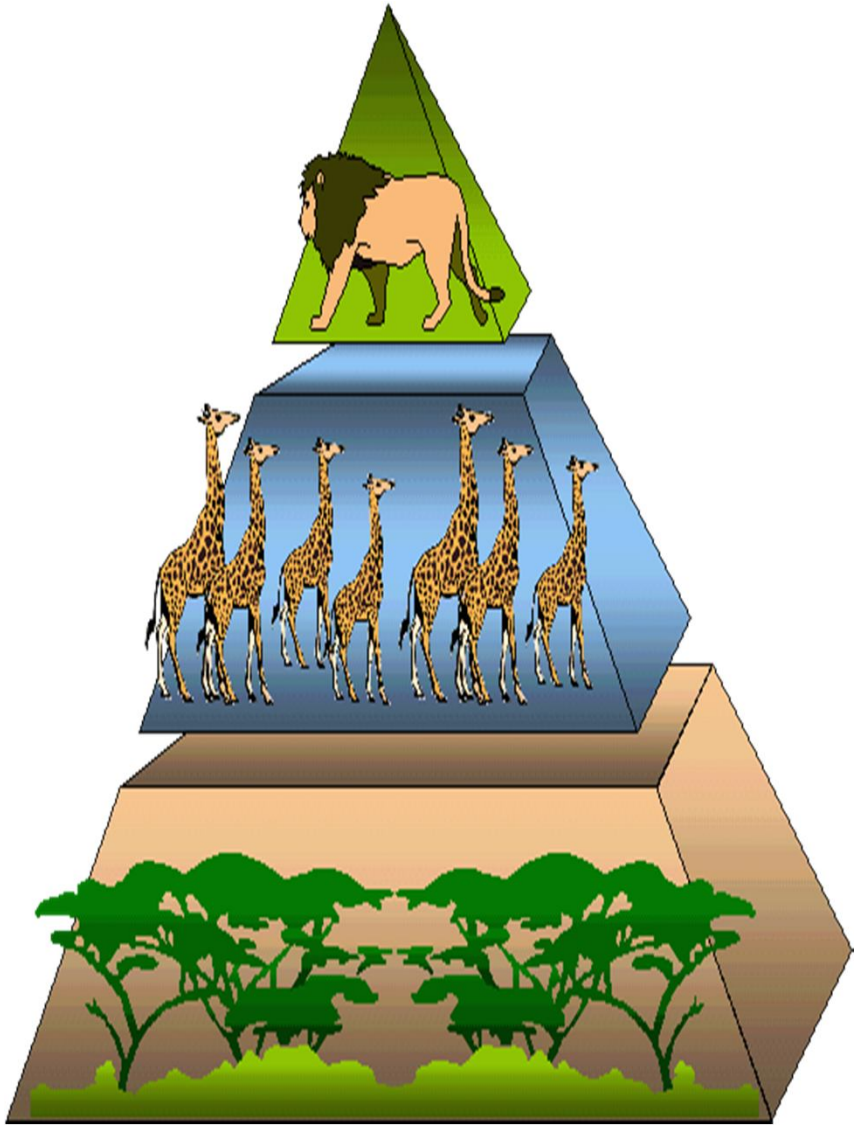
Pyramid of Number

Pyramid of number is used to show the number of individuals in each tropic level.

It is upright in case of grassland and pond ecosystems.



