OUR ENVIRONMENT

ECOSYSTEM, FOOD WEB, BIOMAGNIFICATION

Our Environment

Environment

Environment is the surrounding which includes biotic and abiotic components.

Biotic Components

Biotic components include living organisms like, plants, animals and microbes

Abiotic Components

Abiotic components include non-living physical factors like air, water, soil, sunlight, temperature etc.

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Environmental Pollution

Any undesirable change that occurs in the physical, chemical and biological characteristics of air, water or soil, which affect any living organism directly or indirectly is called environmental pollution.

Pollutants

The substances or chemicals that cause pollution are called pollutants.

Ecosystem

All the interacting organisms in an area together with the non-living components of the environment form an ecosystem.

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Classification of Materials

Biodegradable Materials	Non-Biodegradable Materials
They can be easily decomposed by microbes.	They cannot be easily decomposed by microbes.
They are obtained from living beings (Plants and animals).	They are man-made materials.
Harmful if accumulates in large volumes.	Harmful as they enter the food chains.
Eg., Paper, dung, leather.	DDT, glass, plastic, detergent.

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Ecosystems

- Natural Ecosystems
  - Forests
  - Ponds
  - Lakes
- Artificial Ecosystems
  - Gardens
  - Crop- fields
  - Aquarium

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Biotic Components of the ecosystem

- Producer
- Consumer
  - Primary consumer → Herbivore
  - Secondary Consumer → Primary Carnivore
  - Tertiary Consumer → Secondary Carnivore
  - Top Consumer → Top Carnivore / Omnivore
- Decomposer

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Abiotic components of the Ecosystem

- Air
- water
- Soil
- Sunlight
- Temperature

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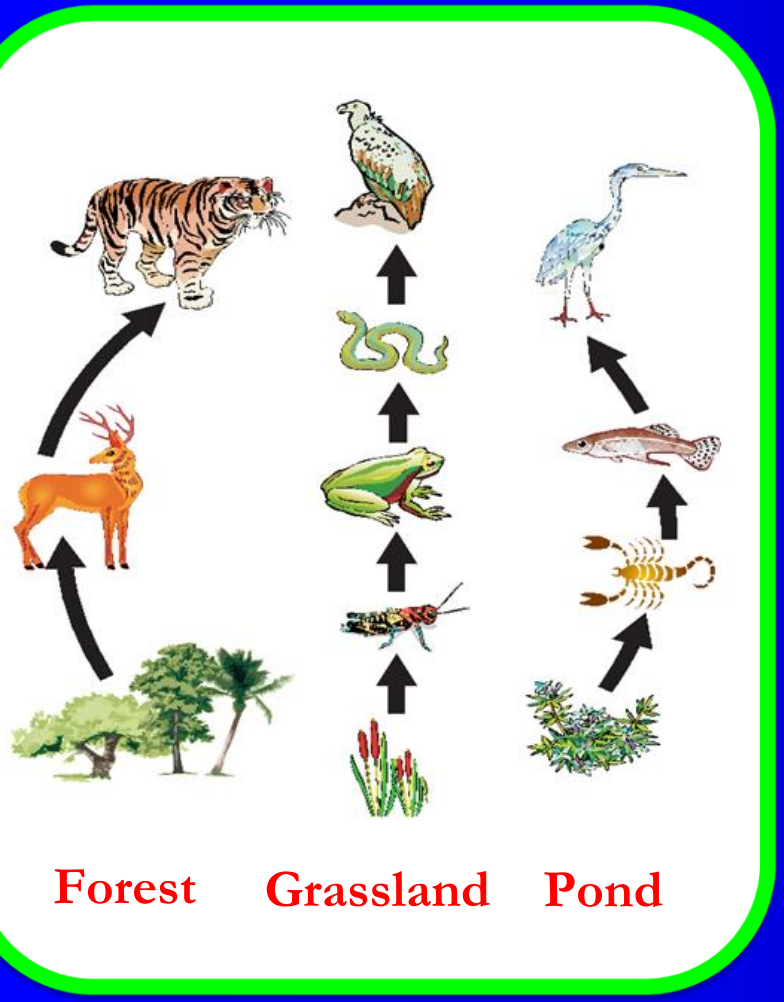
Food chain and Food web

Food Chain



A series of organisms feeding on one another, taking part at various biotic levels form a food chain.

It can also be defined as follows.

The sequential flow of energy from one organism to the other is called food chain.

No food chain operates in isolation. So it is less real in nature.

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Food Chains

Paddy → Man — 2 Trophic levels

Grass → Deer → Tiger — 3 Trophic levels

Plants → Mouse → Snake → Eagle — 4 Trophic levels

Grass → Grasshopper → Frog → Snake → Hawk

Grass → Grasshopper → Frog → Snake → Peacock

5 Trophic levels

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Food Chain

Grass	Grasshopper	Frog	Snake	Hawk
Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer	Top Consumer
Green Plant	Herbivore	Primary Carnivore	Secondary Carnivore	Top Carnivore

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Food Chain

Grass	Grasshopper	Frog	Snake	Peacock
Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer	Top Consumer
Plants	Herbivore	Primary Carnivore	Secondary Carnivore	Omnivore

