

CC-9T: PLANT ECOLOGY

4TH SEMESTER (HONS.)

UNIT- 9: Functional Aspects of Ecosystem

1. Production and productivity
2. Ecological efficiencies

MS. SHREYASI DUTTA

DEPARTMENT OF BOTANY

RAJA N.L KHAN WOMENS' COLLEGE

(AUTONOMOUS)

GOPE PALACE, MIDNAPUR

Production and Productivity

- ❖ The relationship between the amount of energy accumulated and the amount of energy utilized within one trophic level of food chain has an important bearing on how much energy at one trophic level passes in the food chain. The portion of energy fixed at a trophic level passes on to the next trophic level is called **production**.

In ecology, productivity refers to the rate of formation of biomass in the ecosystem. It can also be referred to as the energy accumulated in the plants by photosynthesis. There are two types of productivity, namely:

1. Primary Productivity
2. Secondary Productivity

1. Primary Productivity

Primary Productivity refers to the generation of biomass from autotrophic organisms such as plants. Photosynthesis is the primary tool for the creation of organic material from inorganic compounds such as carbon dioxide and water. The amount of organic matter present at a given time per unit area is called **standing crop or biomass**.

Primary productivity can be divided into two aspects:

- A) Gross primary productivity
- B) Net primary productivity

A) Gross primary productivity

The solar energy trapped by the photosynthetic organism is called gross primary productivity. All the organic matters produced falls under gross primary productivity. This depends upon the photosynthetic activity and environmental factors.

B) Net primary productivity

This is estimated by the gross productivity minus energy lost in respiration.

$$\text{NPP} = \text{GPP} - \text{Energy lost by respiration}$$

It is the net energy stored in the plants. This energy serves as food for the animals that feed on plants. It is measured as the amount of organic matter produced in a community in a given time. Annually, over 170 billion tons of net primary productivity occurs over the entire biosphere.

2. Secondary Productivity

Heterotrophs such as animals influence **Secondary Productivity**. It is the accumulation of energy at the consumer's level. It keeps moving from one organism to another, unlike primary productivity. This process occurs as a result of organic materials being transferred between various trophic levels. It is also referred to as rate of increase in the biomass of heterotrophs. Organisms such as animals, fungi, bacteria and numerous protists influence Secondary Production.

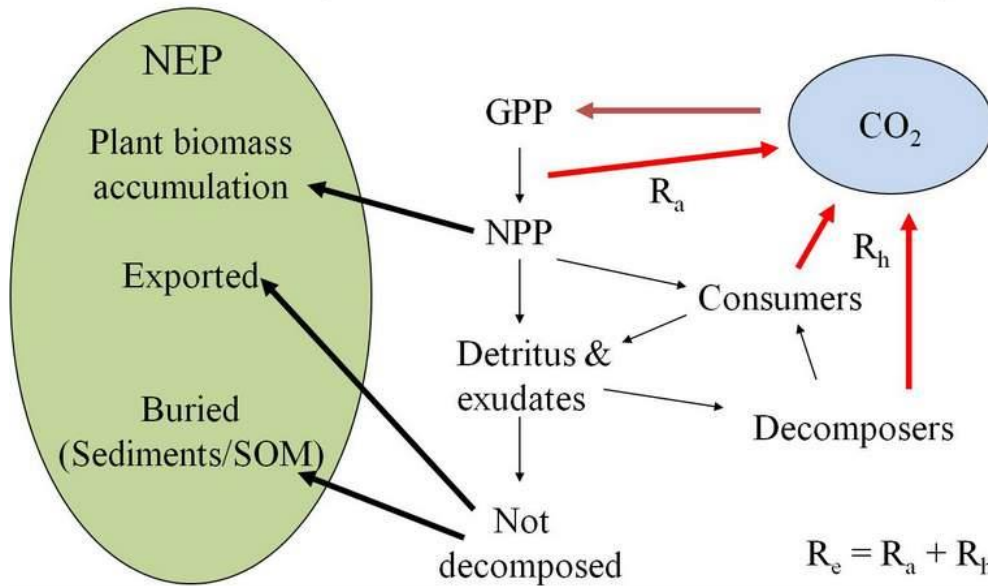
❖ Unit of Productivity

Typically, productivity is expressed in units of mass per unit volume (or surface) per unit time.