Inverted pyramid of number

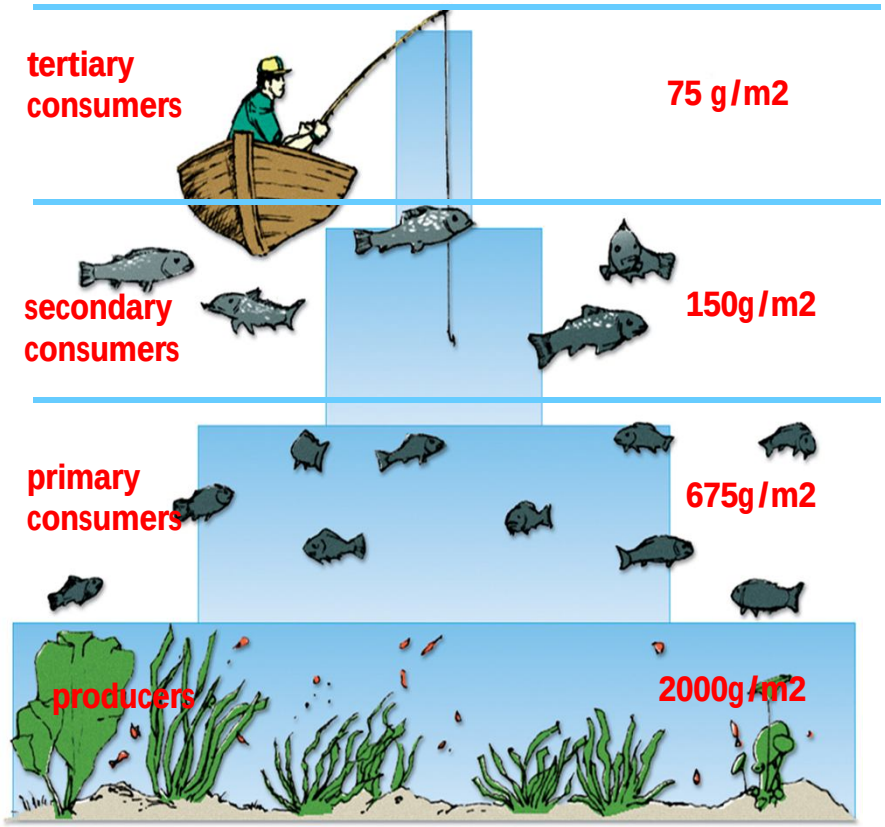


Pyramid of Biomass

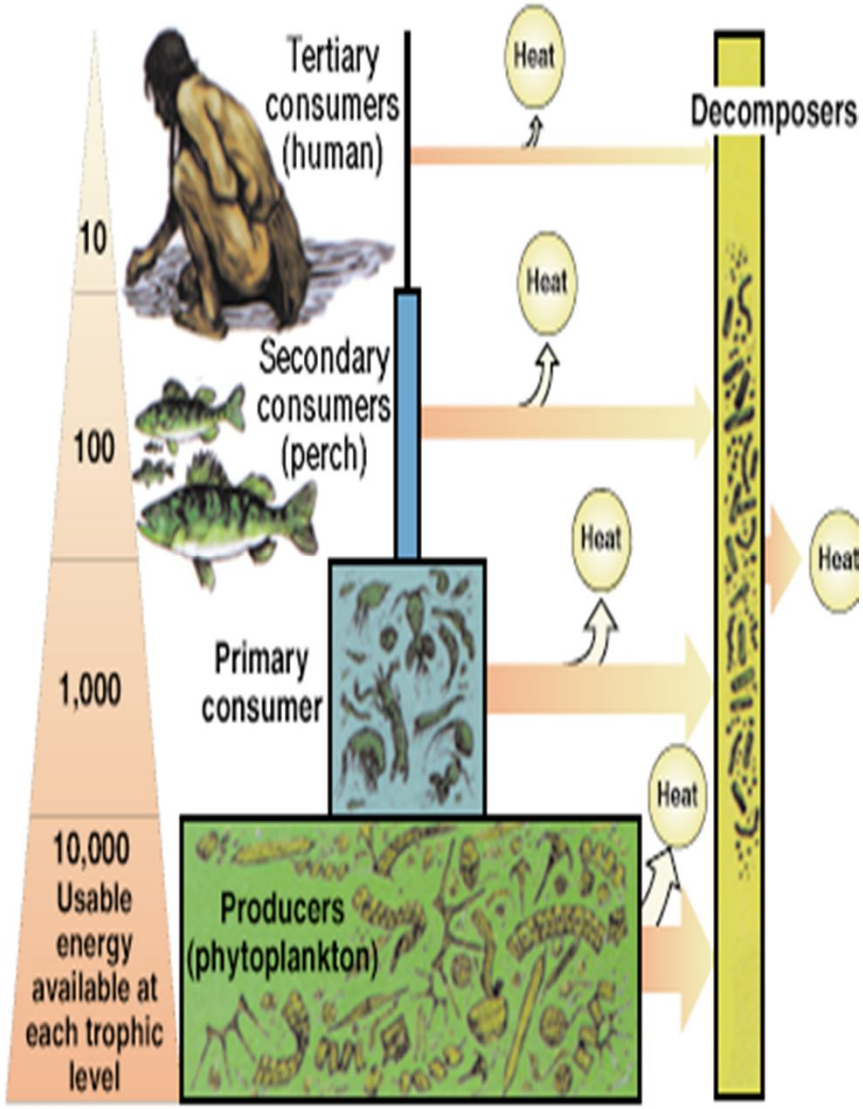
Pyramid of biomass records the total dry organic matter of organisms at each trophic level in a given area of an ecosystem.

