

## ***Effect of Abiotic and Biotic Factors on Biomass of the Herbaceous Layer in a Forest Ecosystem***

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*Each organism has requirement in life which interlock with those of many other individual in the area. Some of these organisms belong to same species but most are very different organism with different ways of interacting. The sum total of all the biotic(living) and abiotic (non-living) components/factor that surround and influence the organism constitute the environment complex of an organism. Some components of the environment serve as a resource while others act as regulatory factor. The various components of the environment are interlinked and interdependent as Atmosphere/Air, Light, temperature, water, Edaptic factor (Soil), fire, producers, consumers and decomposers. Biomass is the total dry weight of vegetation at any time, for a unit area in an ecosystem. Productivity is the rate of creation of organic material, by photosynthesis per unit area and time (Whittaker, 1970) since the inception of International Biological Programme (1964-74) most of the ecologists have been working on the production ecology of terrestrial, freshwater and marine ecosystem.*

[**Keywords** : Abiotic, Biotic, Biomass, Herbaceous layer, Forest ecosystem, Marine ecosystem]

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## 1. Introduction

A contribution to the production ecology of various ecosystem has been greatly made by Lindemann (1942). Odum (1960) described the biomass production in a farmland in South Carolina (USA). The biomass production changes from compartment to compartment by the process of production, mortality and disappearance caused by several factors different species have various germinating season, growth maturity and senescence time. It results in maximum and minimum biomass in different months. Golley (1965) has explained the biomass of broomsedge community in South Carolina.

Singh (1978) studied aboveground and belowground biomass and herbaceous production in a Teak plantation at Varanasi. Saxena and Singh(1980) studies the biomass structure and nutrient status of grasslands in Kumaun Himalayas. Singh and Singh (1980) discussed the herbaceous structure of a sub tropical moist forest of Meghalaya. Alpine vegetation regarding biomass and productivity was studied by Ram (1988). Singh et al. (1987) studied the Sal forest of Varanasi. Sah & Ram (1989) worked out biomass and primary productivity of grazing land in Oak and Pine forest in Garhwal. Rikhari et al. (1992) have studied different forest grazing lands in Central Himalayas for biomass and productivity estimation.

## 2. Observation

The structural component of an ecosystem include both biotic and abiotic components, influencing the properties of each other. Ecosystem can be studied in detail by assessing its two essential parameters they are :

**Abiotic factors :** These include the environmental factors and

**Biotic factors :** These are composed of all living organisms.

### 2.1 Abiotic Factors

#### 1. Atmosphere/Air

It is protective, transparent, envelope of gases surrounding the Earth (hydrosphere and Lithosphere) upto 300 Kms above Earth's surface. It consists of four concentric regions/layers based on variations in temperature and pressure at various altitudes.

### Relative Gases in Atmosphere

N <sub>2</sub>	-	78%
O <sub>2</sub>	-	20.78%
A <sub>2</sub>	-	0.9%
CO <sub>2</sub>	-	0.03%

He, Ne, Kr, Water vapor - Trace Amounts.

### Different Layers of Atmosphere

Troposphere	-	20 Kms above earth surface.
Stratosphere	-	30 Kms from troposphere.
Ionosphere/Thermosphere	-	Trapopause exists between troposphere and stratosphere and stratopause is the transition zone between stratosphere and mesosphere. The upper limit of mesosphere is mesopause. Homosphere extends upto 100 Kms from earth surface.

## 2. Light

Sun is the ultimate source of light and the other natural sources are moonlight, starlight, luminescent organisms. A great deal of solar energy (more than 50%) is absorbed by atmosphere (water vapour gases). The solar energy that reaches earth (our electromagnetic spectrum) consist the different effect of light as photosynthesis, photomorphogenesis, growth, plant movement, photoperiodism, metabolism, opening and closing of stomata.

Based on overall vegetative development of plant parts are :

- (a) Heliophytes - Growing in full sunlight.
- (b) Sciophytes - Grow best at lower light intensities.

## 3. Temperature

Temperature varies with altitude, latitude, topography, vegetation and slope. On the basis of variation in mean temperature along latitude, the main climatic regions are :

- Tropical (0<sup>o</sup>-20<sup>o</sup> latitude) above 24<sup>o</sup>C.
- Sub-tropical (20<sup>o</sup>-40<sup>o</sup> latitude) 17<sup>o</sup> - 24<sup>o</sup>C..
- Temperate (40<sup>o</sup>-60<sup>o</sup> latitude) 7<sup>o</sup> - 17<sup>o</sup>C
- Arctic and Antarctic (60<sup>o</sup> - 80<sup>o</sup> latitude) Below 7<sup>o</sup>C.

