Class: BSc (H) Semester IV
Core Course IX: Ecology (CBCS)

- Unit 9: Functional aspects of ecosystems

Topic for this week (March 23, 2020):

Energy Flow

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Disclaimer:

1. Some of the flowcharts/videos are downloaded from freely available online e-resources.
2. Lecture is only for circulation among the students of this class only; strictly not for any commercial purposes.

Instructions to the Students

1. Online teaching-learning mode is in addition to the class room teaching (not a substitute) so as to share latest e-resources available globaly.

2. You go-through this lecture and also see the last year question papers provided to you in earlier class. Make a list of your questions.

3. You may ask/disscuss any related quarries on-line anytime or in class room after March 31, 2020.

Flow of Energy in Ecosystem

Unlike materials that recycles in an ecosystems, **Energy Flows** through different trophic levels in an **ecosystem**. ... At the first trophic level, primary producers use solar **energy** to produce organic material through photosynthesis. The herbivores at the second trophic level, use the plants as food which gives them **energy.** Further, from herbivores to carnivores…. energy flows.

Types of Models of Energy Flow in Ecosystem

- **Single-Channel Energy Models**
- **Y-shaped Model of Energy Flow**
- **Multi channel Model of Energy Flow**

Single-Channel Energy Models

The principle of food chains and the working of the two laws of thermodynamics can be better made clear by means of, energy flow diagrams shown in Figures 1. 3 and 1. 4.

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As shown in Figure 1.3 out of the total incoming solar radiation (118,872 gcal/cm2/yr), 118,761 gcal/cm2/yr remain un-utilised, and thus gross production (net production plus respiration) by autotrophs is 111 gcal/cm2/yr with an efficiency of energy capture of 0.1 0 per cent. It may also be noted that 21 percent of this energy or 23 gcal/cm2/yr is consumed in metabolic reactions of autotrophs for their growth, development, maintenance and reproduction.

It may be seen further that 15 gcal/cm2/yr are consumed by herbivores that graze or feed on Autotrophs-this amounts to 17 per cent of net autotroph production.
Decomposition (3 gcal/cm^2yr) accounts for about 3.4 per cent of net production. The remainder of the plant material, 70 gcal/cm^2/yr or 79.5 per cent of net production, is not utilised at all but becomes part of the accumulating sediments. It is obvious, then that much more energy is available for herbivore than is consumed.

