ECOSYSTEM

ECOSYSTEM

Defined area in which a community lives with interaction taking place among the organisms between the community and its non-living physical environment

- An ecosystem is formed by the interaction between all living and non-living things

Structure:

- Living (biotic)
- Nonliving (abiotic)

ABIOTIC components:

- Solar energy provides practically all the energy for ecosystems.
- Inorganic substances, e.g., sulfur, boron and carbon cycle through ecosystems.
- Organic compounds, such as proteins, carbohydrates, lipids, and other complex molecules, form a link between biotic and abiotic components of the system.

BIOTIC components:

The biotic components of an ecosystem can be classified according to their mode of energy acquisition.

In this type of classification, there are:

Autotrophs

- Organisms that produce their own food from an energy source, such as the sun, and inorganic compounds.

Heterotrophs

- Organisms that consume other organisms as a food source.

Producers are able to capture the sun's energy through photosynthesis and absorb nutrients from the soil, storing them for future use by themselves and by other organisms. Grasses, shrubs, trees, mosses, lichens, and cyanobacteria.

Consumers are organisms that do not have the ability to capture the energy produced by the sun, but consume plant and/or animal material to gain their energy for growth and activity. Consumers are further divided into three types based on their ability to digest plant and animal material

- **Herbivores** eat only plants Deer, Elephant and Goat

- **Carnivores** eat only animals, such as the snake, lion, tiger etc.,
- **Omnivores** eat both plants and animals, such as the black bear, mice, rat, human etc.,

Decomposers they feed on dead organic matter that includes the insects, fungi, algae and bacteria both on the ground and in the soil that help to break down the organic layer to provide nutrients for growing plants. There are many millions of these organisms in each square metre of grassland.

Tropic Levels

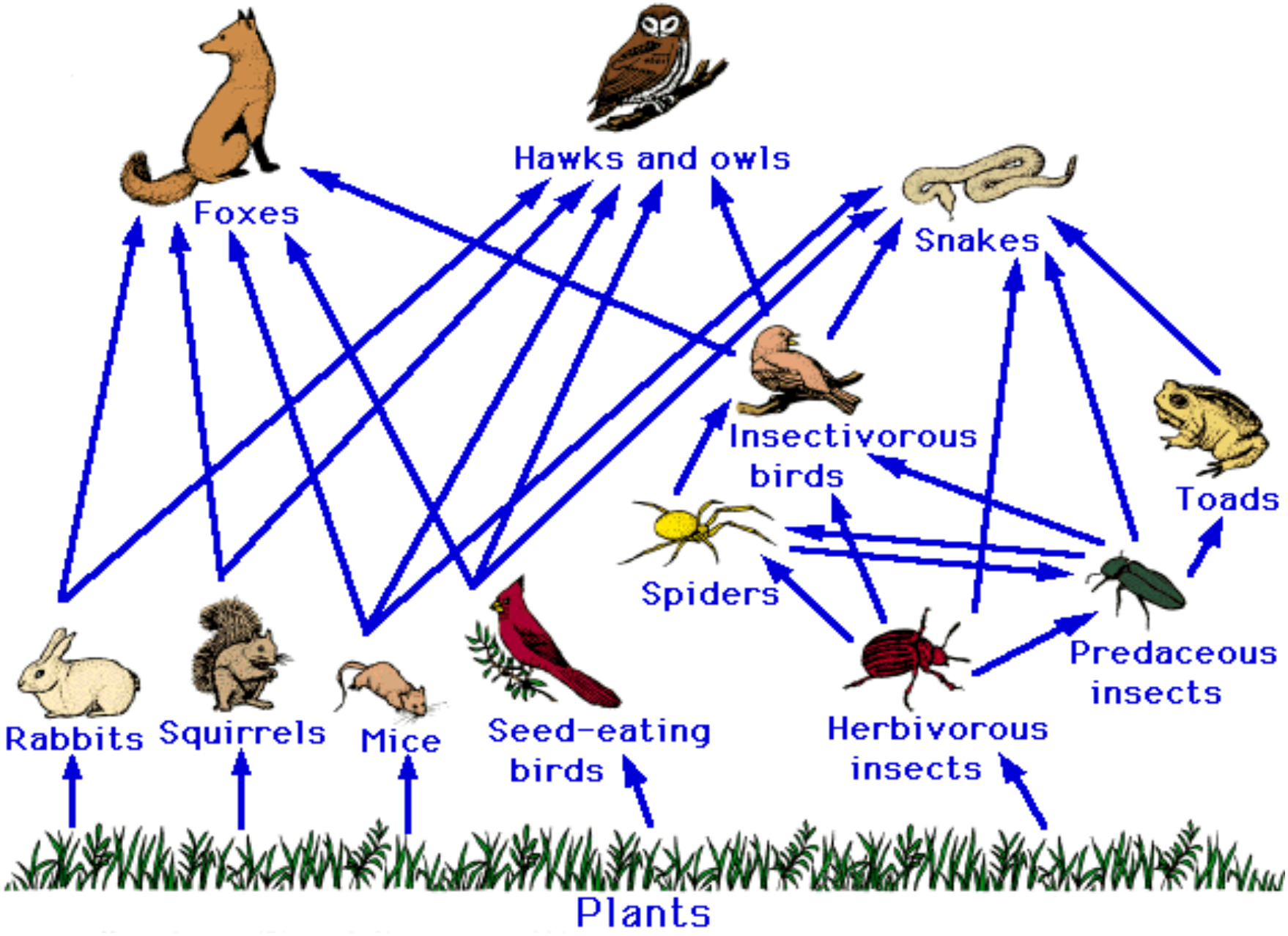
A tropic level is the position occupied by an organism in a food chain.

Tropic levels can be analyzed on an energy pyramid.

- **Producers** are found at the base of the pyramid and compromise the **first tropic level.**
- **Primary consumers** make up the **second tropic level.**
- **Secondary consumers** make up the **third tropic level**.
- Finally **tertiary consumers** make up the **top tropic level**.

Food web

In nature simple food chains occur rarely The same organism may operate in the ecosystem at more than one tropic level i.e. it may derive its food from more than one source. Even the same organism may be eaten by several organisms of a higher tropic level or an organism may feed upon several different organisms of a lower tropic level. usually the kind of food changes with the age of the organism and the food availability. Thus in a given ecosystem various food chains are linked together and interested each other to form a complex network called food Web.