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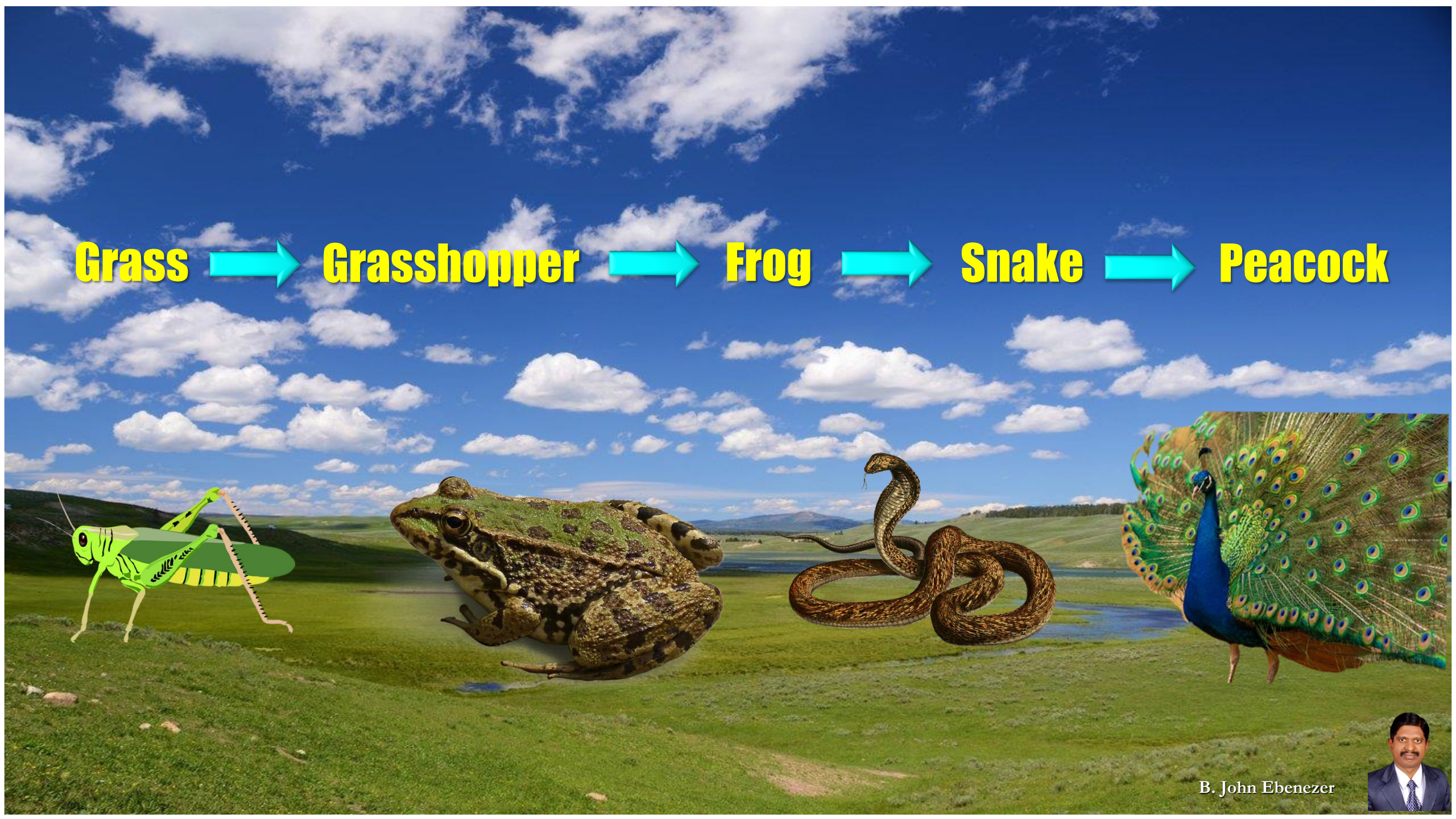
Grass → Grasshopper → Frog → Snake → Peacock



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Herbivores

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Carnivore

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Food Chain

All animals depend on plants (directly or indirectly) for their food.

Hence they are called **consumers.** All the consumers are **heterotrophs**.

The primary consumers are always **herbivores**.

Some common herbivores are insects, birds and mammals in terrestrial ecosystem and molluscs in aquatic ecosystem.

The animals which feed on the primary consumers are called **secondary consumers.**

The animals which feed on the secondary consumers are called **tertiary consumers.**

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Food Chain

Grass	Grasshopper	Frog	Snake	Peacock
Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer	Top Consumer
Plants	Herbivore	Primary Carnivore	Secondary Carnivore	Omnivore

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Trophic Levels

Each step or level of the food chain forms the trophic level.

The autotrophs or producers are at the first trophic level.

They fix the solar energy and make it available for heterotrophs or the consumers.

The herbivores or the primary consumers form the second trophic level.

Small carnivores or the secondary consumers form the third trophic level.

Larger carnivores or the tertiary consumers form the fourth trophic level.

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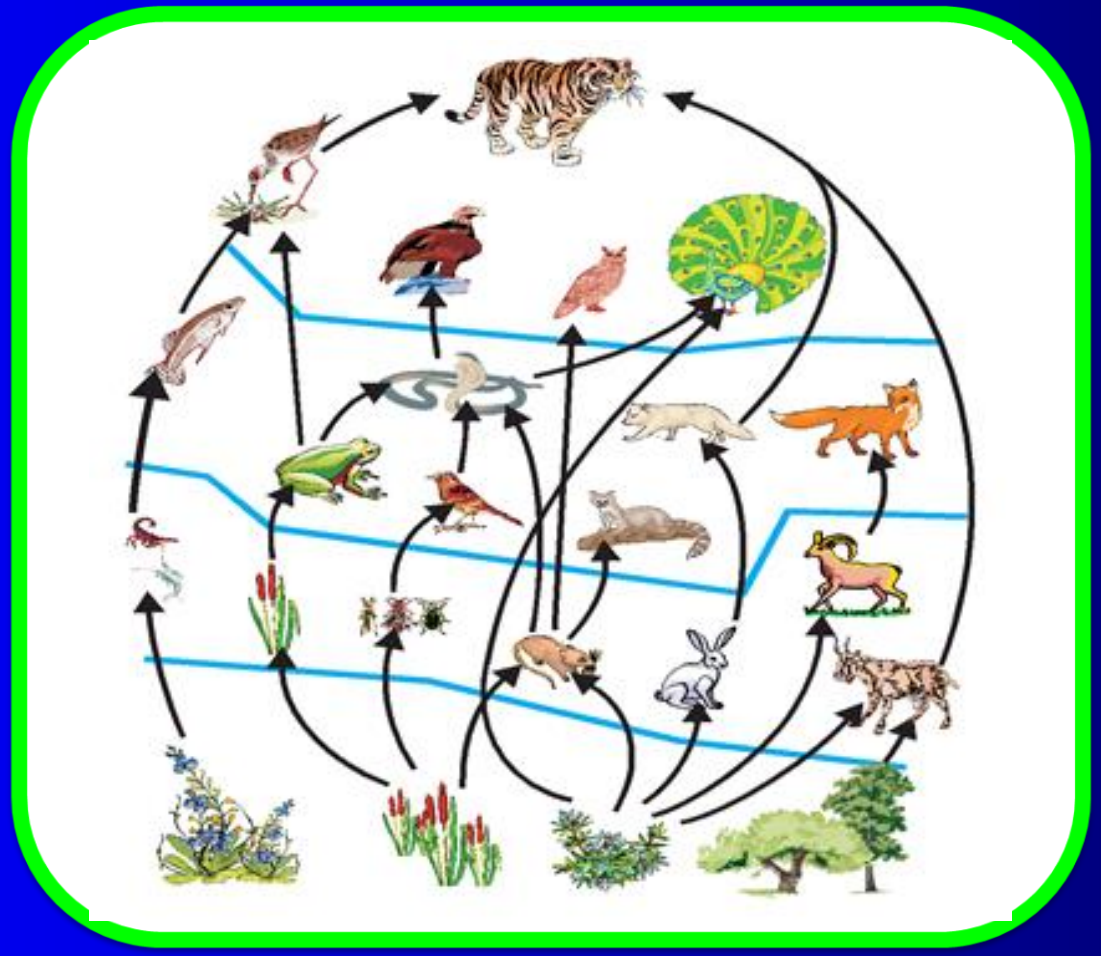
Food web

