S. S. College, Jehanabad

Department: Zoology

Class: M.Sc. Semester II

Subject: Zoology

Topic: Lindeman's trophic dynamic concept

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Q1) Lindeman's Trophic Dynamic concept and Energy flow in Ecosystems.

=> Introduction :-

Energy can be defined as the capacity to do work. There are two kind of energy - Potential and Kinetic. Potential Energy is energy at rest. It is capable of and available for works. Kinetic Energy is due to motion and results in work. Energy is described by two laws of thermodynamics. The First law states that "energy is neither created not destroyed". Second law States that "whenever energy is transformed from one kind to another", there is an increase in uniformity and decrease in the amount of useful energy.

Energy in Ecosystem :-

Living organisms can use Energy in two forms - Radiant and fixed. Radiant Energy (Solar energy) of Sun is transformed into chemical Energy by the Process of Photosynthesis and Stored in Plant tissues. This

Energy then transformed into mechanical and heat form of energy during metabolic activities.

In the biological world the energy flows from sun to plant and then to all heterotrophic organism such as microorganism, animal and man.

Production of Energy

a) Primary Production :

Only a small fraction (1 to 5 %) light energy reaching the earth is trapped and plant can utilize solar energy for production of food. The Radiant energy of sun is converted into chemical and Potential energy in plant. In plant all the energy actually fixed in the formation of sugar. The total amount of sugar produced by plant is termed Primary Production. Some of these energy lost through Respiration.

b) Secondary Production :

The Produce energy by plant some of then is used

by herbivores or omnivores instead of food by Plant. The Herbivores then may be eaten by carnivores, who in turn may be eaten by other carnivores. When the Plant food is consumed by herbivores only 10% of Plant energy is transform into animal energy. Although there is no loss in total energy, there is a decrease in the amount of useful energy for some energy is lost as heat as second law of thermodynamics.

The resultant amount of energy stored in the tissues of heterotrophs (carnivores, omnivores) is termed net secondary production.

Laws governing Energy transformation:

Energy transformation in ecosystems can also be explained in relation to the laws of thermodynamics. The first law of thermodynamics is the law of conservation of energy which says that energy may be transformed from one form into another but is neither created nor destroyed. If an increase or decrease occurs in the internal energy (E) of the system itself, work (W) is done and heat (Q) is either evolved or absorbed. Thus,

$$\Delta E = W + Q$$

Decrease in the internal of energy of the System. = Work done by the system + Heat given of by the system.

The sign Δ refers to a change in quantity. The total amount of heat produced or absorbed in a chemical reaction, either occuring directly or in stages, always remains the same. This is called the specific law of constant heat sums and included in the first law.

The second law of thermodynamics states that processes involving energy transformation will not occur spontaneously unless there is degradation of energy from a non-random to a random form.

Lindeman's trophic dynamic concept of energy flows:

⇒ Lindeman (1942) put forth a most useful generalization regarding energy transfer in various trophic levels in a food chain called 10% law. According to this law in nature only some fraction of the energy entering any population is available for transfer to the next population that feeds upon the former. The actual amount varies. In the grazing food chain, about 10% of the energy in the food eaten is turned into the biomass of the eater.

For example - 100 kg of organic matter in grass will turn into 10 kg of flesh of deer which in turn will form 1 kg of flesh of a tiger that feeds on the deer.