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

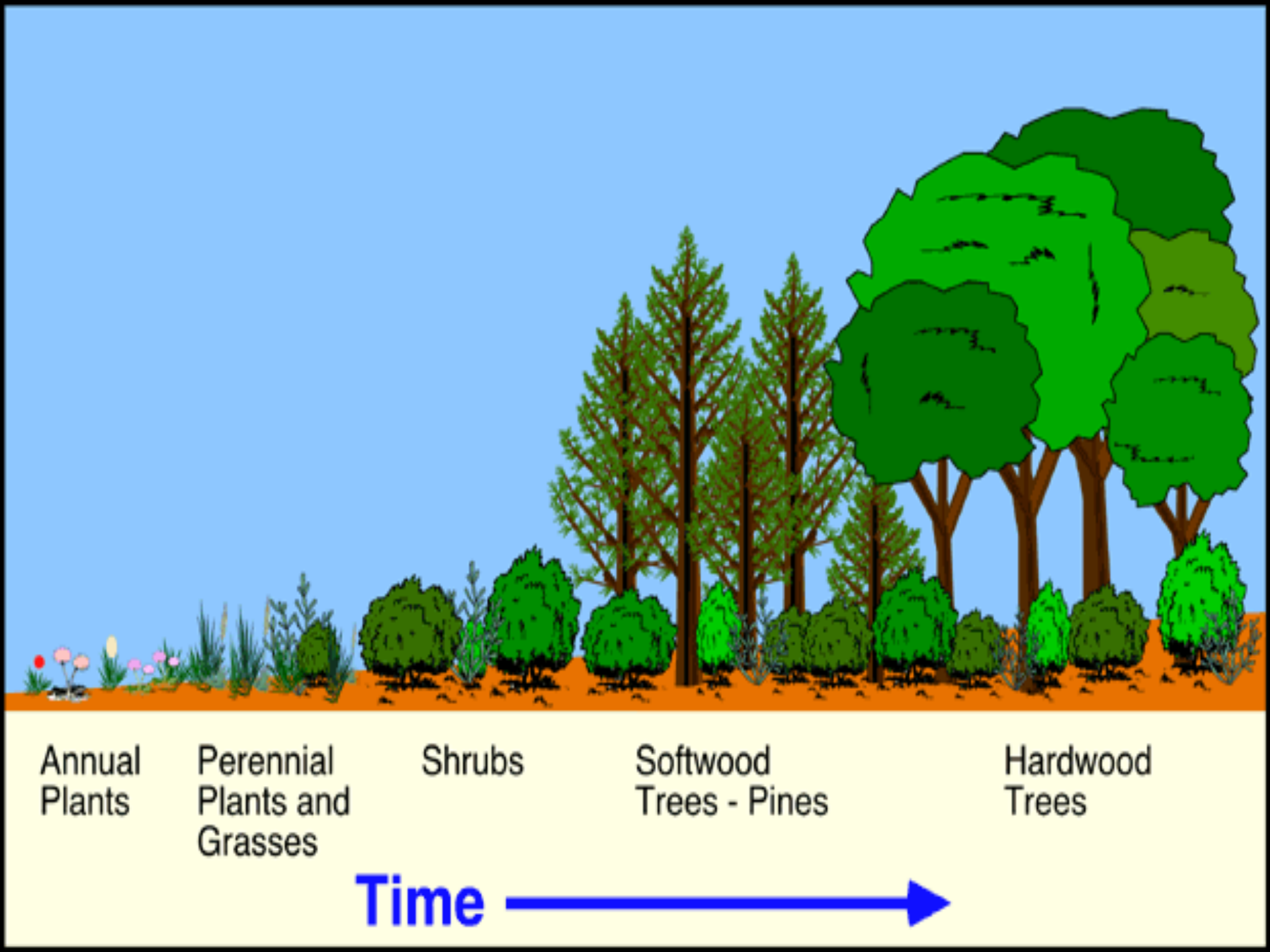
ECOLOGICAL SUCCESSION

In a particular area, one community of species may be replaced by another community; The progressive replacement of one community by another till the development of stable community in a particular area is called as ecological succession.

TYPES OF SUCCESSION

Primary succession.

If an area in any of the basic environments (such as terrestrial, fresh-water or marine) is established by organisms for the first time, the succession is called primary succession.