The interconnected matrix of food chains in an ecosystem is called food web. Food webs are really operating in nature.



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Difference between Food chain and Food web

Food chain	Food web
A series of organisms feeding on one another, taking part at various biotic levels form a food chain.	The interconnected matrix of food chains in an ecosystem is called food web.
No food chain is operating in isolation. So it is less real in nature.	Food webs are really operating in nature.

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Ten Percent Law

Lindeman's 10% Law

The amount of energy flows from one trophic level to the other is only 10%. Some of the energy is utilized for the metabolism of the organism and the remaining energy is lost in the form of heat and light.

There are food chains with 2, 3, 4 and 5 trophic levels.

Food chain with a maximum of five trophic levels only can exist in nature, because the amount of energy reaches the top consumer is very less.

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Food Chain

Plants use only 1% of solar energy for photosynthesis.

The amount of energy flows from one trophic level to the other is 10%. In the following food chain;

Grass produces 1000 Joules of energy.

Deer receives100 Joules of energy. (10%)

Lion receives 10 Joules of energy. (10%)

Sun

1 %

Grass → **Deer** → **Tiger**

1000 J 100J 10J

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Food chain

Grass → Deer → Tiger

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Food chain

Sun

1 %

Plants produce 75,000 kilojoules of energy. (10%)

Mouse receives 7,500 kilojoules of energy. (10%)

Snake receives 750 kilojoules of energy. (10%)

Eagle receives 75 kilojoules of energy. (10%)

Plants → **Mouse** → **Snake** → **Eagle**

75,000 kJ 7,500 kJ 750 kJ 75 kJ

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Ecological Pyramids

Ecological Pyramids

The graphical representation of a food chain is called ecological pyramid.

The graphical representation of a food chain that shows the **number of individuals** present at each trophic level, is called pyramid of number.

The graphical representation of a food chain that shows the **amount of biomass** available at each trophic level, is called pyramid of biomass.

The graphical representation of a food chain that shows the **amount of energy** available at each trophic level is called pyramid of energy.

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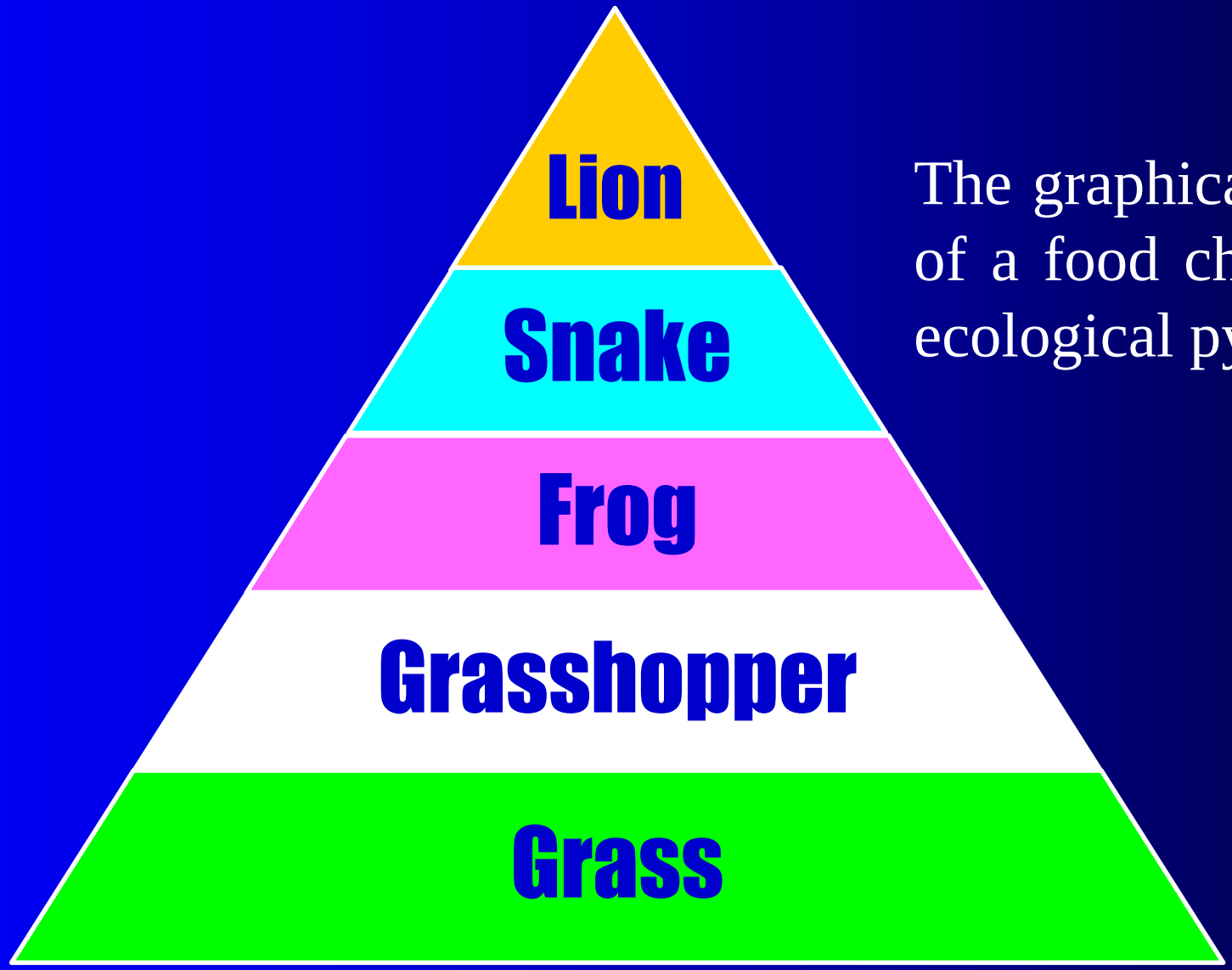
Ecological Pyramid