The pyramid of biomass is used to show the total biomass of individuals at each trophic level.

It is better than the pyramid of number for showing the relationships between organisms.



Pyramid of energy



- Pyramid of energy is used to show the amount of energy transferred between tropic levels.

- It provides the best representation of the overall nature of an ecosystem.

- The pyramid of energy flow is always upright because there is always loss of energy while moving from lower tropic level to higher tropic level. Therefore, the energy reaching the next tropic level is always less compared to that in the previous tropic level.

Ecological Succession

Ecological succession is the gradual process by which ecosystems change and develop over time. It is therefore a series of predictable temporary communities or stages leading up to a climax community. Each stage/temporary community is called a successional stage. Each step prepares the land for the next successional stage. All habitats are in the state of constant ecological succession.

Ecological Succession is an orderly sequence of different communities over a period of time.

Types of Ecological Succession

Primary Succession

Secondary Succession

Process of ecological succession

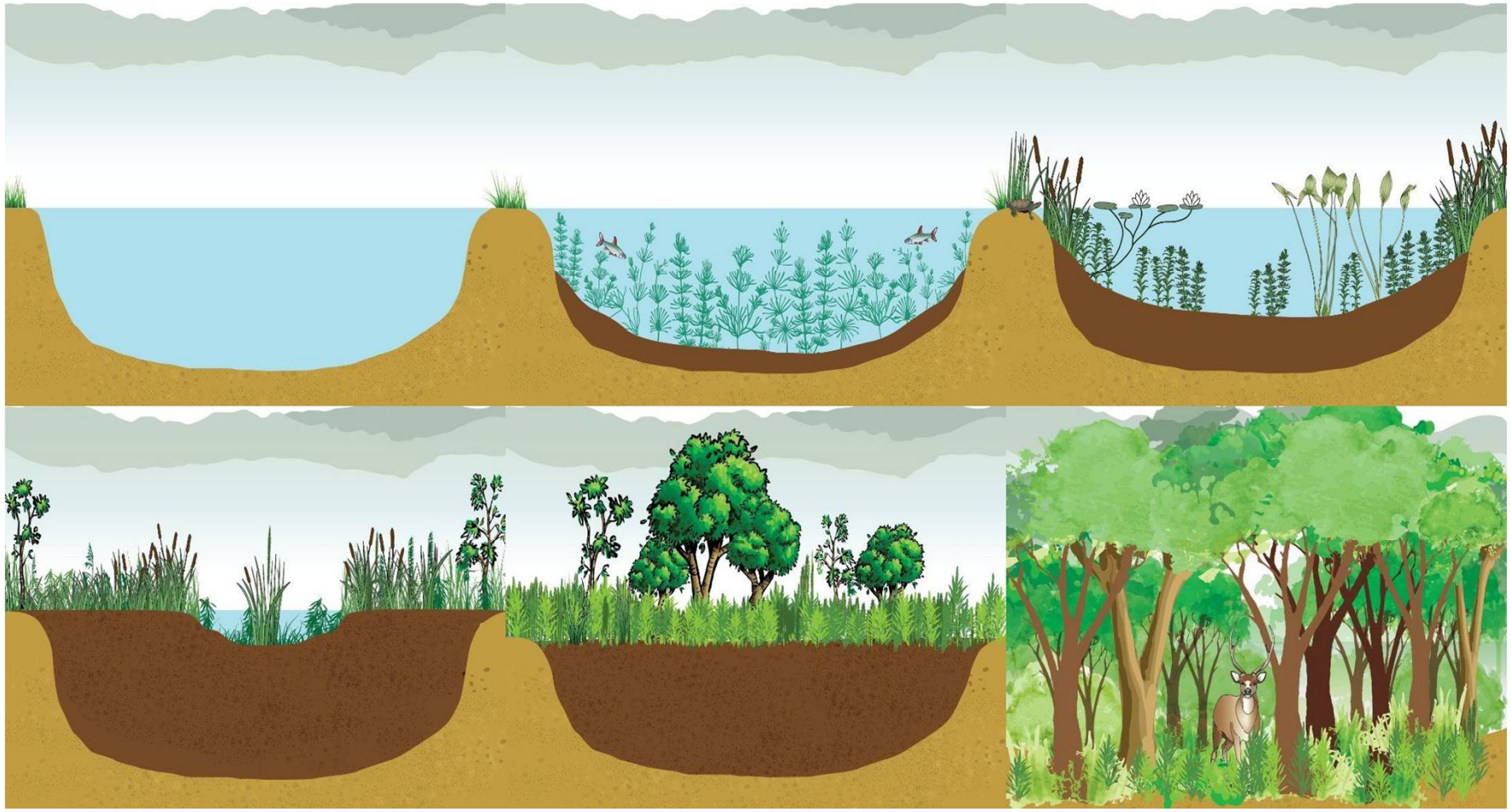
- Nudation- Creation of bare area
- Invasion— Successful establishment of new species

  Migration (dispersal)-

  Ecesis (establishment)

  Aggregation- population rises
- Competition
- Stabilization

Primary succession: is the process by which an area first changes from bare rock into a functioning ecosystem.