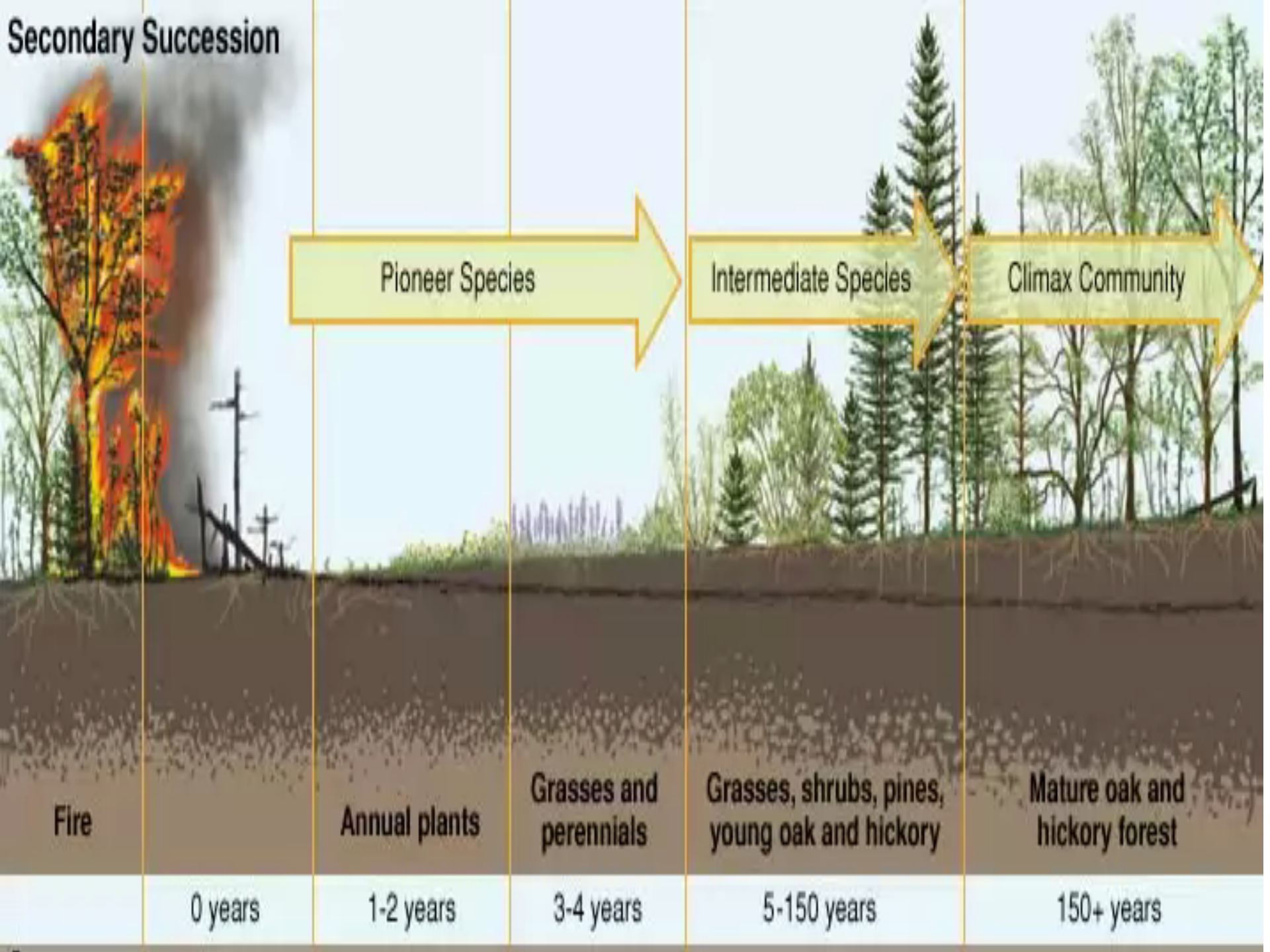

Annual Plants
Perennial Plants and Grasses
Shrubs
Softwood Trees - Pines
Hardwood Trees
Time

Secondary succession.

If the area under established has been cleared by whatsoever agency (such as burning, grazing, clearing, felling of trees, sudden change in climatic factors, etc.) of the previous plants, it is called secondary succession.

Autogenic succession.

After the succession has begun, in most of the cases, it is the community itself (as a result of its reactions with the environment) modifies its own environment and, thus, causing its own replacement by new communities. This course of succession is known as autogenic succession.


Secondary Succession
Pioneer Species
Intermediate Species
Climax Community
Fire
Annual plants
Grasses and perennials
Grasses, shrubs, pines, young oak and hickory
Mature oak and hickory forest
0 years
1-2 years
3-4 years
5-150 years
150+ years

ENERGY FLOW IN ECOSYSTEM:

Energy is defined as the capacity to do work. For living organisms, it is the basic force responsible for running all the metabolic activities. The flow of energy from producer level to top consumer level is called energy flow.

The flow of energy in an ecosystem is unidirectional. It flows from producer level to consumer level.

The process of energy flow involves transfer of energy from autotrophs to various components of heterotrophs and help in maintaining bio diversity. The main source of energy in the ecosystem is sunlight. About 80% of energy is lost during flow of energy from one tropic level to the next one.

Food Chain in Ecosystem

In an ecosystem one can observe the transfer or flow of energy from one tropic level to other in succession.

A tropic level can be defined as the number of links by which it is separated from the producer, or as the which position of the organism in the food chain.

Thus, primary producers trap radiant energy of sun and transfer that to chemical or potential energy of organic compounds such as carbohydrates, proteins and fats.

When a herbivore animal eats a plant (or when bacteria decompose it) and these organic compounds are oxidized, the energy liberated is just equal to the amount of energy used in synthesizing the substances (first law of thermodynamics), but some of the energy is heat and not useful energy (second law of thermodynamics).

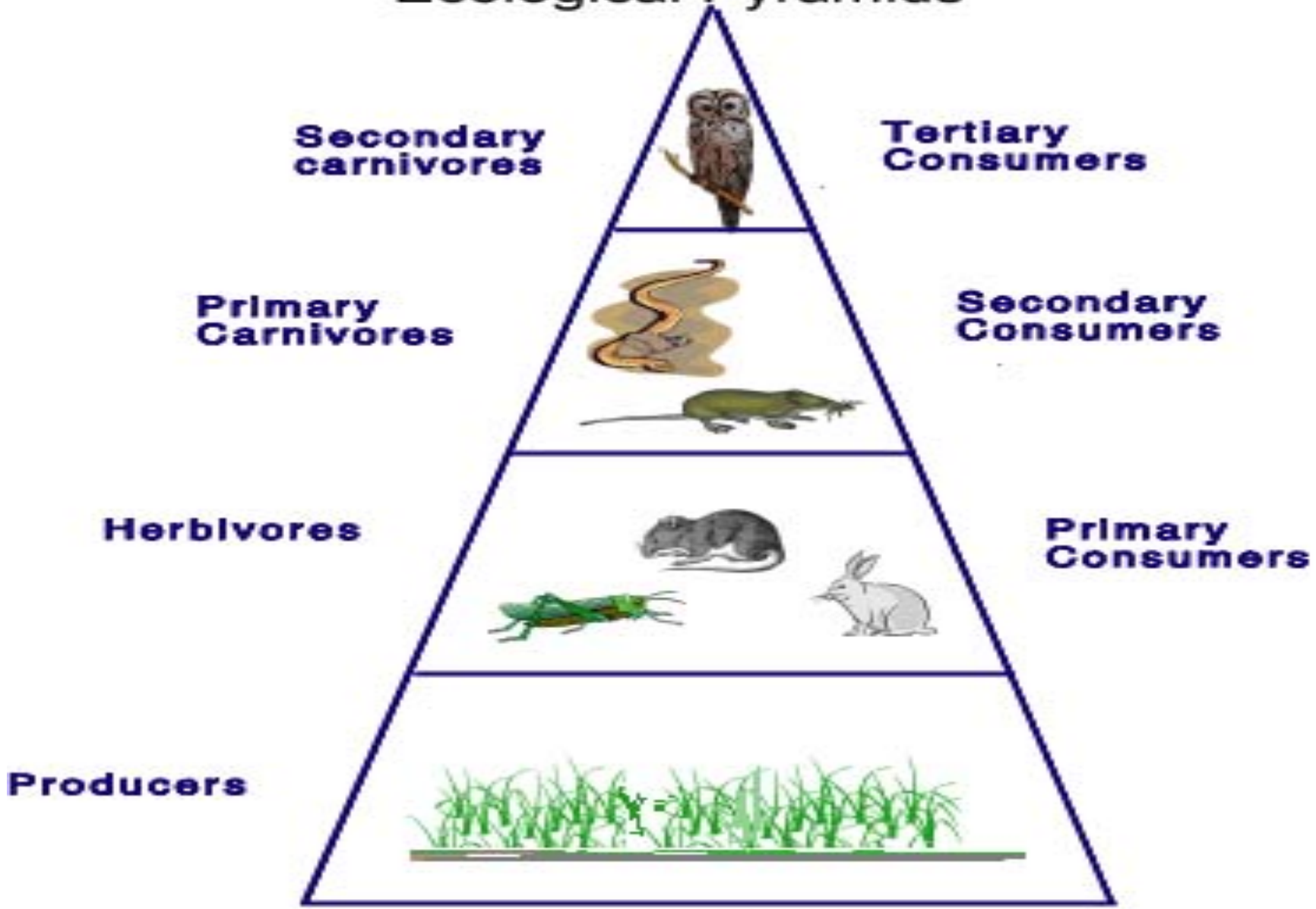
If this animal is eaten by another one, along with transfer of energy from a herbivore to carnivore a further decrease in useful energy occurs as the second animal (carnivore) oxidizes the organic substances of the first (herbivore or omnivore) to liberate energy to synthesize its own cellular constituents.

