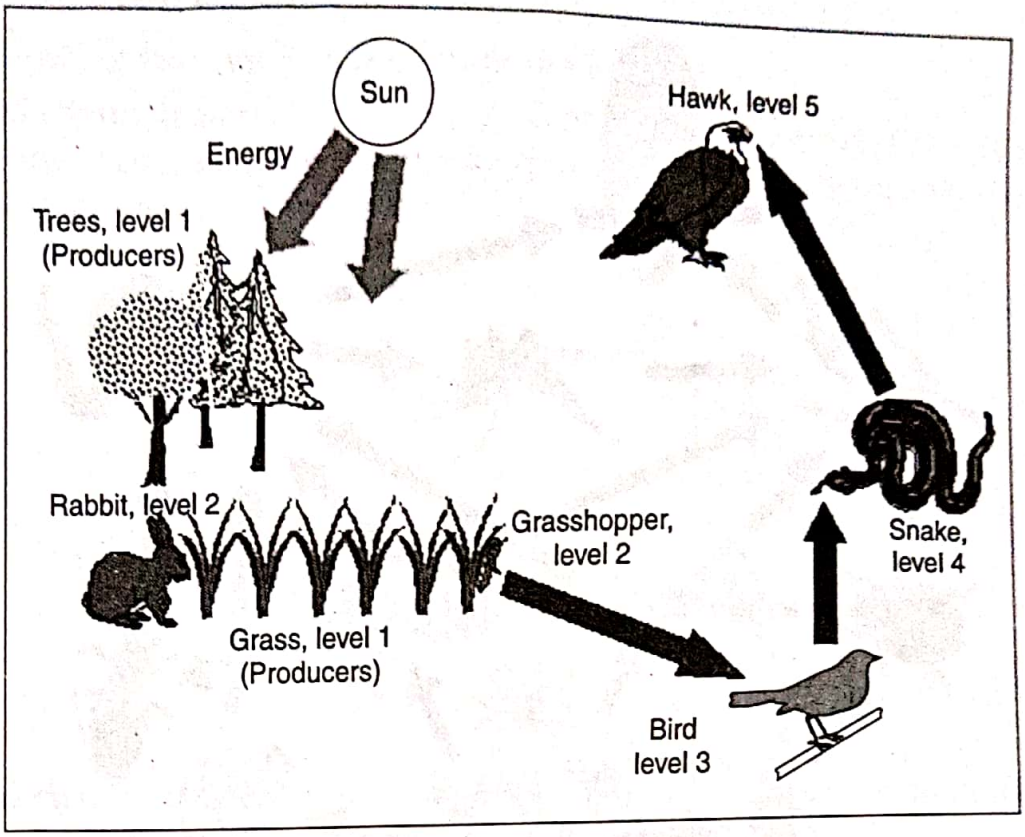

Fig. 2.7 *Trophic level*

Third Trophic Level

Carnivores which are secondary consumers fall in this category. They depend on primary consumers for their food energy.

Fourth Trophic Level

Omnivores which may be tertiary consumers fall in this category. They depend upon secondary consumers for energy.

Trophic classification does not employ the categorization of species. All organisms taking food in same number of steps come under the same trophic level. According to the source of food assimilated, a given species may occupy one, two or more trophic levels.

2.5 ECOLOGICAL PYRAMIDS

Ecological pyramids are the diagrammatic representation of trophic structure in which the trophic levels are depicted in successive stages.

2.5.1 Types of Ecological Pyramids

There are three types of ecological pyramids:

Pyramids of numbers: The numbers of individual organism at different trophic levels in an ecosystem are depicted. The length of the bar at different levels represents the number of organisms at that particular trophic level. It is expressed in number per unit area (Fig. 2.8).