The graphical representation of a food chain is called an ecological pyramid.

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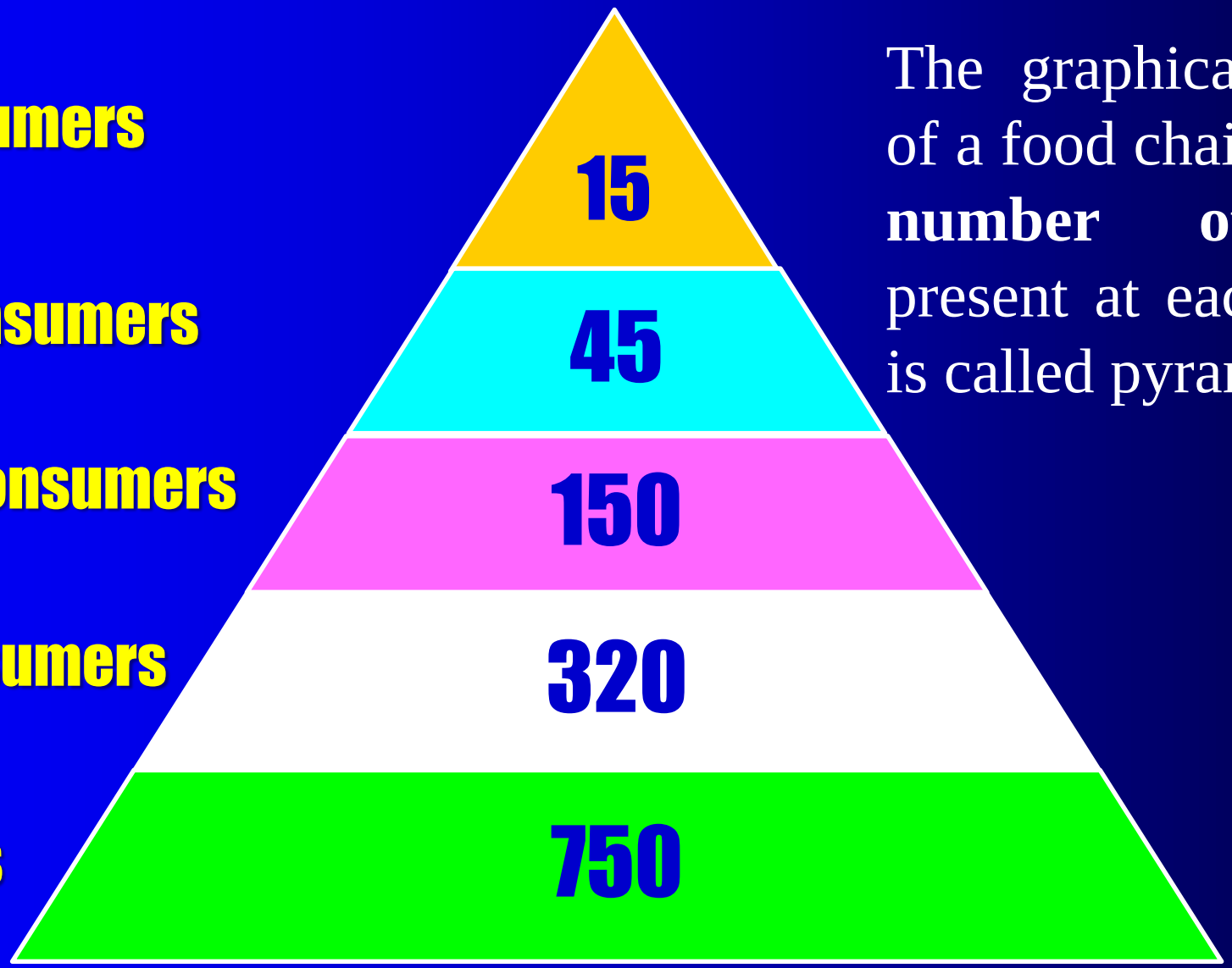
Pyramid of Number



The graphical representation of a food chain that shows the **number of individuals** present at each trophic level, is called pyramid of number.