Such transfer of energy from organism to organism sustains the ecosystem and when energy is transferred from individual to individual in a particular community, as in a pond or a lake or a river, we come across the food chains.

Ecological Pyramids

In the successive steps of grazing food chain producers, herbivorous, carnivores and decay bacteria-the number and mass of the organisms in each step is limited by the amount of energy available. Since some energy is lost as heat, in each transformation the steps become progressively smaller near the top. This relationship is sometimes called **"ecological pyramid".** The ecological pyramids represent the tropic structure and also tropic function of the ecosystem.

Ecological Pyramids



http://www.eelsinc.org/id64.html

Definition:

Graphical representation of structure and function of tropic levels of an ecosystem.

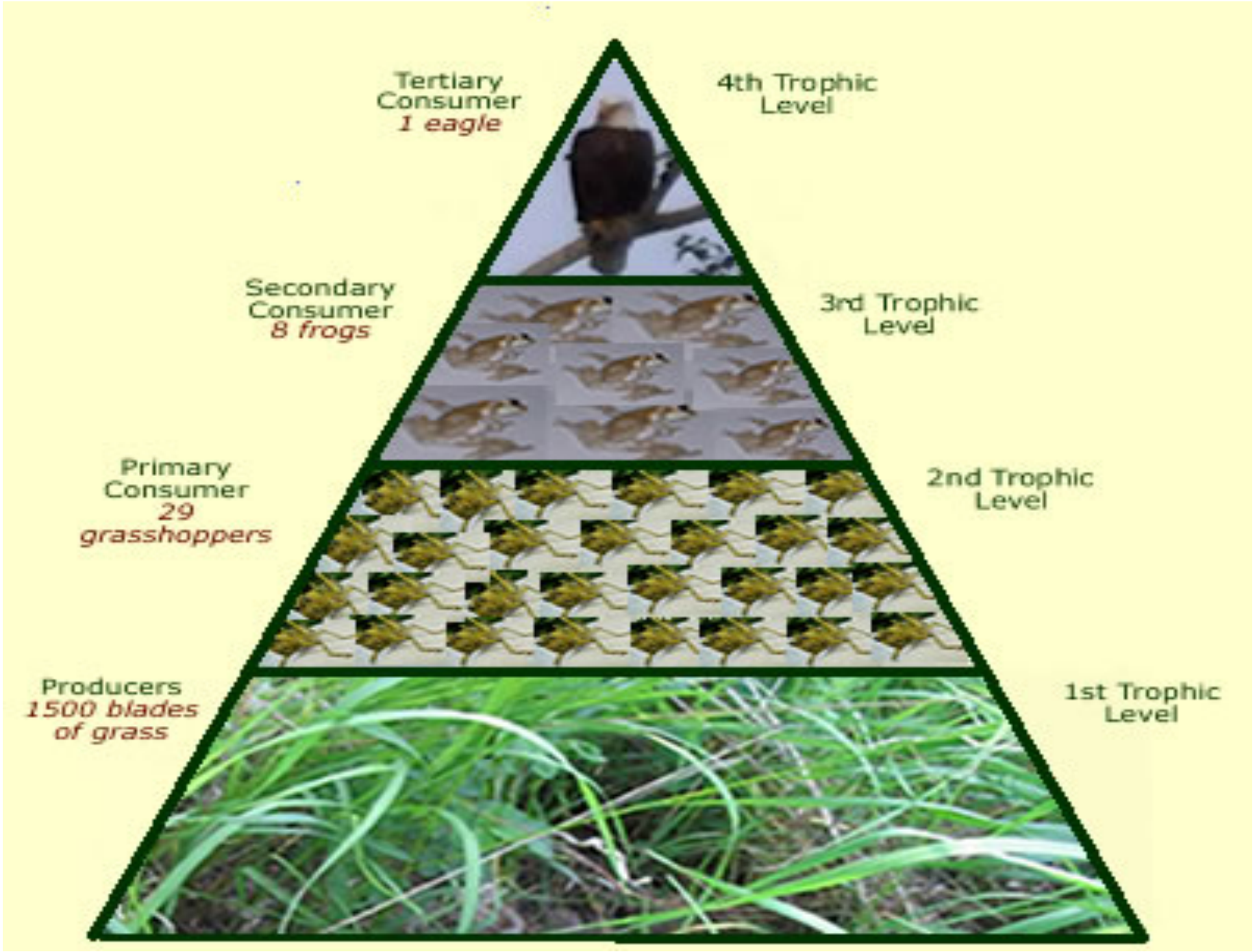
Types of Ecological Pyramids

The ecological pyramids may be of following three kinds

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

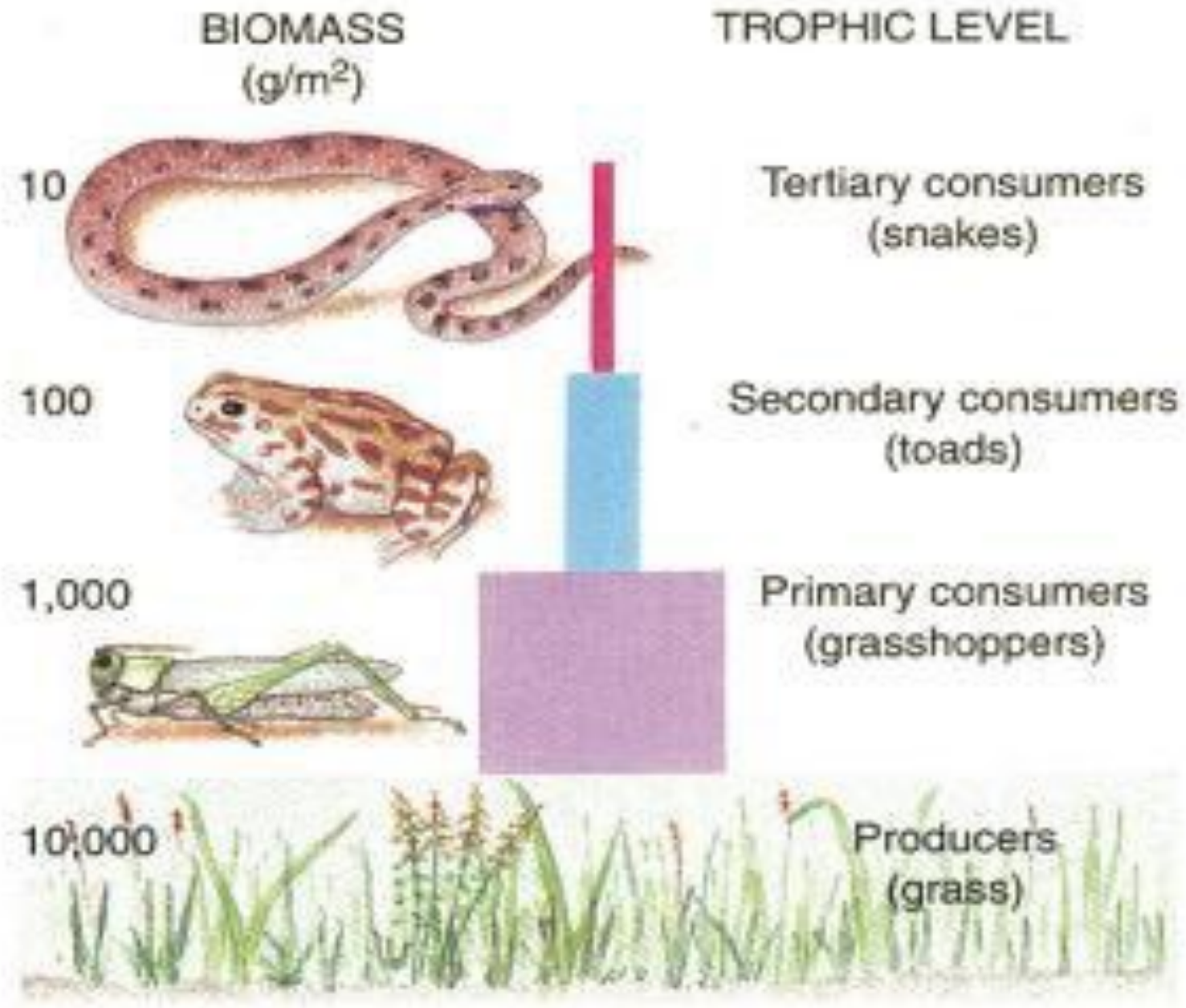
- **Pyramid of number**

It depicts the number of individual organisms at different tropic levels of food chain. The animals at the lower end (base of pyramid) of the chain are the most abundant. Successive links of carnivores decrease rapidly in number until there are very few carnivores at the top. The pyramid of number ignores the biomass of organisms and it also does not indicate the energy transferred or the use of energy by the groups involved. The grassland ecosystem provides a typical example for pyramid of number.


Tertiary Consumer
1 eagle
4th Trophic Level
Secondary Consumer
8 frogs
3rd Trophic Level
