

Nalanda Open University

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E-CONTENT 4

for

Part-I Examination, 2020

SHORT DESCRIPTION OF THE SUGGESTED TOPICS

REMAINING TOPICS OF PAPER – I (FUNDAMENTALS OF ENVIRONMENTAL SCIENCE & ECOLOGY)

9. Detailed description of Forest ecosystem, Grassland Ecosystem and Marine ecosystem.

Forest Ecosystem:

A forest is an extensive area of land that is dominated by the thick growth of trees and bushes and has a wide variety of organisms. Forests are well organized natural communities of flora and fauna. The landscapes that various types of forests present look different from one another due to numerous characteristics with seasonality (mean annual temperature, mean annual rainfall, wind and air currents etc.) being the most importance influencing factor.

There are three major types of forests in the world classified according to latitude. They are:

- I. Tropical Forests
- II. Temperate Forests and
- III. Boreal or Taiga Forests (also called as Cool-Temperature Coniferous Forests).

Tropical Forests are further subdivided into:

- (i). Tropical Evergreen Forests
- (ii). Tropical Deciduous Forests
- (iii). Tropical Desert Forests

Similarly, Temperate Forests are further subdivided into:

- (i). Temperate Evergreen Forests
- (ii). Temperate Deciduous Forests
- (iii). Temperate Desert Forests

Major Forest systems in India:

Owing to adequate rainfall in most parts of our country which supports the growth of trees, the natural vegetation of India consists largely of forests. There are five major types of forest in India. They are:

- a. Tropical rain forests.
- b. Tropical deciduous forests
- c. Thorn forests
- d. Tidal forests and
- e. Coniferous forests

Note: Further description of each of the types of forest is required.

Grassland Ecosystem:

Grasslands are an important part of the earth's ecological communities. They are characterized as land covered with many types of grass and small annual plants rather than large shrubs or trees. Grasslands have provided grazing land for both domesticated and wild animals. Grasslands occur in areas with warm or hot climates and less annual rainfall. The soil depth and quality is usually poor. Grassland ecosystems are scattered all over the world in tropical, temperate and alpine regions.

There are two main divisions of grasslands. They are:

- I. Tropical grasslands or Savannas and
- II. Temperate grasslands.

Note: Here, present a brief description of Abiotic and Biotic components, and Producers, Consumers and Decomposers of each type of grassland ecosystems.

Marine Ecosystem:

Aquatic ecosystems that have a high concentration of salt and mineral ions are called Marine Ecosystems. Marine ecosystems cover nearly 70 percent of the Earth's surface. Unlike terrestrial and fresh water ecosystems the seas and oceans are continuous, and are in continual circulation due to surface currents, seasonal turnover in the upper waters and tidal action.

An ocean is like a basin with three distinct regions. They are

- (a). The continental shelf
- (b). The continental slope
- (c). The ocean floor

Note: Here, present a brief description of the three regions of oceans. Brief description of Abiotic and Biotic components of the oceans and Producers, Consumers and Decomposers (i.e. oceanic Flora and Fauna) in marine ecosystem is also required.

10. Meaning of Community; Origin, Structure and Organization of Bio-Community.

Meaning of Community:

The term Community as applied in the study of ecosystems includes all the populations of plants, animals and microorganisms occupying a given geographical area at the same time.

“Community is a general term applying to any aggregation of organisms irrespective of its successional rank.”

Very often we use terms like “Community of fishes” or the “Community of shrubs”. It then refers to the entire population of fishes or shrubs of different diversity present in a given geographical area at the same time. As the term community refers to the aggregation of organisms a more common term Bio-community (i.e. Biological Community) is commonly used for community.

The biological community together with the non-living i.e. physical environment with which the community interacts through the exchange of matter and energy are referred to as an ecological system or ecosystem.

Note: For origin, structure and organization of Bio-community students are advised to consult the Study Learning Material (SLM) provided by Nalanda Open University, Patna and the book ‘Environment Biology’ by P. D. Sharma, chapter – 8: Community-Structure and Dynamics. Other learning sources may also be consulted as per the choice and availability to the students.