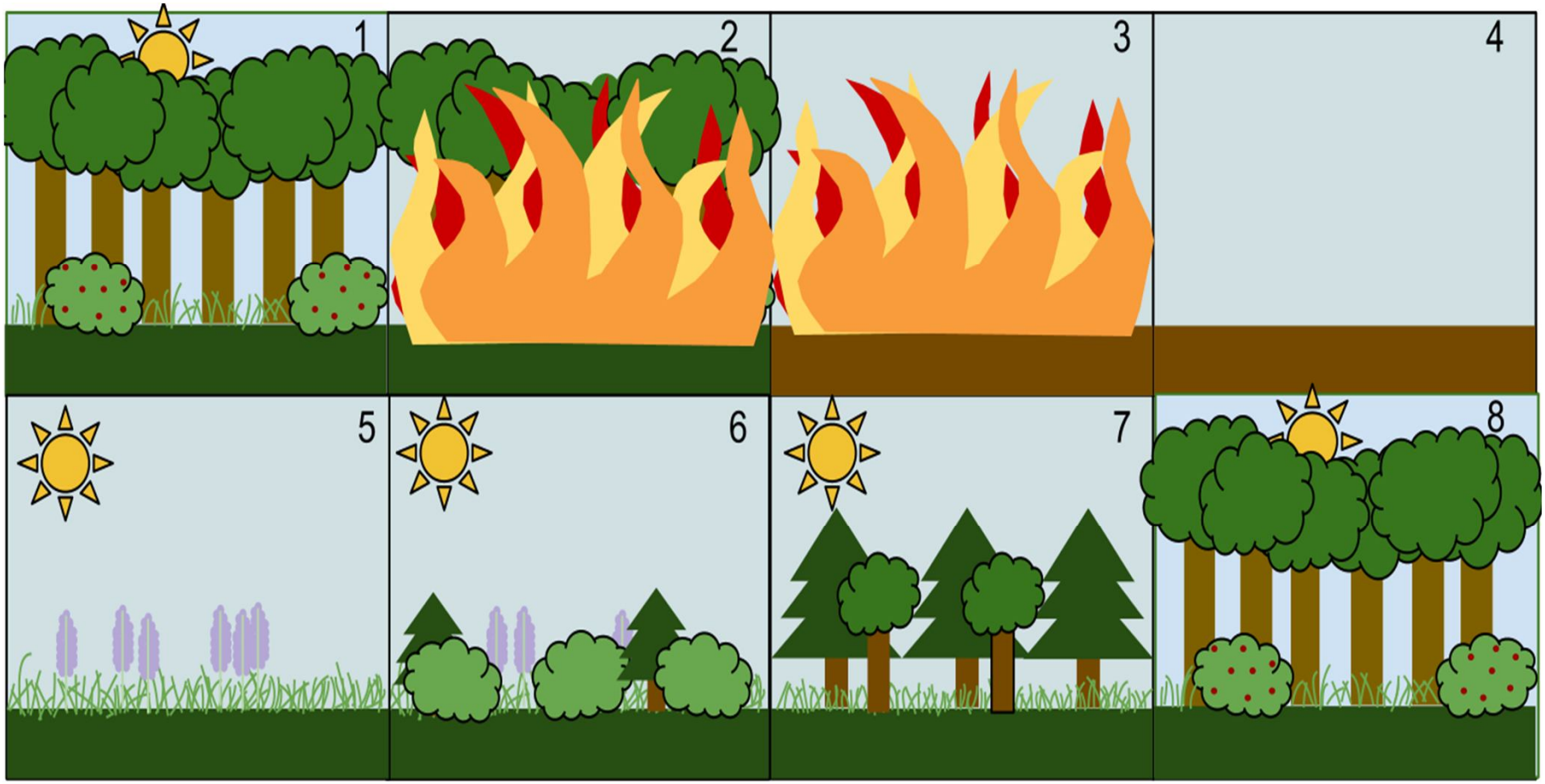
Secondary Succession

- SECONDARY SUCCESSION begins in habitats where communities were entirely or partially destroyed by some kind of damaging event.

- When an existing community has been cleared by a disturbance such as a fire, tornado, etc...and the soil remains intact, the area begins to return to its natural community. Because these habitats previously supported life, secondary succession, unlike primary succession, begins on substrates that already bear soil. In addition, the soil contains a native seed bank.

- Since the soil is already in place, secondary succession can take place five to ten times faster than primary succession.

Secondary succession is the process by which an ecosystem that has been destroyed gradually returns to its previous state.



Forest Ecosystem

Abiotic Components

Inorganic and organic substances found in the soil, climatic factors, e.g., temperature, humidity, rainfall, and light.

Biotic Components

Producers

Different kinds of trees depending upon the climate

Consumers

Different kinds of primary, secondary, and tertiary consumers, e.g., deer, elephant, moles, snakes, lizards, lion, and tiger

Decomposers

These are various kinds of bacteria and fungi

Forest ecosystem

- Tropical Rain Forests (small mammals, reptiles birds, monkeys, predators like tigers, jaguars etc. plant biodiversity Tall tree, dense canopy.)

- Temperate Forests (deciduous plants like oaks, maples, coniferous plants like pines, ferns, lichens and mosses are also found.)