#### 4. Water

It regulates various metabolic processes, acts as a resource and habitat of various organisms. The total amount of water on earth remains constant. It regulates the structure and distribution of plant communities.

#### 5. Edaptice Factor (Soil)

Soil is one of the most important ecological factor as plants depend for their nutrients, water supply and anchorage on soil. Soil complex is a mixture comprising of five main components as mineral matter, organic matter, soil water, soil atmosphere and biological system.

#### 6. Fire

Fire has marked effect on the physical environment through removal of plant cover, burning of litter mass present on the soil surface and loss of nutrients due to volatilization. There are certain pyrohpytes which can withstand fire with little or no damage. These are woody plants with thick bark eg.- *Gravia sapida*, *Combretum nanum* and *cochlospermum religosa* are some of the common pyrophytes in Shivalik Hills, India.

### 2·2 Biotic Factors

They include producers, consumers and decomposers.

1. Producers : These are autotrops. They provide food, shelter and O<sub>2</sub> to the consumers. They are called transducers because they change light energy to chemical energy eg.- in terrestrial ecosystem, producers include green plants, phototrophic bacteria, algae etc.
2. Consumers : They are heterotrophs i.e. dependent directly or indirectly on plants. Consumers are also called phagotrops which can be placed in different categories- Primary, Secondary, tertiary and Top consumers.
3. Decomposers : They include micro-organisms which feed on dead and decaying bodies of other organisms eg. Fungi and bacteria.

The upper layer of soil is the place for decomposition and the organic remains obtained constitute detritus. Two type detritus are :

- Above ground detritus - It consists of dead remains of plants also called litter fall.

- **Below ground detritus** : It includes dead roots , plants and animal remains (faecal matter).

**Source** : Botany, Unique Publishers(I) Pvt Ltd, New Delhi-24.

### **3. Legal Studies under Environment Law**

1. The Soil Conservation and Domestic Allotment Act Pub. 74-461, enacted February 29, 1936) is a United States federal law that allowed the government to pay farmers to reduce production so as to conserve soil.
2. Water (prevention and control of pollution) act, 1974. One of the important provision of the water act, 1974 is to maintain and restore the 'wholesomeness' of our aquatic resources/ under water act, 1974 Sewage or pollutants con not be discharged into water bodies including lakes and it is the duty of the state pollution control board to intervene and stop such activity
3. The forest (conservation) Act, 1980 an Act of the parliament of India to provide for the conservation of forest and for matters connected therewith or ancillary or incidental there to. It was further amended in 1988 it was enacted by parliament of India control further deforestation of Forest Areas in India. The Act came into force on 25 October 1980. It has five sections
4. The government passed this act in 1981 to clean up our air by controlling pollution it state that sources of air pollution such as industry, vehicles power plants, etc., are not permitted to release particulate matter, lead carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level.

To ensure this pollution control boards (PCBs) have been setup by government to measure pollution levels in the atmosphere and certain sources by testing the air. This is measured in the part for in milligrams or micrograms per cubic matter

The Environment (Protection) Act, 1986 authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds.

- The EPA Act was enacted under Article 253 of the Indian Constitution which provides for the enactment of legislation for giving effect to international agreements.

- Article 48A of the Constitution specifies that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.
- Article 51A further provides that every citizen shall protect the environment.

**Coverage :** The Act is applicable to the whole of India including the state of Jammu & Kashmir.

#### 4. Results and Discussion

The climatic conditions and edaptic characteristics of any ecosystem mainly control the structure and function of the vegetation. These are closely related to phenology and floristic diversity (Singh & Singh, 1980), Bliss (1966), Billing and Mooney (1968), Kuramoto and Bliss(1970), Sims and Singh (1978) and McNaughton (1985) have reported that the life forms along with climatic and biotic conditions have a remarkable effect on live, dead and litter biomass. The major climatic factors that govern the growth and development of plants include temperature, solar insolation, atmospheric humidity, snow cover and wind velocity. The edaptic factors are largely of secondary importance in high altitude (Mani, 1978). The biotic factors like that of grazing intensities is also responsible for variations in the standing crop & in turn influence the productivity.

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