Primary Consumer
29 grasshoppers
2nd Trophic Level
Producers
1500 blades of grass
1st Trophic Level

Pyramid of biomass

The biomass of the members of the food chain present at any one time forms the pyramid of the biomass. Pyramid of biomass indicates decrease of biomass in each tropical level from base to apex. For example, the total biomass of the producers ingested by herbivores is more than the total biomass of the herbivores in an ecosystem. Likewise, the total biomass of the primary carnivores (or secondary consumer) will be less than the herbivores and so on.


BIOMASS
(g/m²)
TROPHIC LEVEL
10
Tertiary consumers
(snakes)
100
Secondary consumers
(toads)
1,000
Primary consumers
(grasshoppers)
10,000
Producers
(grass)

Pyramid of energy

When production is considered in terms of energy, the pyramid indicates not only the amount of energy flow at each level the actual role the various organisms play in the transfer of energy. the pyramid of energy is constructed is the quantity of organisms produced per unit time.

Classification of Ecosystems / Ecology

- Terrestrial Ecosystems -which encompass the activities that take place on land.
- Aquatic ecosystems - the system that exists in water bodies.

Terrestrial ecosystem

- Forest ecosystem
- Desert ecosystem
- Grassland ecosystem

Aquatic ecosystem

- Pond ecosystem
- River or stream ecosystem
- Marine ecosystem
- Estuarine ecosystem

FOREST ECOSYSTEM

A forest ecosystem is the one in which a tall and dense trees grow that support many animals and birds.

Forest occupies 40% of the world's land.

Total land area is 19% in India.

There are three important types of forests are

- Tropical rain forests.
- Temperate deciduous forests.
- Coniferous forests.