- Coniferous Forests (spruce, pine fir)

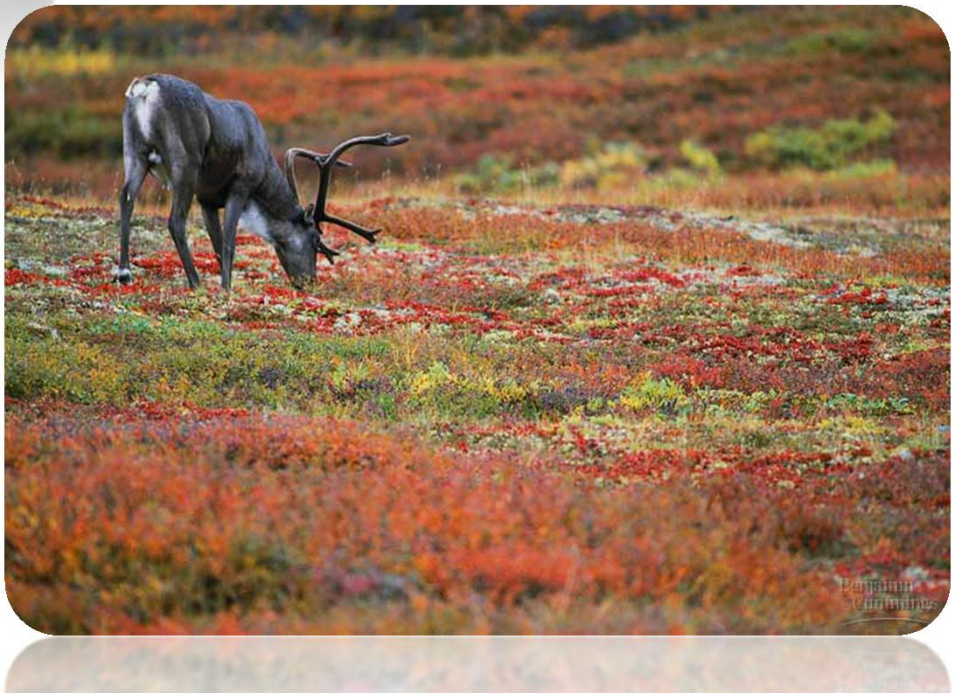
- Tundra (mosses, lichens, grasses and some dwarf trees; animals like arctic foxes, hares, snowy owls; it is fragile ecosystem)

Tropical Forest: Vertical stratification with trees in canopy blocking light to bottom strata. Many trees covered by epiphytes (plants that grow on other plants).

Temperate Deciduous Forest: Mid-latitudes with moderate amounts of moisture, distinct vertical strata: trees, understory shrubs, herbaceous sub-stratum. Loss of leaves in cold, many animals hibernate or migrate then. Original forests lost from North America by logging and clearing.

Coniferous forest: Largest terrestrial biome on earth, old growth forests rapidly disappearing, usually receives lots of moisture as rain or snow.

Tundra: Permafrost (Permanent frozen ground), bitter cold, high winds and thus no trees. Has 20% of land surface on earth.



Grassland Ecosystem

Abiotic Components

Inorganic elements (C, H, O, N, P, S), climatic components, temperature, rainfall, light, etc.