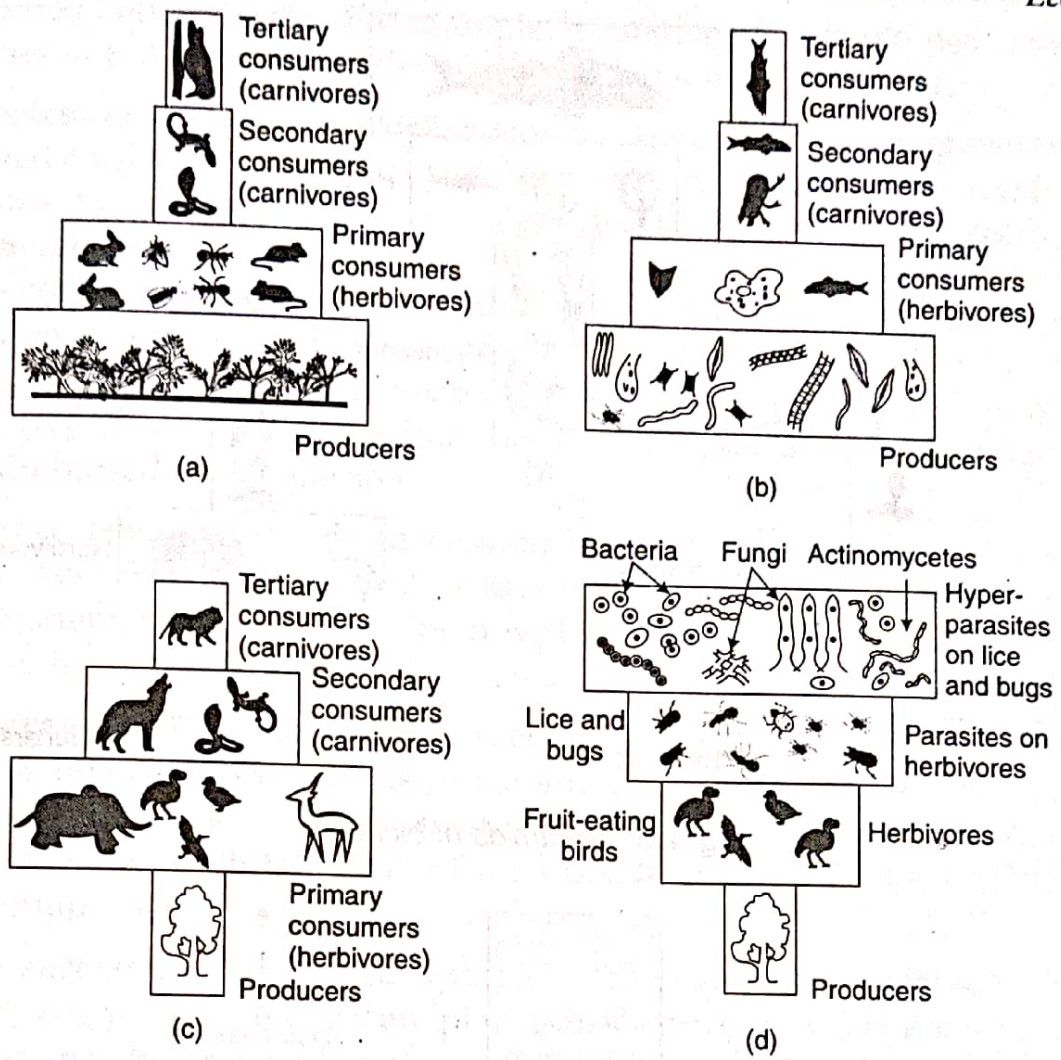

Fig. 2.8 *Pyramids of numbers*

Pyramids of biomass: It is based on the total dry weight of the total amount of living matter. It is expressed in gram per unit area (Fig. 2.9).

Pyramid of energy: When the production of a community is measured in terms of energy, it is known as pyramid of energy. It is expressed in calorie per unit area per year. There is always a gradual decrease in energy content at successive level from the producers to consumers.

2.6 ECOLOGICAL SUCCESSION

It means ecological development. It refers to the process of gradual change in conditions of environment and the replacement of older species over the time undergoes automatically. The occurrence of ecological succession has following characteristics:

(i) It is a systematic process that involves changes in species structure.

(ii) The changes are directional and take place as a function of time.

(iii) The succession occurs due to changes in physical environment and population at the species.

