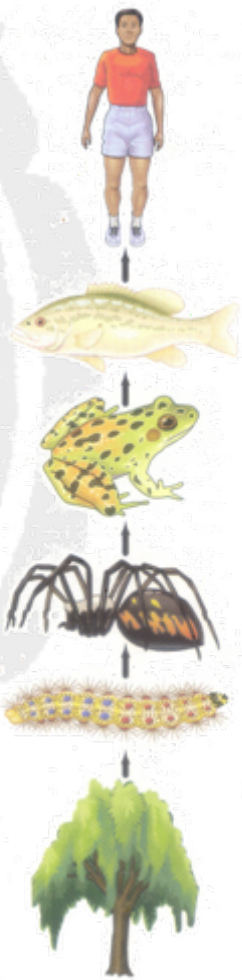
Unit 3 Lecture 3
Food chain, food web, ecological pyramid

- Definition of food chain

The transfer of food energy from the source in plants through a series of organisms with repeated eating and being eaten is referred to as the food chain



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Food chain, food web and ecological pyramid

- The various steps in a food chain are called **trophic levels**
- The autotrophic plants are known as **producers**
- The producers are directly eaten by the herbivores, which are called **primary consumers**
- The next step in the food chain is occupied by **secondary consumers (primary carnivores)**
- A step above this remains occupied by **tertiary consumers (secondary carnivores)**
- These final elements are the **decomposers**

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Food chain, food web and ecological pyramid

- Types of food chain

  Mainly, there are two types of food chains

1. Grazing food chain, classified as
   - Predator Chain
   - Parasitic chain
2. Detritus food chain

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Food chain, food web and ecological pyramid

- Grazing food chain

Gross production in plants –

(1) May be oxidized in respiration

(2) May be eaten by herbivores

(3) May die and decay

The disposition of energy in herbivores follows three routes:

Respiration

Decay of organic matter by decomposers

Consumption by carnivores

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Thus, the energy flow through grazing food chain is as follows:

Autotrophs (Primary Producer) →	Herbivores (Primary Consumer) →	Primary Carnivore (Secondary consumer) →	Secondary Carnivore (Tertiary consumer)

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- The grazing food chain is of two types, namely,

(1) Predator chain here one animal captures and devours another animal. The animal, which is being eaten, is called prey and the animal, which eats it, is called predator.

(2) Parasitic chain – the plants and animals of the grazing food chain are infected by parasites.

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Detritus food chain – the organic wastes, exudates and dead matter derived from the grazing food chain are usually called detritus.

It has the following characteristics:

1. In some ecosystems more energy flows through the detritus food chain than through the grazing food chain

2. In the detritus food chain the energy flow remains as a continuous passage rather than as a stepwise flow between discrete entities

3. Energy storage for detritus food chain may be largely external to the organisms and the detritus itself.

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❑ Link between grazing and detritus food chain

The two main food chains cannot operate independently. They are interconnected at various levels. The stability of the ecosystem is directly proportional to the number of such links. The detritus feeders obtain energy from the dead bodies of plants and animals, which are components of the grazing food chain. Again, some of the detritus feeders are eaten by the consumers of the grazing food chain. For e.g., in a pond ecosystem earthworms belonging to the detritus food chain are eaten by fishes belonging to the grazing food chain.

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❑ Significance of food chain

Food chain studies help in:

- Understanding the feeding relationships and the interaction between the organisms in any ecosystem.
- Apprehending the energy flow mechanism and matter circulation in ecosystems,
- Understanding the movement of the toxic substances in the ecosystem and understanding the problem of biological magnification

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Food Web In an ecosystem, the various food chains are interconnected with each other to form a network. The interlocking of many food chains is called food web

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Food chain, food web and ecological pyramid

1. Grass → Grasshopper → Hawk
2. Grass → Grasshopper → Lizard → Hawk
3. Grass → Rabbit → Hawk
4. Grass → Mouse → Hawk
5. Grass → Mouse → Snake → Hawk