Tropical rain forests

- They are found near the equator.
- These forests have a warm annual mean temperature.
- These forests have high humidity and heavy rainfall almost daily.
- These forests consists of broadleaf ever green plants.
- These trees have larger surface on their leaves that allows them to collect more sunlight and do photosynthesis extensively.
- Tropical rain forests have wide varieties of species.

Temperate Deciduous forests:

- Temperate deciduous forests can be found in the eastern part of the United States and Canada, Europe ,China and Japan
- Winter, spring and summer. Winters are cold and summers are warm.
- Temperate deciduous forests have a great variety of plant species.
- Conifers like spruce, fir and pine trees can also be found mixed in with the hardwood trees.
- There is great diversity of life. Insects, fox,deer etc., are common.

Coniferous forests:

- The temperate coniferous forest includes areas South America, New Zealand North America, northwest Europe and Iceland and southern Japan
- Many softwood trees such as fir, pine, spruce.
- Most animals are herbivores, however some carnivores and omnivores are thrown in. Animals in Coniferous Forests include the red fox, moose and owl.
- Coniferous Forests are the largest land of the World.
- A Conifer is a tree that produces its seeds in cones. The Pine tree is the most common example. Conifer leaves conserve water with the thick, waxy layer that covers their leaves.

STRUCTURE OF FOREST ECOSYSTEM

- ABIOTIC COMPONENTS:
  Climate factors(Temp,light,rainfall)

- BIOTIC COMPONENTS:
  1.Producers: Trees,shrubs etc.,

  2.Consumers:
  Primary consumers : ants,flies & insects
  Secondary consumers : snakes,birds.
  Tertiary consumers : tiger,lion.

  3.Decomposers: Bacteria,fungi

GRASSLAND ECOSYSTEM

- 20% of earth surface.
- It improves the production of grasslands.
- Overgrazing leads to desertification.

There are three types of grasslands

- A. Tropical grasslands
- B. Temperate grasslands
- C. Polar grasslands

Tropical grasslands

They has high temperature and moderate rain fall, 40-100cm.They have tall grasses with scatteres shrubs.They are the shelter for animals like zebras, giraffes and African elephant. Savanna grassland in Africa is good example for tropical grassland.

Temperate grasslands:

Cold in Winters and hot in summers, annual precipitation is less and falls unevenly through the year. *Pampas* in South America and *Veldt* in Africa are examples for temperate grasslands.

Polar grasslands:

It is also known as *arctic polar region*. Severe cold and strong winds along with ice and snow. They have animals like arctic fox.

STRUCTURE OF GRASSLAND ECOSYSTEM

- ABIOTIC COMPONENTS:
  Climate factors(Temp,light,rainfall),C,H,O,N.,

- BIOTIC COMPONENTS:
  1.Producers: Grass,shrubs etc.,

  2.Consumers:
  Primary consumers : cow,deer.
  Secondary consumers : snakes,birds.
  Tertiary consumers : hawks,eagle

  3.Decomposers: Bacteria,fungi

DESERT ECOSYSTEM

- Deserts are dry places with unpredictable and infrequent precipitation.
- Desert occupies about 35% of world's land area.
- It is characterizes by 25 cm rain fall.
- The atmosphere is dry.

TROPICAL DESERTS	TEMPERATE DESERTS	COLD DESERTS
Temperatures are high around year	Day time temperature are high in summer & low in winter	Winters are too cold, summers are too hot
There is very little rainfall during 1 or 2 months of a year.	There is more precipitation than tropical deserts	Precipitation is too low
These driest places on the earth have few plants along with wind blown sands and rocks	It consists of drought resistant shrubs, cacti and few animals	Small shrubs
Ex: *Sahara* desert	*Majave* desert	*Gobi* desert

STRUCTURE OF DESERT ECOSYSTEM

- ABIOTIC COMPONENTS:

  Climate factors(Temp,light,rainfall)

- BIOTIC COMPONENTS:

  1.Producers: Trees,grass etc.,

  2.Consumers:Squirrels,foxes,rabbits.

  3.Decomposers: Bacteria,fungi

WATER or AQUATIC ECOSYSTEMS

The aquatic system deals with water bodies.The major types of organism found in this ecosystem.

1.Fresh water ecosystem :Ponds,river,stream,lake.

2.Salt water ecosystem: oceans and estuaries.

POND ECOSYSTEM:

It contains algae,plants,insects,fish.

Characteristic :

1.Pond is temporary,seasonal,get polluted easily.

Lake ecosystem:

- Littoral zone

  light penetrates to the bottom, allowing aquatic plants to grow.