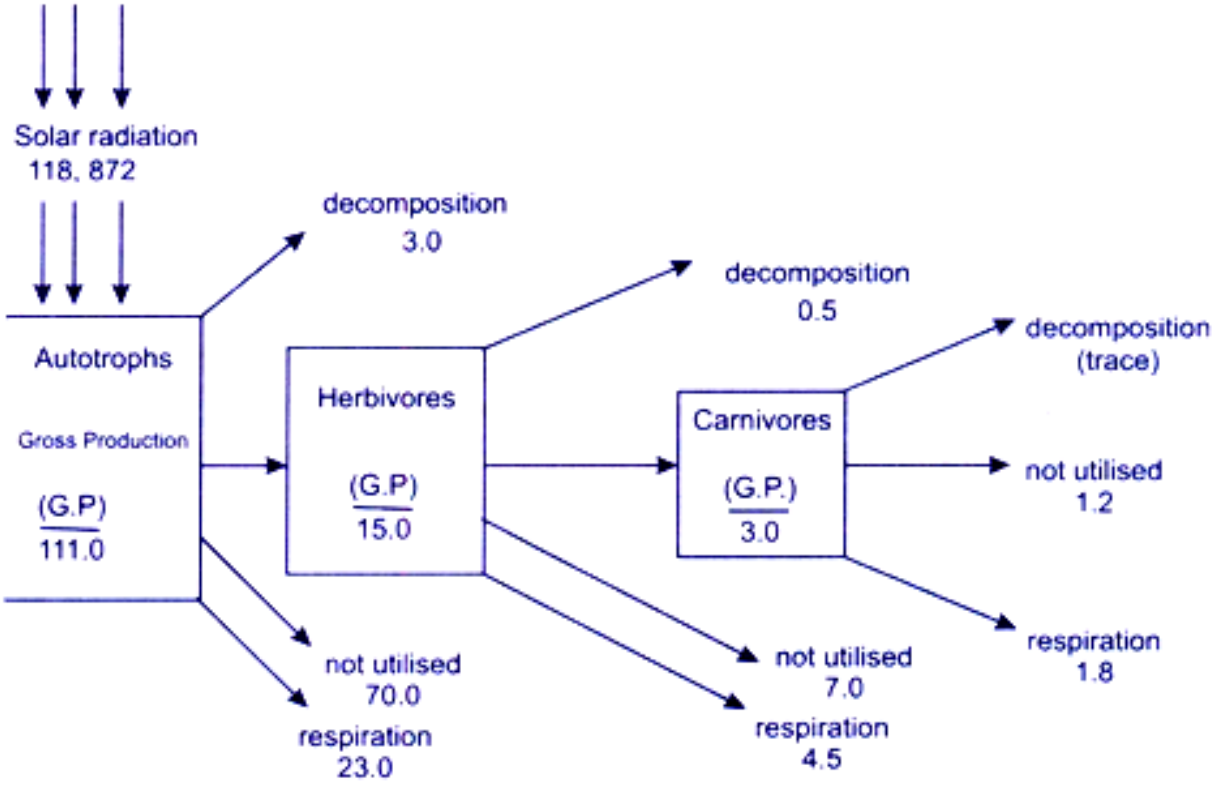


Fig. 1.3 Energy flow diagram for a lake (freshwater ecosystem) in g cal/cm2/yr

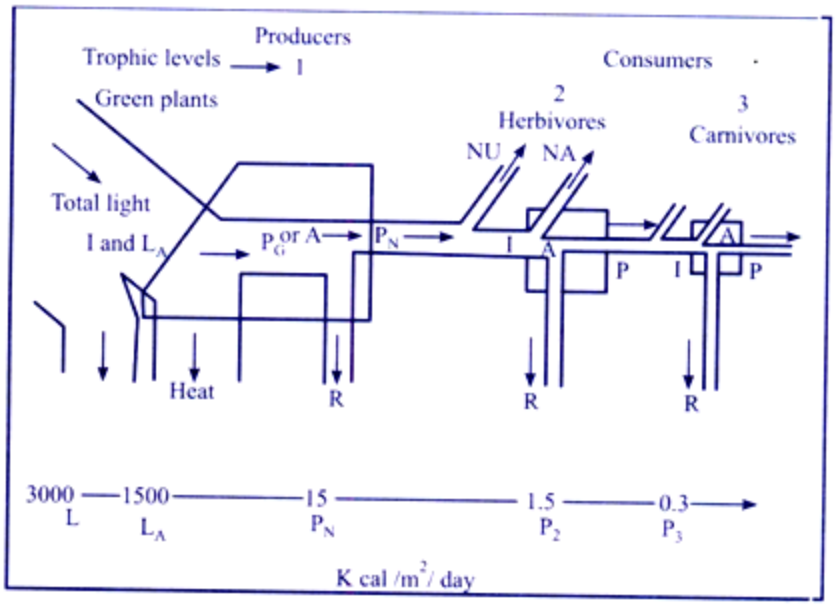


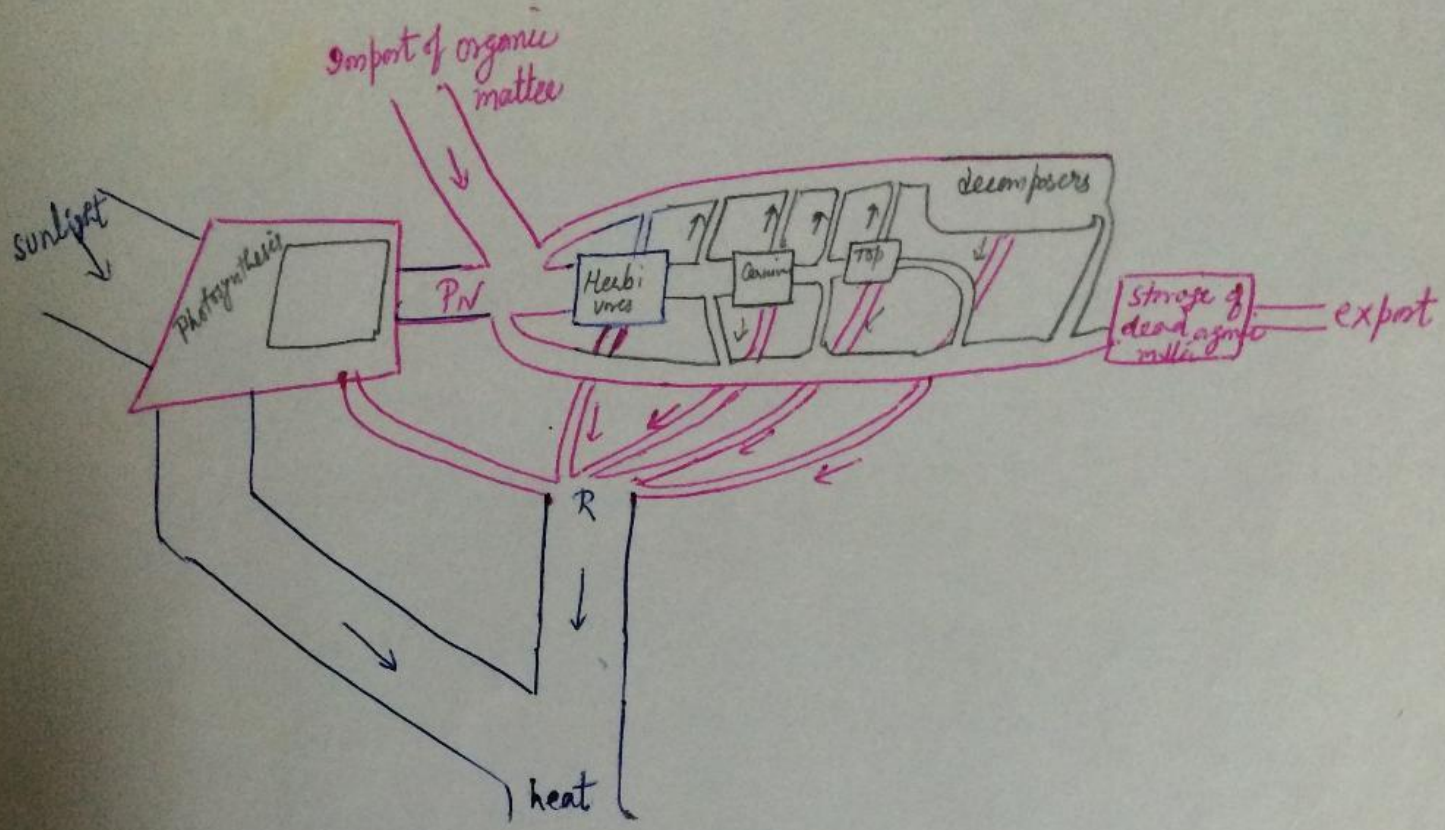
Fig. 1.4 A simplified energy flow diagram depicting three trophic levels

It becomes evident from Figures 1.3 and 1.4 that there is a successive reduction in energy flow at successive trophic levels. Thus shorter the food chain, greater would be the available food energy as with an increase in the length of food chain there is a corresponding more loss of energy.

Y-shaped Model of Energy Flow

The important point in Y-shaped model is that the two food chains are not isolated from each other. This Y- shaped model is more realistic and practical working model than the single-channel model because,

- (i) it confirms to stratified structure of ecosystems,
- (ii) it separates the grazing and detritus chains (direct consumption of living plants and utilization of dead organic matter respectively) in both time and space, and
- (iii) that the micro-consumers (absorptive bacteria, fungi) and the macro-consumers (phagotrophic animals) differ greatly size-metabolism relations. (E-P> Odum. 1983).



The relationship between flow of energy through the grazing food chain and detritus food chain (E.P. Odum, 1956)

Further References/E-resources

http://www.yourarticlelibrary.com/environment/ecosystem/2-models-of-flow-of-energy-in-an-ecosystem-with-diagram-explained/27324

https://www.youtube.com/watch?v=wqkAc16iNzE

https://www.youtube.com/watch?v=T5XhbhqOL_c