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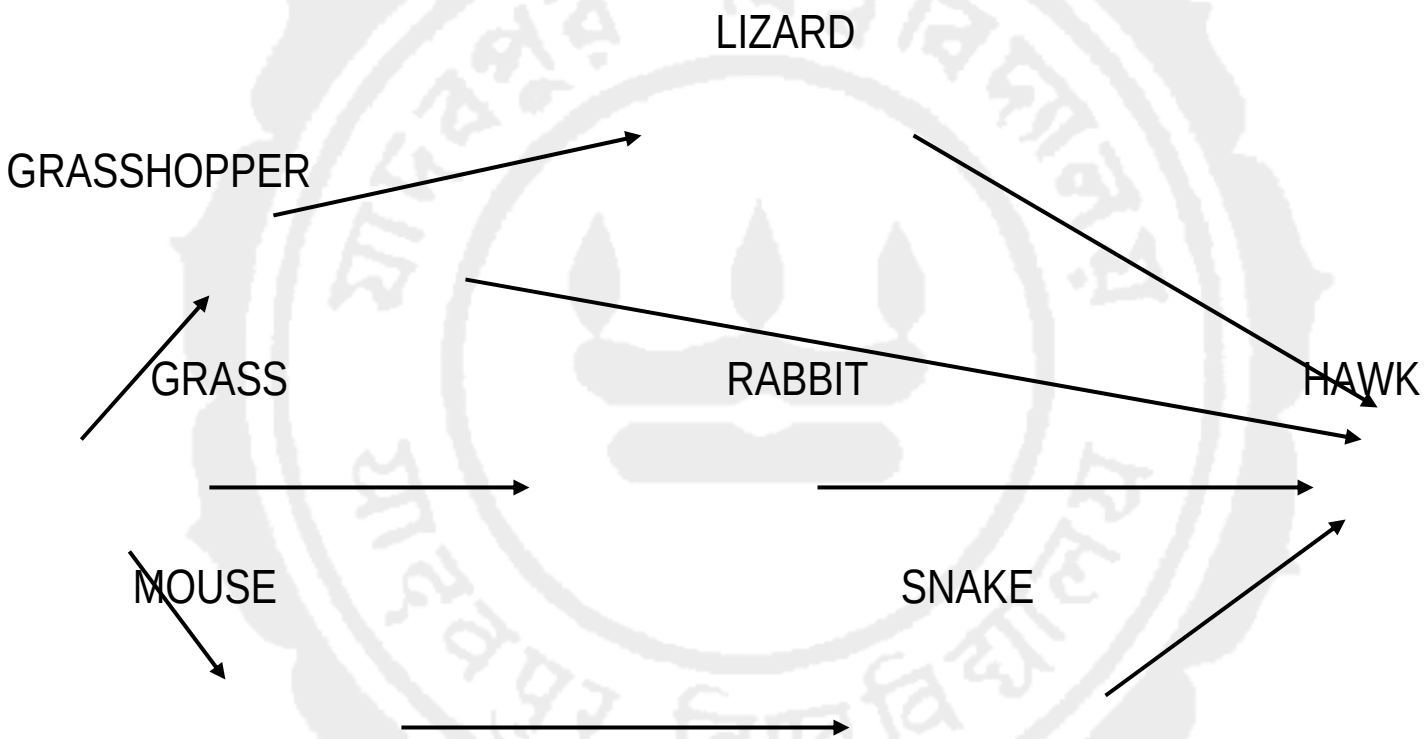
Food chain, food web and ecological pyramid



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❑ Significance of food web

Food webs are very important in maintaining the stability of an ecosystem. For e.g., the deleterious growth of grasses is controlled by the herbivores. When one type of herbivore becomes extinct, another type increases in number and control the vegetation.

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❑ Ecological Pyramids

The interaction of the food chain phenomenon and size-metabolism relationship result in communities having a definite trophic structure.

There are three types of ecological pyramids:

1. The pyramid of number
2. The pyramid of biomass
3. The pyramid of energy

❑ Significance of Ecological Pyramids

As graphic devices, ecological pyramids may be used to illustrate quantitative relationships in specific parts of the ecosystem in which one might have a special interest for e.g., predator-prey or host-parasite groups.

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- **The pyramid of number**

  It depicts the number of individual organisms at different trophic levels of food chain.

- **Inverted pyramid of number**

  In food chain involving parasites, the pyramid of number is reversed for the successive steps of parasite dependency and the parasites are more numerous than their hosts.

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❑ The pyramid of biomass

The total weight of living matter per unit area of an ecosystem is called biomass. The pyramid of biomass indicates gradual decrease of biomass in each tropic level and from the base to apex.

Example: In grassland the biomass of grasses is maximum and it gradually decreases towards the consumer level in the following order:

Grass → Mouse → Snake → Hawk

Grass → Grasshopper → Lizard → Hawk

Example: In Forest the biomass of trees is maximum and the biomass of the top carnivores is the minimum. The decrease of biomass occurs in the following order:

Plants → Deer → Fox → Tiger

Plants → Rabbit → Fox → Tiger

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- Inverted pyramid of biomass

If organisms of lower levels average much smaller than those of higher levels, the biomass pyramid may be inverted.

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- **The pyramid of energy**

  When production is considered in terms of energy, the pyramid indicates not only the amount of energy flow at each trophic level but also the actual role of various organisms in the transfer of energy.

  Example: in a pond, maximum energy is trapped by phytoplankton. Then the amount of energy decreases towards the top consumer level.

  Phytoplankton $\rightarrow$Zooplankton $\rightarrow$ Small fish $\rightarrow$ Large fish