- Limnetic zone

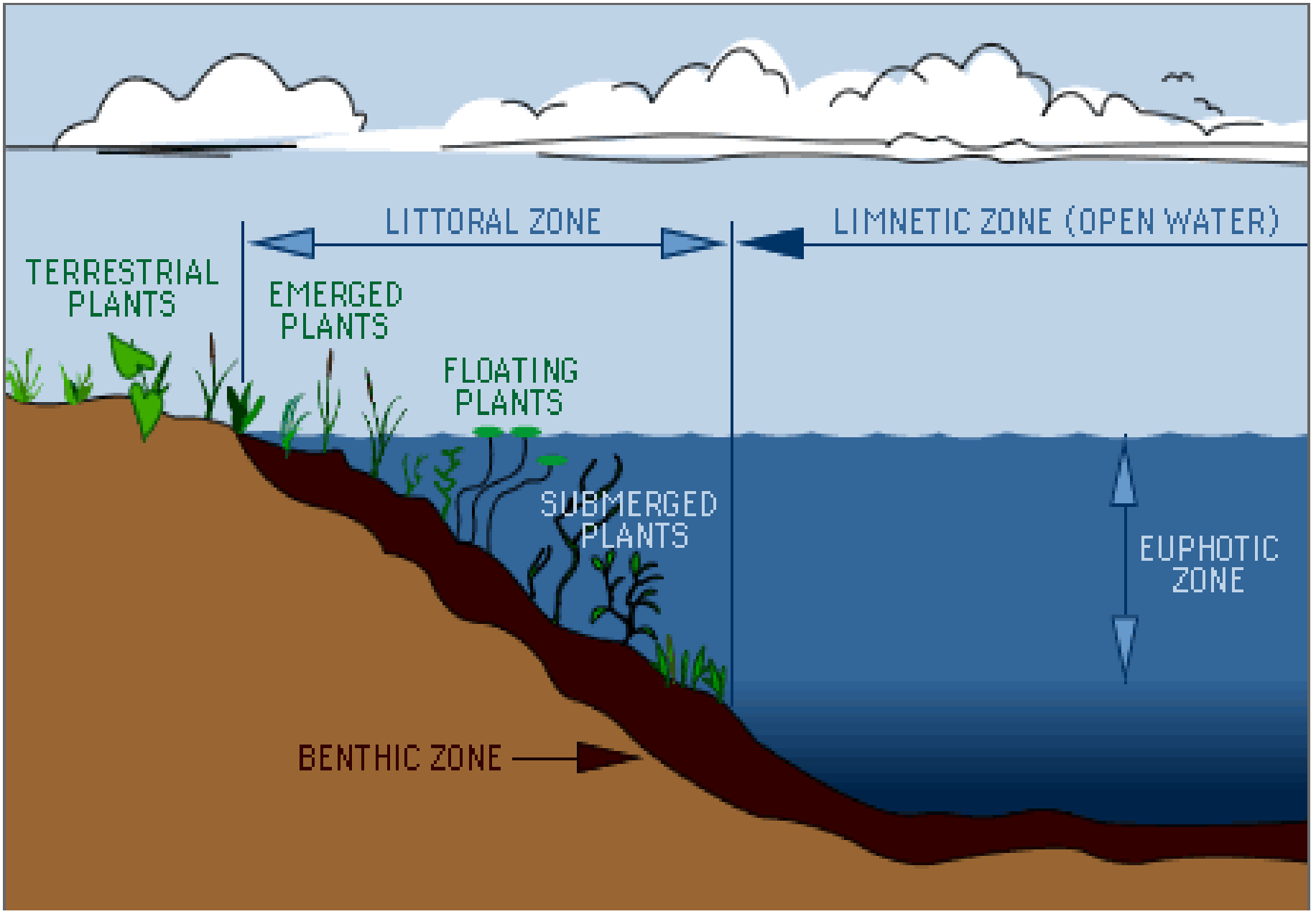
  the open water area where light does not generally penetrate all the way to the bottom.

- Euphotic zone

  the layer from the surface down to the depth where light levels become too low for photosynthesis.

- Benthic zone

  the bottom sediment.


LITTORAL ZONE
LIMNETIC ZONE (OPEN WATER)
TERRESTRIAL PLANTS
EMERGED PLANTS
FLOATING PLANTS
SUBMERGED PLANTS
EUPHOTIC ZONE
BENTHIC ZONE

- LAKE ECOSYSTEM:

Lakes are natural shallow water bodies.

Characteristic:

1.Permanent water body.

2.It helps in irrigation and drinking.

3.It is fresh water body.

RIVER ECOSYSTEM or STREAM ECOSYSTEM:

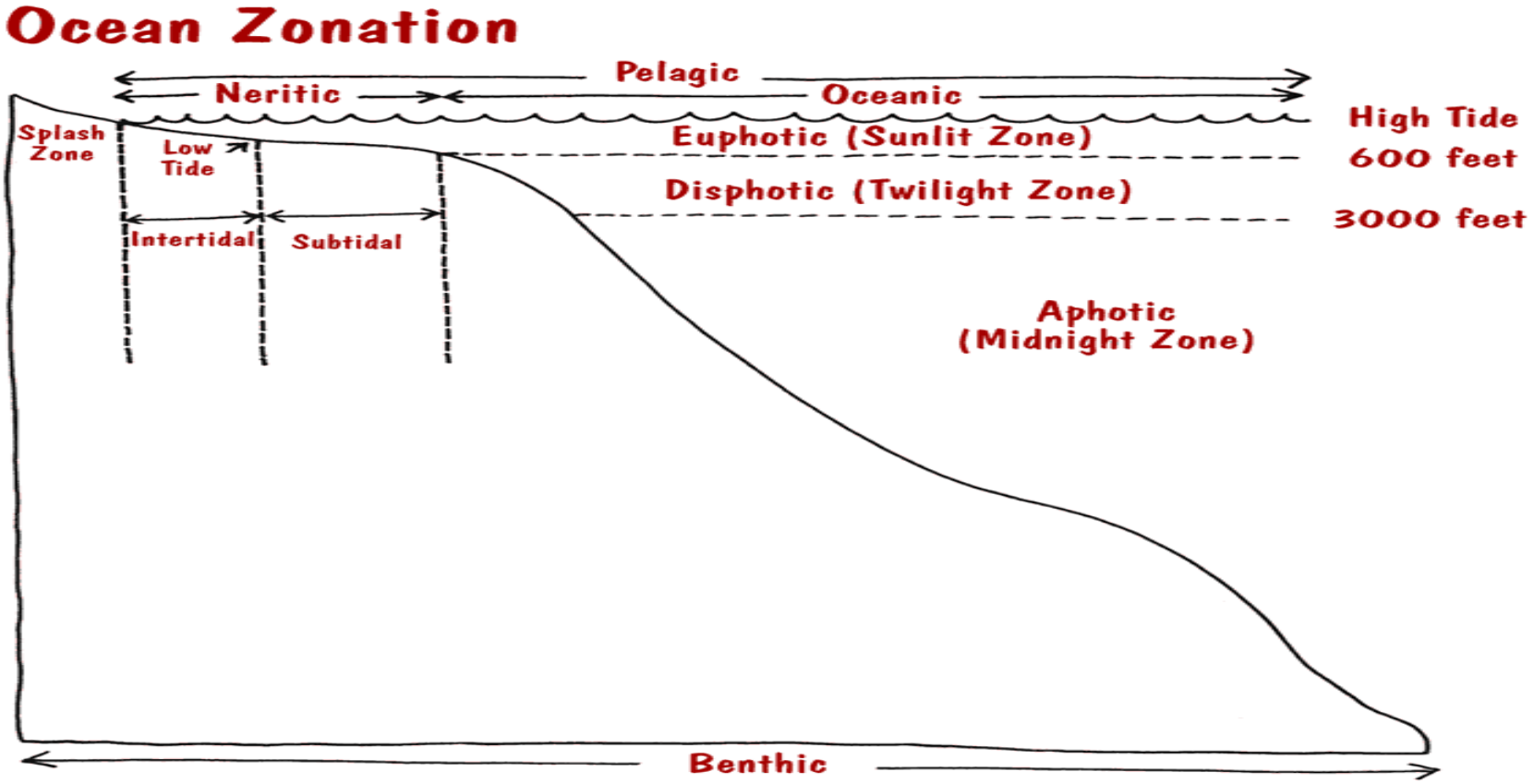
Well oxygenated,no.of animals are less.