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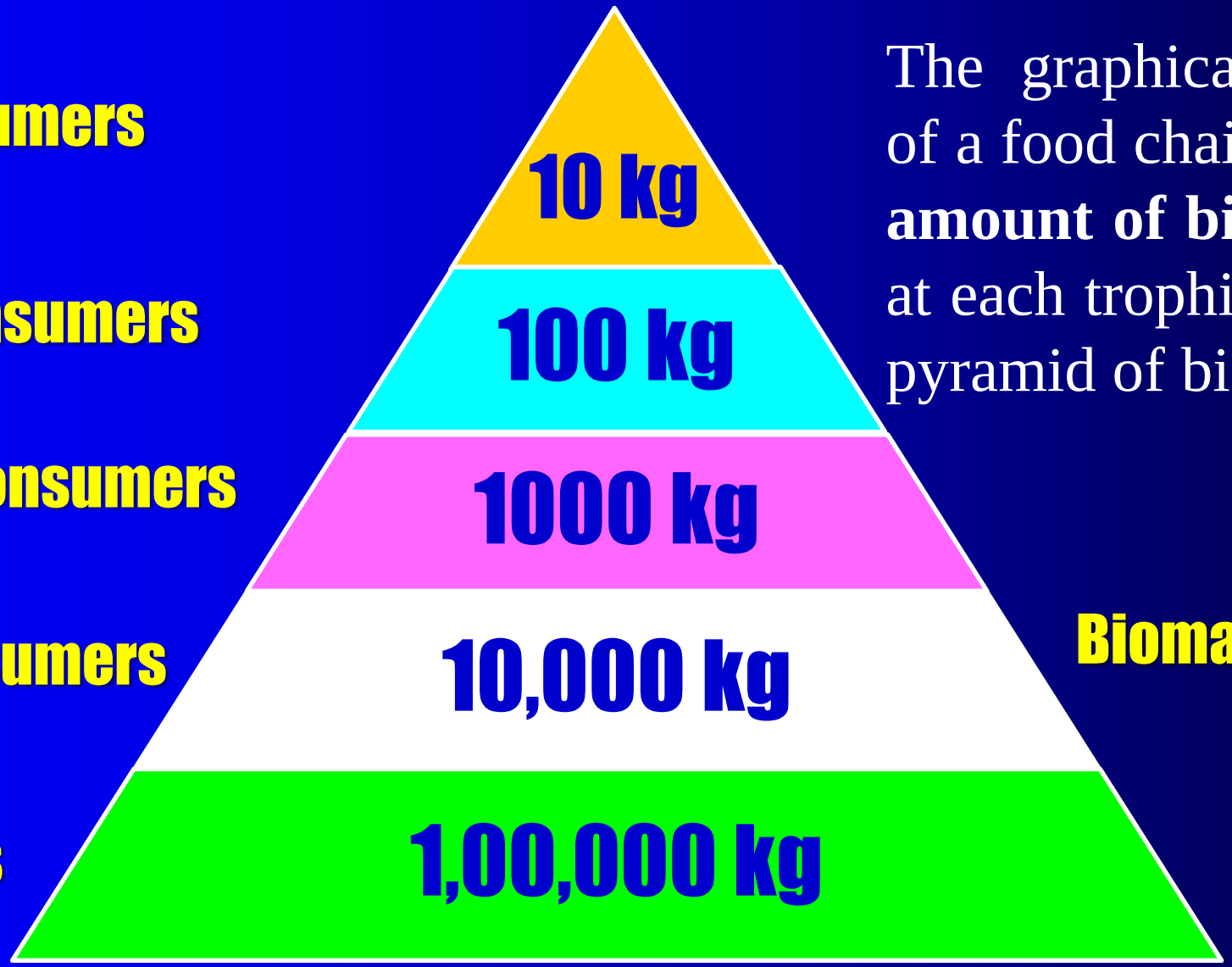
Pyramid of Biomass



The graphical representation of a food chain that shows the **amount of biomass** available at each trophic level, is called pyramid of biomass.

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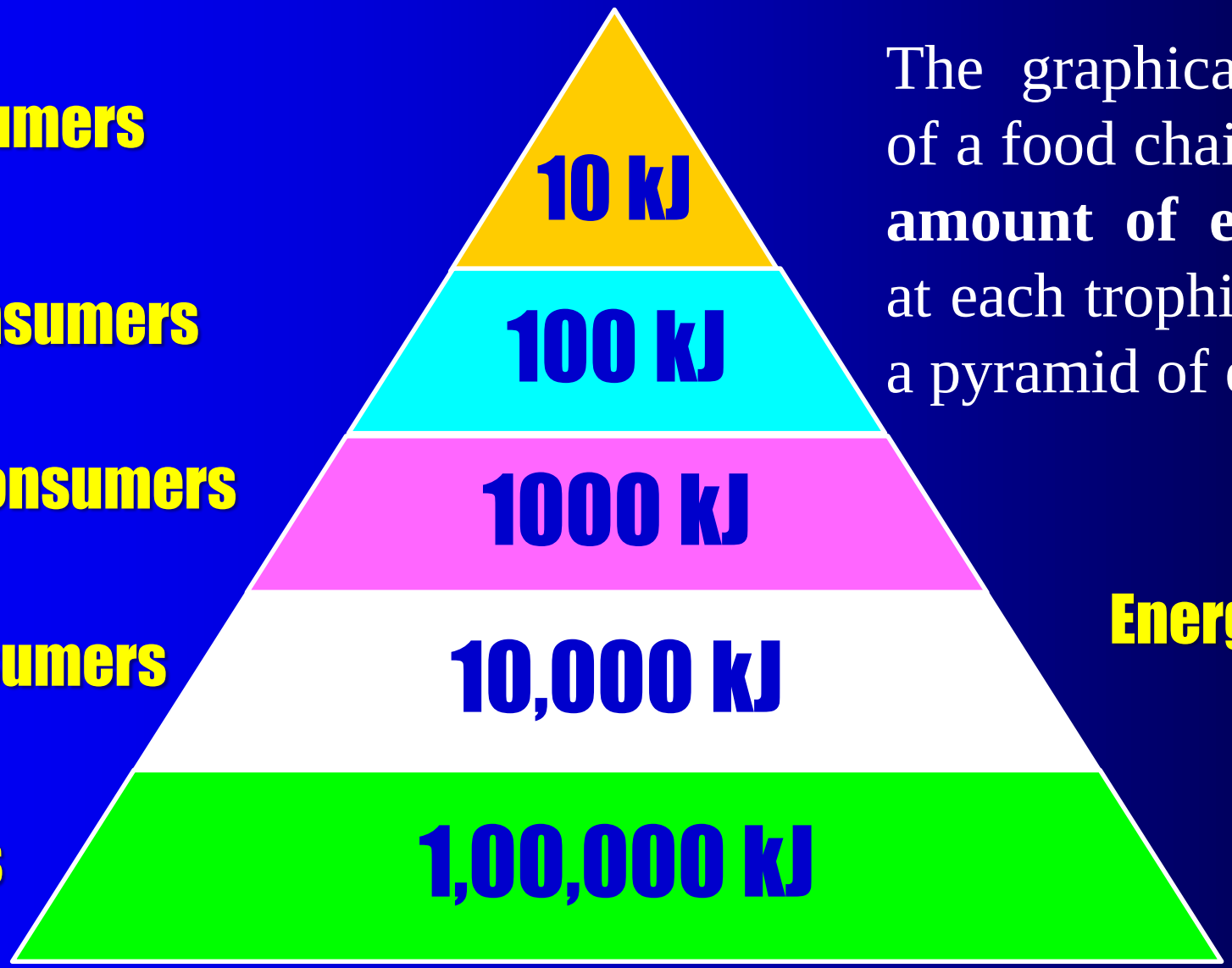
Pyramid of Energy