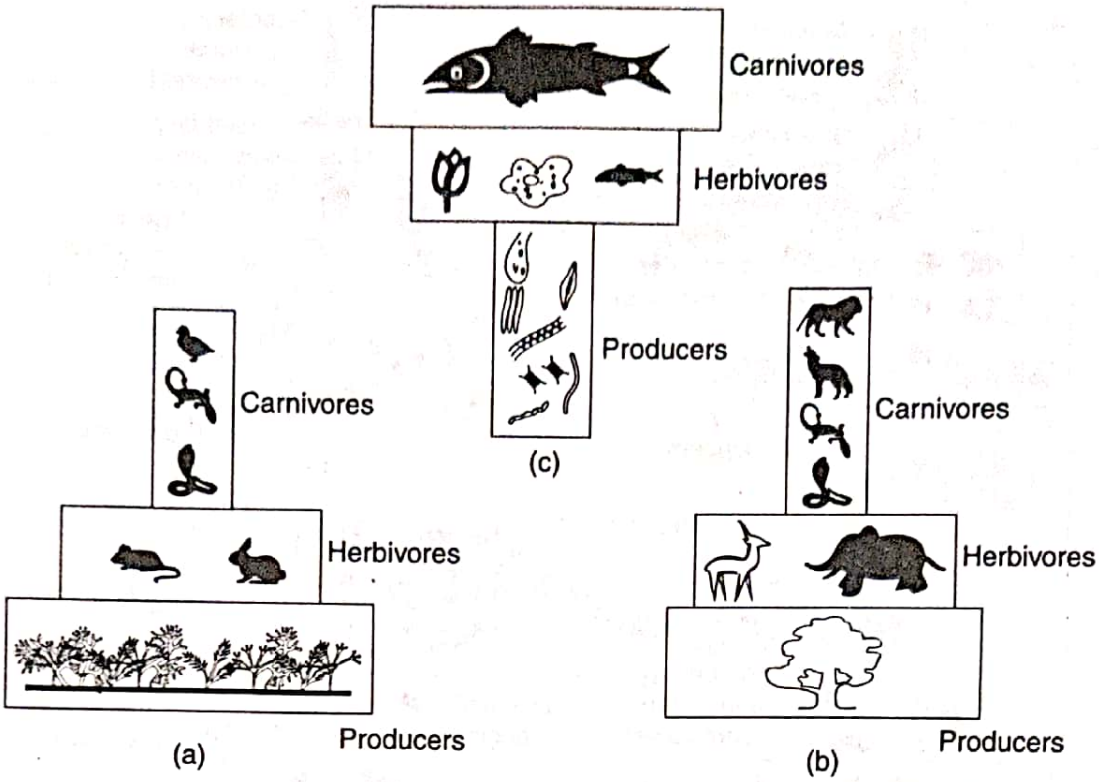

Fig. 2.9 *Pyramids of biomass*

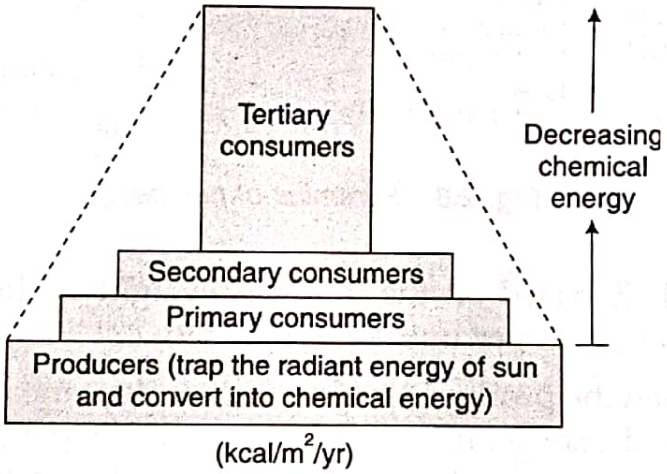

Fig. 2.10 *Pyramids of energy*

(iv) The changes also occur due to population explosion of the species.
(v) The changes are predictable.