Biotic Components

Producers
Mainly grasses with a few scattered trees

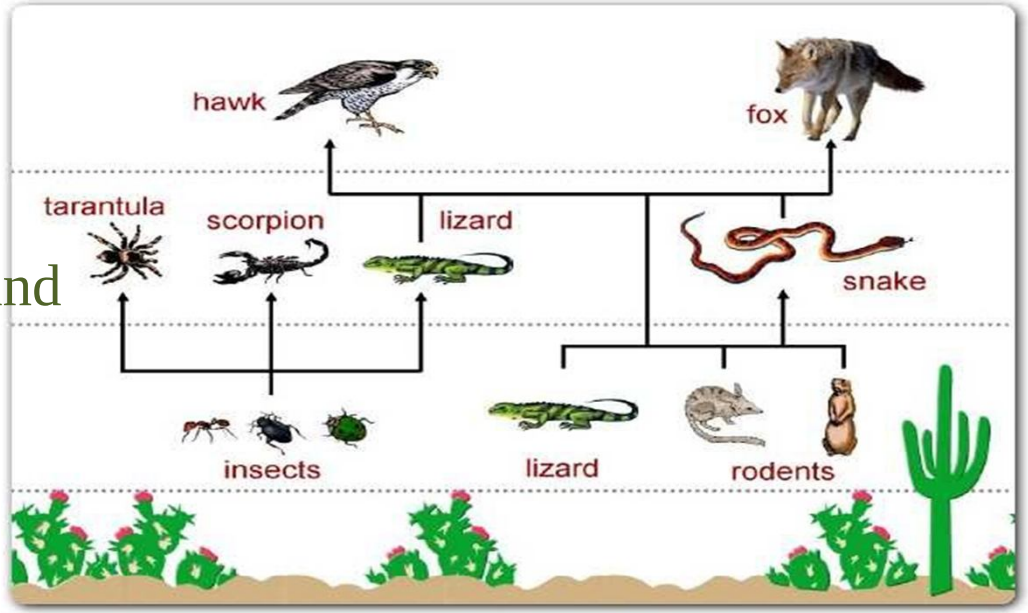
Consumers
Deer, rabbit, giraffe, etc., are herbivores, while wolf, leopard, etc., are carnivores

Decomposers
Mainly bacteria and fungi

Grassland ecosystem

- **Grasslands** (grazing animals like wild horses, kangaroos, zebra as well as predators like wolves, cheetas etc.)
- **Tropical grassland** (hot through out the year) (savannas)
- **Temperate grassland** (hot during summer and very cold during winter)

Desert Ecosystem



Abiotic Components

Low rainfall, high temperature, and sandy soil

Biotic Components

Producers

Predominantly thorny shrubs, cactus, opuntia, etc.

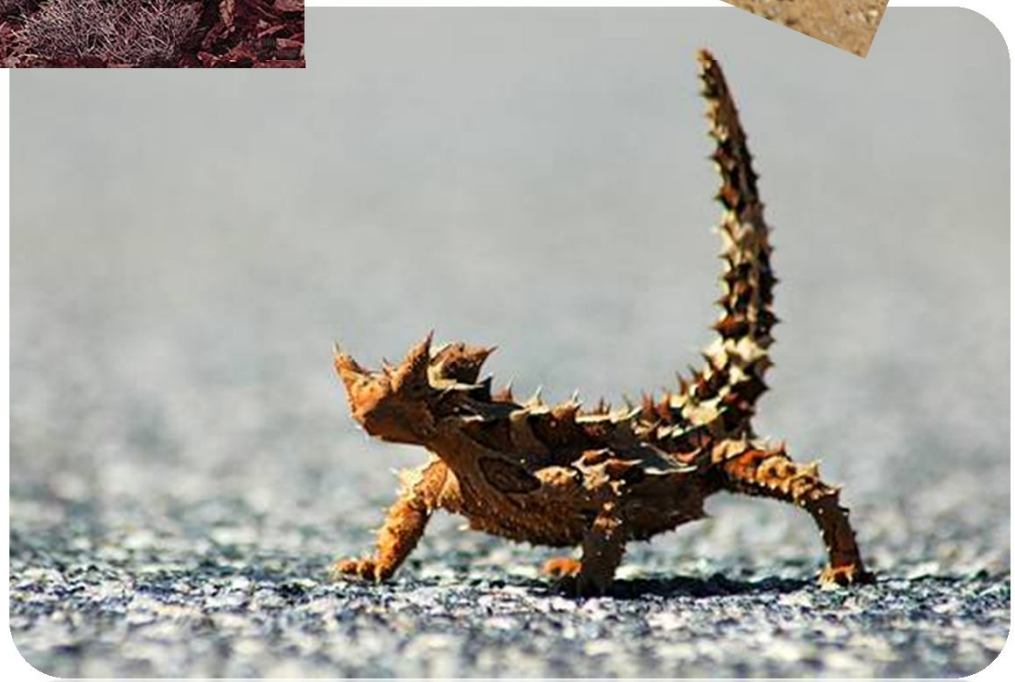
Consumers

Different insects, lizards, reptiles, nocturnal rodents, birds, etc.