The graphical representation of a food chain that shows the **amount of energy** available at each trophic level, is called a pyramid of energy.

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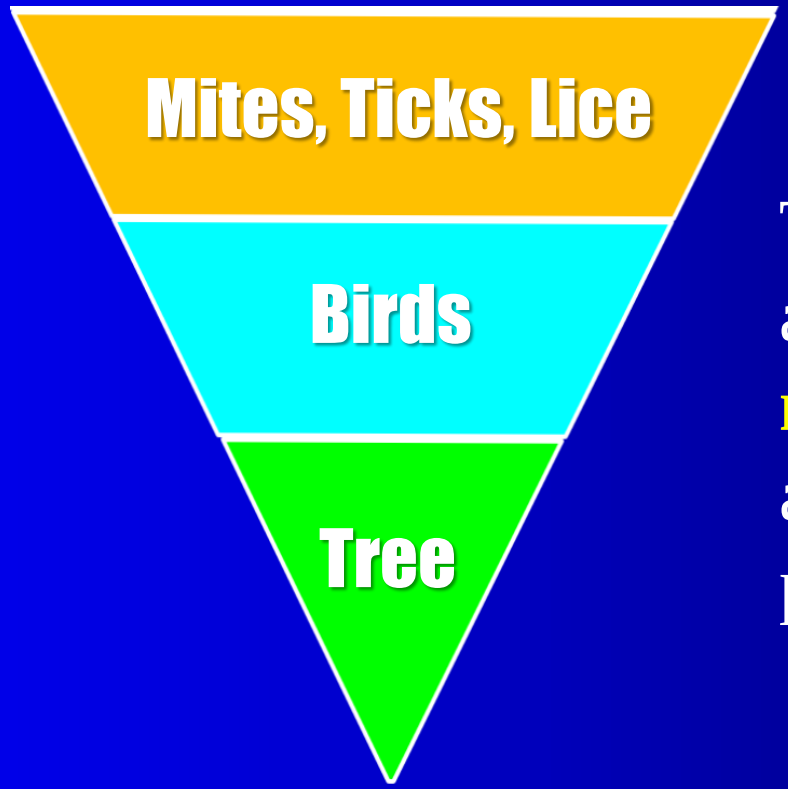
Inverted Pyramid of Number of a Tree Ecosystem

Parasites

Herbivores

Producer



The graphical representation of a food chain that shows the **number of individuals** present at each trophic level, is called a pyramid of number.

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Inverted Pyramid of Biomass of an Aquatic Ecosystem

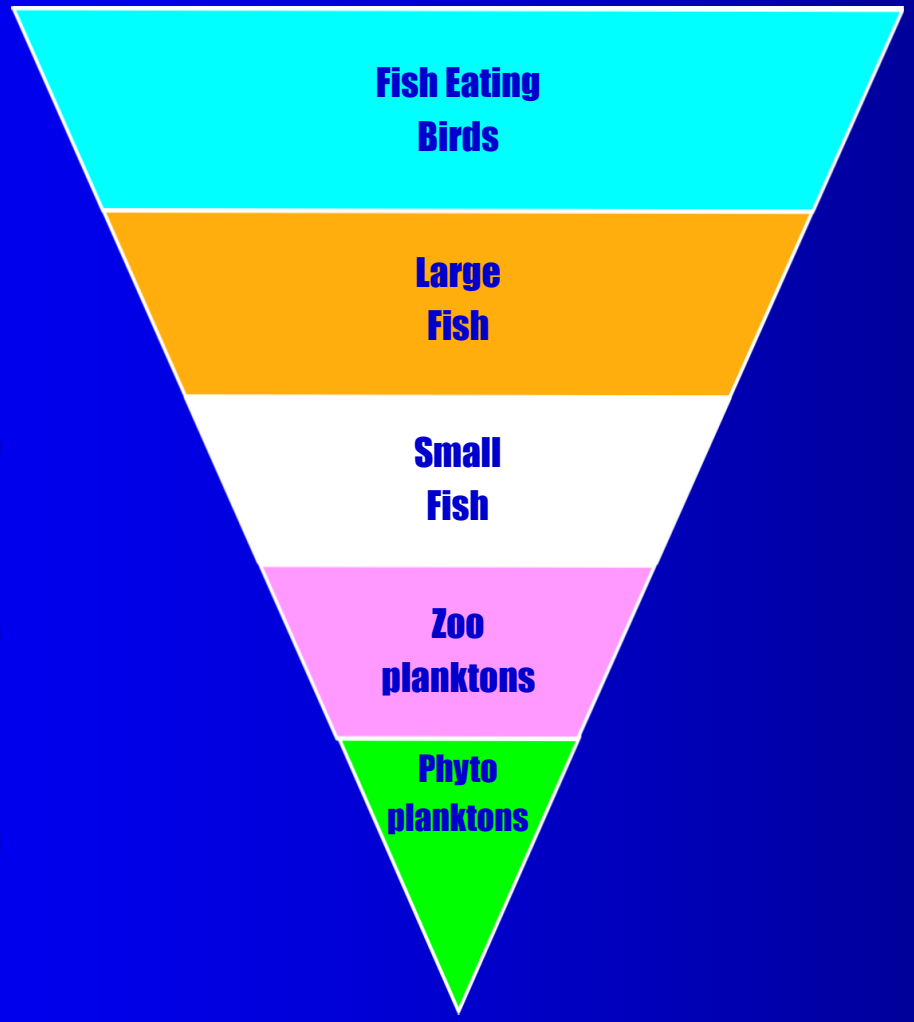
Top Consumer

Tertiary Consumer

Secondary Consumer

Primary Consumer

Producer



The graphical representation of a food chain that shows the **amount of biomass** present at each trophic level, is called a pyramid of biomass.

