Hello students, I welcome you all for today's presentation. I am Mehtab Jahan Bukhari, Professor of Botany at Government College of Arts, Science and Commerce, Quepem, Goa.

The program is Bachelor of Science
subject Botany, Semester 6, course code is BOC- 110 and the course title is Plant Ecology and phytogeography.

The title of the unit is biotic interactions and the module name is ecological pyramids.

The outline includes introduction, types of ecological pyramids and limitations of ecological pyramids.

On completion of this module, students understand the types of ecological pyramids and learns about the limitations of ecological pyramids.

Ecological pyramids are the graphic representation of parameters like number, biomass or accumulated energy at different trophic level in a food chain in an ecosystem.

The idea of ecological pyramid was developed by Charles Elton in the year 1972 hence they are also known as Eltonian Pyramids.

Ecological pyramids start with producers at the base and consumers at the successive trophic levels towards the apex. The ecological pyramids, may be straight or upright. As seen in certain ecosystems or they may be inverted or spindle shaped.
In an upright ecological pyramid, the base is broad and the apex is narrow. While in inverted ecological pyramid the base is narrow, while the apex is broad. And in spindle shaped ecological pyramid it is broader in the middle and narrow above and below.

On the basis of parameters like number, biomass, energy, ecological pyramids are of three types, pyramid of number. Pyramid of biomass and Pyramid of energy.

Now let us see in detail about each of these pyramids.
Coming to pyramid number. It is the graphic representation of number of individuals at different trophic levels in a food chain in an ecosystem. It depicts the relationship between producers, herbivores and carnivores in terms of numbers. It may be upright as seen in grassland ecosystem and aquatic ecosystem. The pyramid of number may be inverted in parasitic food chain. Or it may be Spindle shaped in tree dominated or forest ecosystem.

In grassland ecosystem, the pyramid of number is upright. The producers, which are normally grasses, are always more in number. This number then show a gradual decrease towards the apex as the primary consumers like grasshoppers and rabbits are lesser in number than the grasses, the secondary consumers like snakes, frogs are still lesser in number than the rabbit and grasshopper.

Finally, the tertiary consumers like Hawk and Lion which are at the tip are least in number. So here we can see a gradual decrease in the number from base to apex thus resulting in the development or formation of an upright ecological pyramid.

Similarly, in pond ecosystem the pyramid of number is upright The phytoplanktons which are at the base are more in number and we can see gradual decrease in the primary consumers, secondary consumers and tertiary consumers as we go in the higher trophic levels. Thus, resulting in the formation of an upright ecological pyramid.

In ecosystems like forests the pyramid of number is spindle shaped. The producers are in the form of trees,

which are few in numbers which support a large number of primary consumers and we can see a gradual decrease in the number in the successive trophic level like secondary consumers and tertiary consumers. so here we can see that the pyramid is broader in the middle and narrow at the apex and base resulting in the formation of a spindle shaped pyramid.
While in a parasitic food chain like Oak Tree, the pyramid of number is inverted wherein a single oak tree supports a large number of fruit eating birds which in turn supports still larger number of Parasites like lice and bugs and at the top we have hyper-parasite which are greatest in number. So in this way there is gradual increase in the number from base to apex resulting in the formation of an inverted pyramid of number.

Coming to parameter biomass. Biomass is the total amount of dry weight of living organisms or organic

matter in an ecosystem at any time. Pyramid of biomass is defined as graphic representation of biomass present per unit area in different trophic levels. It is straight or upright in a terrestrial habitat, while it is inverted or spindle shaped in aquatic habitat.

In terrestrial ecosystem like Grassland ecosystem, the pyramid of biomass is upright. We can see that the pyramid of biomass as it is upright showing maximum biomass at the producer level and we can see gradual decrease in biomass from lower to higher trophic level thus forming an upright ecological pyramid.

In aquatic ecosystem like Pond ecosystem, the pyramid of biomass is inverted. The producers have least biomass and we can see gradual increase in biomass at the primary consumers, secondary consumers and tertiary consumer level, which goes on increasing from base to apex,thus forming an inverted pyramid of biomass.

Coming to pyramid of energy. It represents the amount of energy trapped per unit time in an area in different trophic levels of a food chain, the pyramid of energy is always upright or straight and about 90% of energy is lost at least trophic level.

In pyramid of energy the number and weight of organisms at any trophic level depends not on the amount of fixed energy present at any one time in the level just below it, but rather on the rate at which the food is being produced, so the pyramid of energy gives the best picture of overall nature of the ecosystem.

We can see gradual decrease in energy from base to apex. Let us assume that the amount of energy at the producer level is 10,000 kcal. At the next level there is transfer of only 10% of energy which makes up to 1000 kcal, at the next trophic level, we have only 100 kilocalories which is 10 percent of the second trophic level.

So, in this way there is gradual decrease in energy from base to apex. And as it is said, the pyramid of energy is always upright and at each trophic level about 90% of energy is lost for carrying out various metabolic activities and the energy loss occurs in the form of heat and the law governing the retaining of 10 percent energy at each trophic level is known as 10% law and it was proposed by Lindemann.

Among the three pyramids, pyramids of number do not give a clear picture of the trophic structure. It vary in different communities with the same environment.

Whereas, pyramid of biomass is more fundamental as they instead of geometric factor show the quantitative relationship of the standing crop.

And, pyramid of energy gives the best picture of overall nature of the ecosystem.

Coming to limitations of ecological pyramids:
Ecological pyramids do not take into account those species which belongs to two or more trophic levels for example, if a bird feeds on fruits or seeds, it is said to be a primary consumer but if the same bird feeds on snakes or insects or worms, it is said to be a secondary consumer. So, such kind of organisms which belongs to more than two trophic levels or more than one trophic level are not taken into account in ecological pyramids.

Ecological pyramids do not accommodate food-web.

And the decomposers, which are very important in nutrient cycling are also not taken into account in ecological pyramids.

So, these are some of the limitations of ecological pyramids.

Coming to the summary of ecological pyramids. We have seen the definition, pyramid of number, pyramid of biomass, pyramid of energy and, what are the limitations of ecological pyramids.

Here are the books referred for preparing this e-content.

Thank you, students.