2.6.1 Types of Succession

There are following two types of succession:

Primary succession: This is the initial stage of development of an ecosystem. It begins with the creation (birth) of a community (species) on such a location, which was previously unoccupied by any living organism. Such location may be water, land, a new island and

a newly created body of water. For example, formation of certain types of forest on dried lava of a new volcanic flow; development of vegetation on a glacier.

Secondary succession: This is the re-establishment stage in the development of ecosystem, which existed earlier but was destroyed due to natural calamity (fire and flood) or man-made regions. Such re-establishment occurs due to the presence of seeds and organic matter of biological community in the soil. These seeds transform into plants on getting favourable conditions of climate, weather and water. Example: (i) Forest which was destroyed due to fire takes rebirth on abundant land. (ii) Bushes grow on an abandoned mining site. (iii) Vegetation that existed earlier but was destroyed due to flood, grows once again. (iv) Crops which were harvested grow again, as some of the seeds of earlier crops remain buried under the soil.

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

Allogenic succession: In some cases, replacement of one community by another is largely due to forces other than the effects of communities on the environment. This is called allogenic succession, and it may occur in a highly disturbed or eroded area, or in ponds where nutrients and pollutants enter from outside and modify the environment and in turn the communities.

Autotrophic succession: It is characterized by the early and continued dominance of autotrophic organisms like green plants. It begins in a predominantly inorganic environment and the energy flow is maintained indefinitely. There is a gradual increase in organic matter content supported by the energy flow.

Heterotrophic succession: It is characterized by the early dominance of heterotrophs, such as bacteria, actinomycetes, fungi and animals. It begins in a predominantly organic environment and there is a progressive decline in the energy content.

Induced succession: Activities such as overgrazing, frequent scraping, shifting cultivation or industrial pollution may cause deterioration of an ecosystem. Agricultural practices are retrogression of a stable to a young state of man's deliberate action.

Retrogressive succession: It means a return to simpler and less dense or even impoverished form of community from an advanced or climax community. In most cases the causes are allogenic.

Cyclic succession: It is of local occurrence within a large community. Here cyclic refers to repeated occurrence of certain stages of succession whenever there is an open condition created within a large community.

2.6.2 Causes of Ecological Succession

Initial cause: This is responsible for initiating the succession that results in the destruction of existing habitat. It is also responsible for the creation of barren area.

Reasons: Fire, wind or erosion.

Continuing cause: These are responsible for changes in population.

Reasons:

(i) Migration for industrialization and urbanization
(ii) Migration for safety against outsider aggregation
(iii) Feeling of competition.

Stability causes: These causes bring **stability** to the community.

Reasons:

(i) Climatic conditions of the area
(ii) Fertility of agricultural land.

2.6.3 Climax

In this, the final terminal community becomes more or less stabilized for a longer period of time, which can maintain itself in equilibrium with the climate of the area. The final community is called climax stage. The climax community is the most complex and stable, providing food and variety of niches for animals. The climax community can tolerate the conditions created by itself, and there are no more successful species to replace them. Following are theoretical approaches to the climax:

Monoclimax theory: This theory was developed largely by Federick Clements. It recognizes only one climax, determined solely by climate, no matter how great the variety of environmental condition is at the beginning. The monoclimax theory was supported by Cowles, Ranganathan, and Puri, but strongly objected by Daubenmire (1968).

Polyclimax theory: This theory was developed by Tansley. It considers that the climax vegetation of a region consists of not just one type but a mosaic of vegetational climaxes controlled by soil moisture, soil nutrients, topography, slope exposure, fire and animal activity.

Climax pattern hypothesis: This theory was developed by Whittaker, Macintosh and Sellack. According to this theory, the composition, species structure and balance of a climax community is determined by the total environment of the ecosystem and not by one aspect, such as climate alone.

2.6.4 Significance of Ecological Succession

(i) Its knowledge helps in maintaining a specific biotic **seral** stage by interfering the process of biotic succession, e.g., maintenance of teak forest.
(ii) Dams are protected by preventing siltation and biotic succession.
(iii) It gives information about the techniques to be used during reforestation and afforestation.