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Biomagnification

Biomagnification

The pesticides which are used in the crop fields, are carried by the run-off water, reaches the water bodies.

The concentration of pesticides increases at each trophic level.

The increase in the amount of toxic chemicals at each trophic level of a food chain is known as biomagnification.

This is the reason why our food grains such as wheat, rice, fruits and vegetables and even meat, contain varying amounts of pesticide residues.

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Biomagnification

The concentration of DDT becomes higher in higher trophic levels.

This happens because DDT is a non-biodegradable and a **fat-soluble** chemical which accumulates in the fatty tissues of the animals, and is not excreted out.

As human beings occupy the top level in any food chain, the maximum concentration of these chemicals get accumulated in our bodies.

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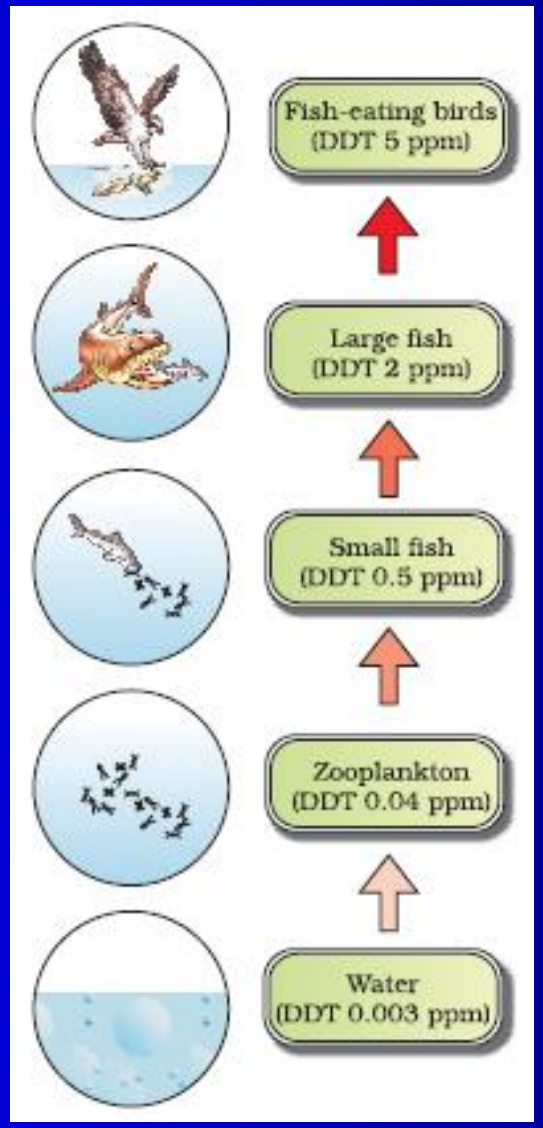
Biomagnification



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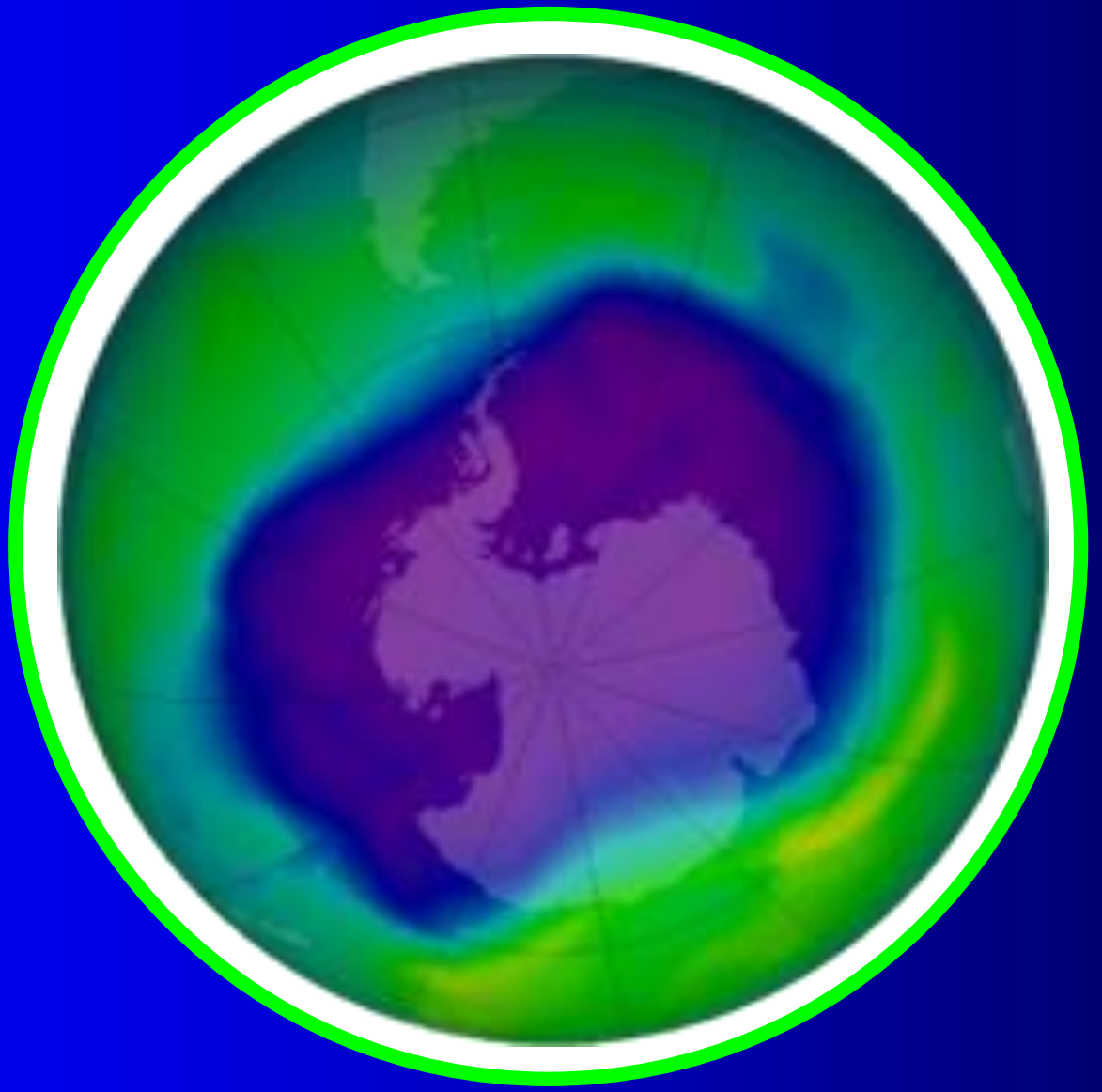
Ozone Depletion