1.It is fresh,flowing water,DO is high,rich in nutrients.

Marine ecosystems:(Ocean ecosysytem)

Ocean

- 70% of the earth's surface
- zones



- The ocean bottom is the **benthic zone**
- water itself (or the water column) is the **pelagic zone**.
- **neritic zone** is that part of the pelagic zone that extends from the high tide line to an ocean bottom less than 600 feet deep.
- Water deeper than 600 feet is called the **oceanic zone.**
- **sunlit zone**, enough light penetrates to support photosynthesis.
- **Twilight zone** where very small amounts of light penetrate.
- Ninety percent of the space in the ocean lies in the **midnight zone** which is entirely devoid of light.

ESTUARINE ECOSYSTEM:

An estuary is a partially enclosed coastal area at the mouth of river, where river joins the sea.

Characteristic:

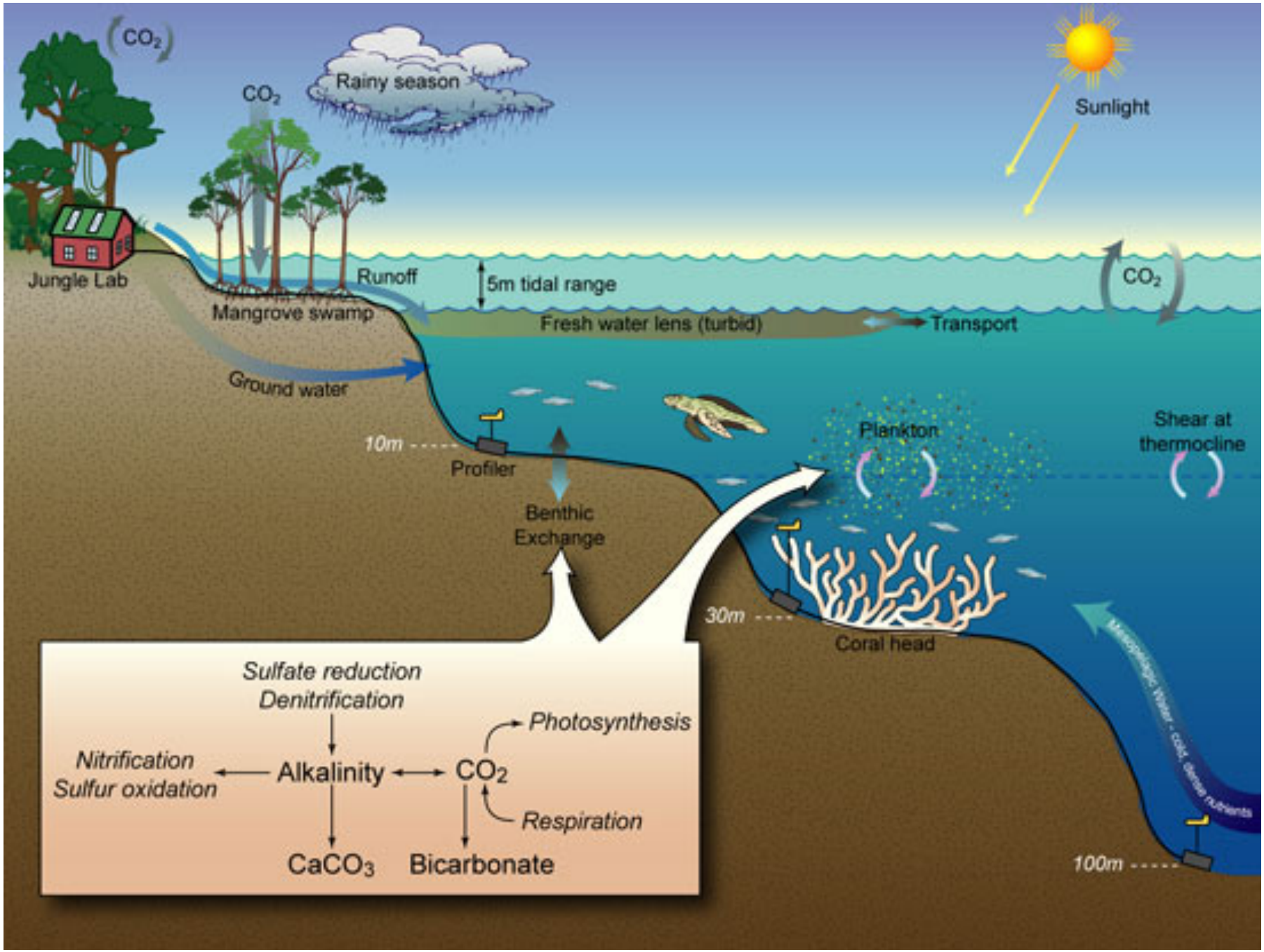
1.Estuaries are transition zone.

2.Water characteristic are periodically changed.

3.The living organism in this ecosystem have tolerence.

4.Salinity is highest during the summer

5.Salinity is lowest during the winter.


CO_2
CO_2
Rainy season
Sunlight
Jungle Lab
Runoff
5m tidal range
CO_2
Mangrove swamp
Fresh water lens (turbid)
Transport
Ground water
10m
Profiler
Plankton
Shear at thermocline
Benthic Exchange
30m
Coral head
Sulfate reduction
Denitrification
Photosynthesis
Nitrification
Sulfur oxidation
Alkalinity
CO_2
Respiration
$CaCO_3$
Bicarbonate
100m

STRUCTURE OF AQUATIC ECOSYSTEM

- ABIOTIC COMPONENTS:

  Climate factors(Temp,light,water,organic and inorganic compounds.

- BIOTIC COMPONENTS:

  1.Producers: phytoplankton

  2.Consumers:

  Primary consumers : zooplankton

  Secondary consumers : small fish

  Tertiary consumers : big fish

  3.Decomposers: Bacteria,fungi