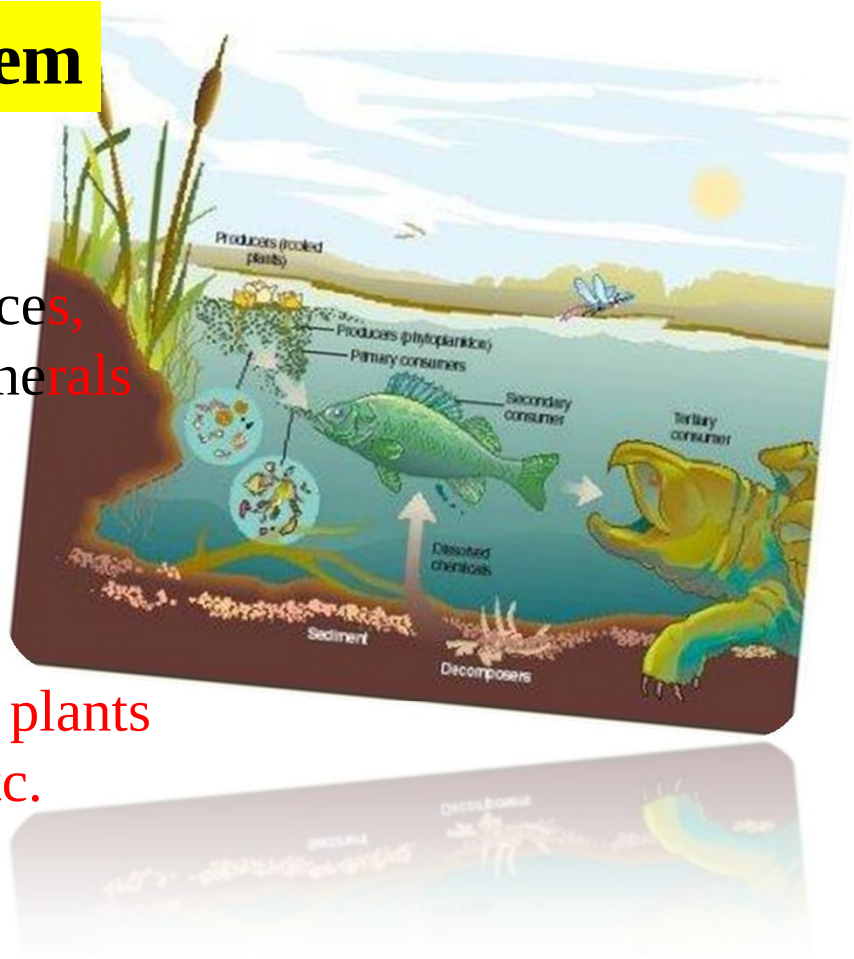
Decomposers

Various bacteria and fungi

Desert: Sparse rainfall (< 30 cm per year), plants and animals adapted for water storage and conservation. Can be either very, very hot, or very cold (e.g. Sahara, Thar, Antarctica)



Pond Ecosystem



Abiotic Components

It includes organic and inorganic substances, atmospheric gases dissolved in water, minerals found in dissolved state, etc.

Biotic Components

Producers

Submerged floating and emergent aquatic plants
For example, nelumbo, hydrilla, chara, etc.

Consumers

May be primary, secondary, or tertiary, e.g., small fishes, beetles, mollusca, crustaceans, etc.

Decomposers

Chiefly bacteria, actinomycetes, fungi, etc.