Ozone Depletion



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Ozone Depletion

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Ozone Depletion

Ozone (O_3) is a molecule formed by three atoms of oxygen.

It protects the earth from ultraviolet (UV) radiation from the Sun.

Ozone is a product of UV radiation acting on oxygen (O_2) molecule at the higher levels of the atmosphere (Stratosphere).

The higher energy UV radiation splits some molecular oxygen (O_2) into free oxygen (O) atoms.

One molecule of O_2 and single oxygen atom (O) join together to form one molecule of ozone.

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Ozone Depletion

CFCs prevent the formation of ozone molecules and hence cause ozone depletion.

$$O_2 \xrightarrow{UV} O + O$$

$$O_2 + O \longrightarrow O_3 \quad \text{Ozone}$$

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Causes of Ozone Depletion

Causes of Ozone Depletion

Chlorofluorocarbons (CFCs) are used as refrigerants in cooling devices such as ACs and Refrigerators.

They are used as propellants in fire extinguishers and spray cans.

The amount of ozone in the atmosphere began to reduce in the 1980s.

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Air Conditioners and Refrigerators

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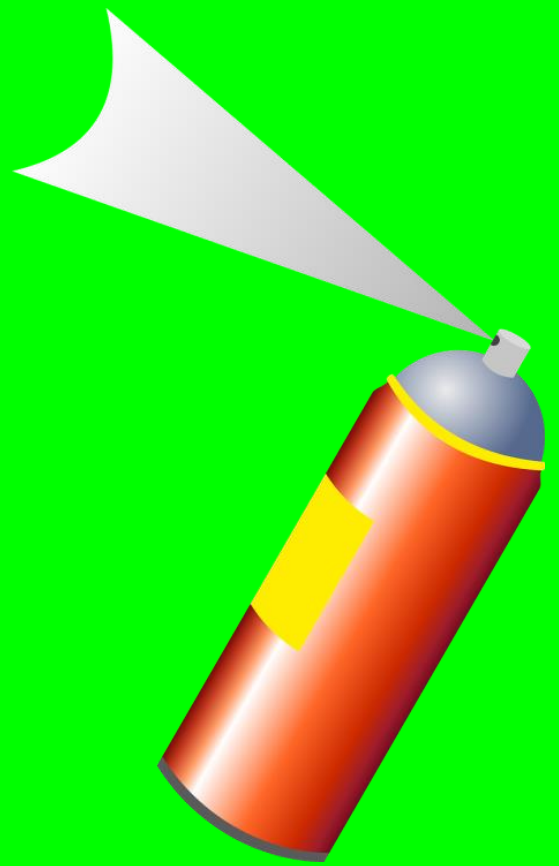
Aerosols



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Effects of Ozone Depletion

Harmful Effects of Ozone Depletion

Ozone depletion leads to the entry of UV Radiation.

UV radiation causes

- Skin cancer.
- Cataract in eyes.
- Photo-aging (Light induced aging)
- Weakening of immune system.
- Affects the life of plants.

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Prevention of Ozone Depletion

Prevention

Don’t use devices that contain CFC (Chlorofluorocarbons).

Use only Eco friendly ACs, Fridges and Cooling devices which contain HFC (Hydrofluorocarbons).

Use only CFC free spray cans.

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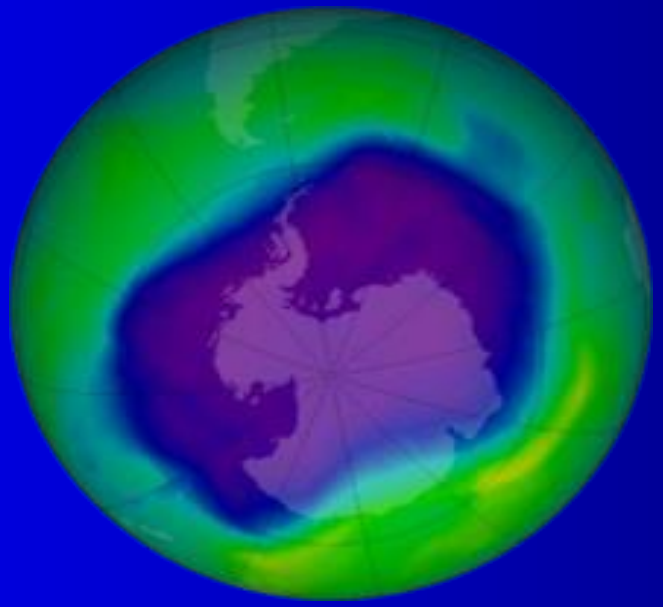
SAY GOOD BYE TO CFC!



SAY WELCOME TO HFC!!

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Garbage Management

Garbage Management

Improvements in our **life-style** have resulted in generation of greater amount of waste materials.

Changes in **attitude** have resulted in using much more disposable things.

Changes in **packaging** have resulted in much of our waste becoming non-biodegradable.

Prevention:

Reduce the use of disposable things.

Use only biodegradable materials for packaging

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God Bless You!