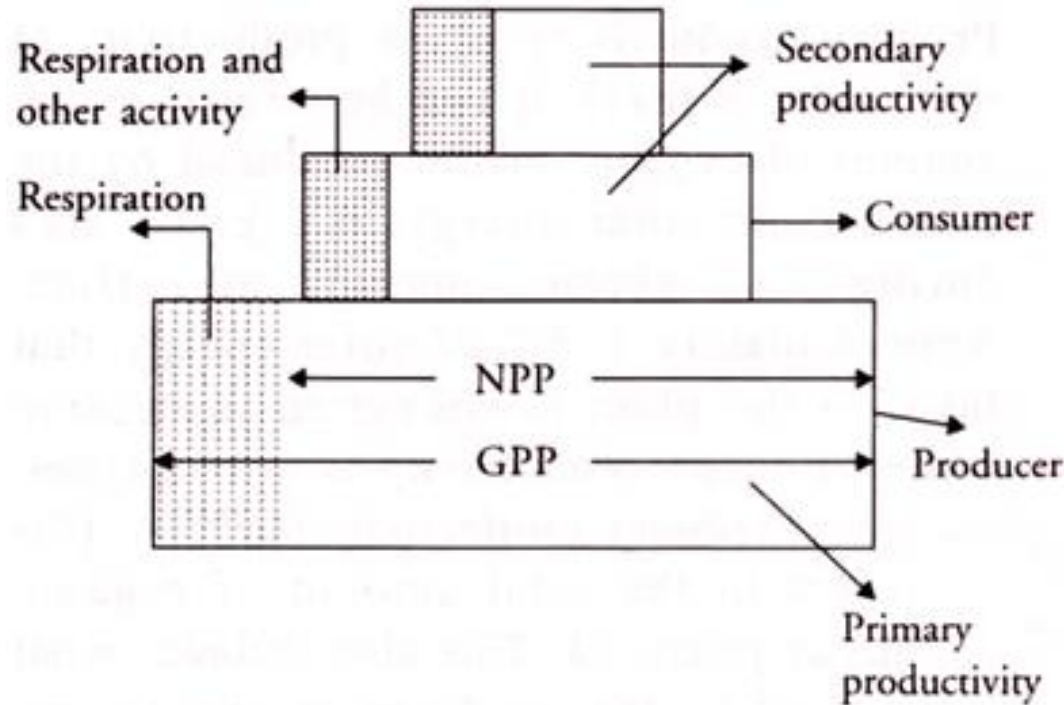
❖ **Environmental factors affecting the production processes in an ecosystem are as follows :**

- 1. Solar radiation and temperature**
- 2. Moisture :** leaf water potential, soil moisture , precipitation
- 3. Mineral nutrition :** uptake of minerals from soil, rhizosphere effects, fire effects , salinity etc.
- 4. Biotic activities :** grazing above ground herbivores , below ground herbivores , predators etc.
- 5. Impact of human population :** population of different sorts, ionizing radiation etc.

Components of Productivity



$$R_e = R_a + R_h$$



Ecological efficiencies

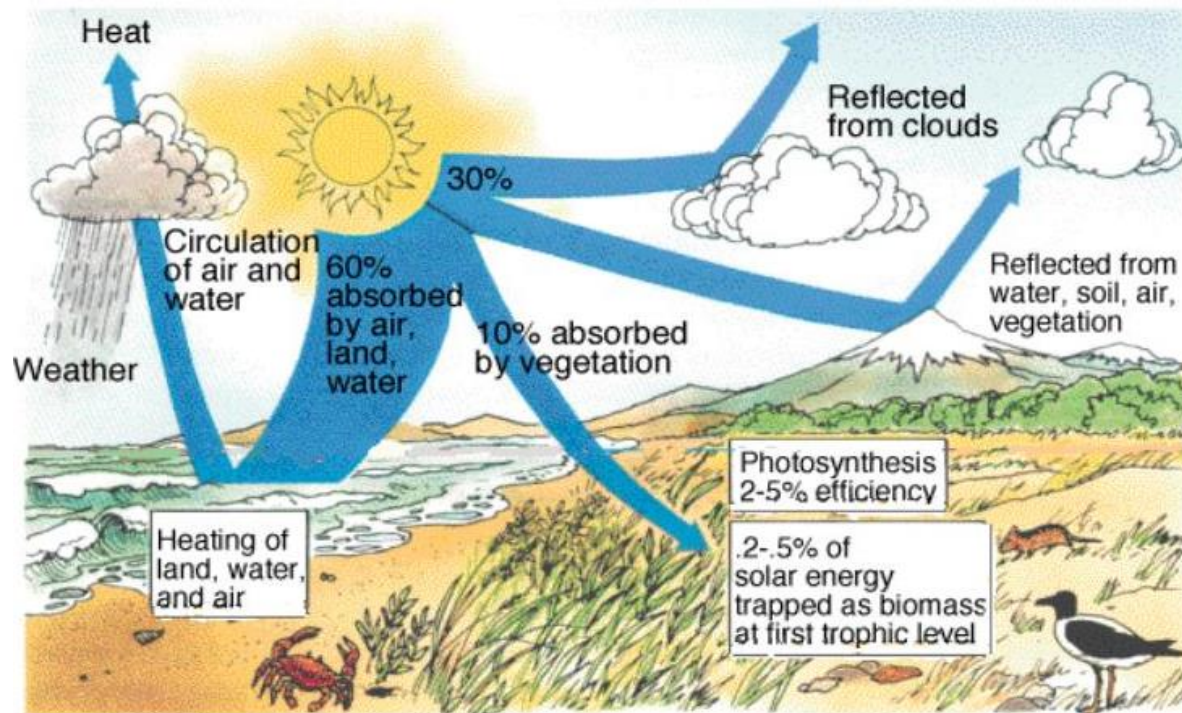
- The relationship between the amount of energy accumulated and the amount of energy utilized within one trophic level of food chain has an important bearing on how much energy at one trophic level passes in the food chain. The ratio of output of energy to input of is referred to as **ecological efficiency**. Typical 10% efficient, 90% lost .

$$\text{NPP (Trophic level x)} : \text{NPP (Trophic level x -1)}$$

- Different kind of efficiencies can be measured by the following parameters :
1. **Ingestion** : which indicates the quantity of food or energy taken by trophic level. This is also called **exploitation efficiency**.
 2. **Assimilation** : which indicates the amount of food absorbed and fixed.
 3. **Respiration** : which indicates the energy lost in metabolism.

- It is vary depending on the organism involved but usually range from 5-20% .
- The means that 80-90% of energy at one level transfer to the next.

Ecological Efficiency



Ref :

- Musselburghgrammar,2017
- Shukla cahndel (book)
- Images are from internet source