11. Brief description of Population Ecology and Law of Population Growth.

Ecological meaning of population:

Population is a group of organisms (flora and fauna) of the same species, inhabiting the same area and functioning as a unit of individuals in an ecosystem. Thus, a group of snails of the same species present in a given area constitute a population.

Population Ecology:

Population Ecology is concerned with interrelationships of co-actions between individuals within and between species. Co-action may either be beneficial to the participants, cooperation or harmful to them. Interspecific cooperation includes mutualism, commensalism and many of the interactions that establish the community as a dynamic unit. Co-actions that are harmful to at least one of the participants include parasitism, predation and competition.

Note: For the other aspect of population ecology and Law of population growth, the students are advised to consult the following study materials:

- a. Study learning Material (S.L.M.) provided by Nalanda Open University, Patna.
- b. Environmental Science (Book) by S.C. Santra.
- c. Environmental Biology (Book) by P.D. Sharma

Study materials from other sources may also be consulted as per the interest and convenience of the students.

12. Explanatory notes on

- a. **Biome,**
- b. **Ecological Succession,**
- c. **Second law of thermodynamics,**
- d. **Primary and Secondary Productivity.**

a. **Biome**

A biome refers to a large regional ecosystem which is characterized by distinct types of vegetation, animals and microorganism that have developed under specific soil and climatic conditions. A biome may have a number of ecosystems having similarity in faunal and floral composition. Thus, a grassland biome may include a number of grassland ecosystems which have the similarity that they all have grasses as principal flora and grazers, the predominant fauna in these ecosystems. Similarly a tropical rainforest is a biome which is the home for a wide variety of plants and animals suitably adopted to live in the habitat that constitutes the forest.

Note: Further elaboration/modification may be done.

b. **Ecological Succession**

Ecological Succession is the gradual change over time that occurs in an ecosystem of a given area of the earth's surface on which populations succeed each other. The time scale can be decades (for example, after a mild fire) or even millions of years after a mass extinction.

Succession may be initiated either by formation of a new unoccupied habitat, such as from a lava flow or a severe landslide or by some form of disturbance of a community such as from a fire, severe wild throw or logging. Succession that begins in new habitats uninfluenced by pre-existing communities is called Primary Succession, whereas Succession that follows disruption of a pre-existing community is called Secondary Succession.

Note: Further elaboration/modification may be done.

c. **Second law of Thermodynamic**

Energy is the single most essential requirement of all living organisms. The flow of energy that occurs along a food chain is known as Energy flow. The energy flow in an ecosystem follows the two basic laws of thermodynamics – The First Law and The Second Law.

The first law states that “Energy is neither created nor destroyed. It can be transferred from one material body to another or can be transferred from one form of energy to some other form”.

The Second law states that “no energy flow is 100% efficient”. In other words, during transformation of one form of energy into some other form or transfer of energy from one trophic level to another a portion of energy is necessarily dissipated (i.e. lost) into the surrounding as heat energy. But as per the first law of

thermodynamics, the total of all forms of energy before and after the transfer or transformation must remain equal in magnitude, the useful energy available in the next step (i.e. to the next trophic level) will be lesser in amount.

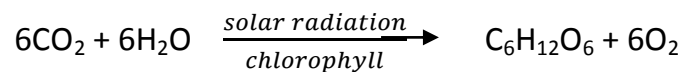
Note: Further elaboration/modification may be done.

d. Primary and Secondary Productivity

Biotic components of an ecosystem are the different forms of life – plants, animals including human beings and microorganisms in it. Based on their nutritional relationship, different organisms of an ecosystem have been divided into two categories –

- i. Autotrophs or Producers and
- ii. Heterotrophs or Consumers.

Autotrophs or producers include green (chlorophyll bearing), plants and a variety of photosynthetic bacteria and protozoa which produce their organic food (i.e. glucose) from simple inorganic substances (eg. CO₂ and H₂O) by the process of photosynthesis.



The plants may be herbs, shrubs, large sized trees or micro-sized free floating phytoplanktons.

The productivity of an ecosystem refers to the rate of production (i.e. generation) of biomass in the ecosystem. The productivity in an ecosystem is of two types. They are:

- ❖ Primary Productivity and
- ❖ Secondary Productivity

❖ Primary Productivity :

It is associated with the producers which are autotrophs (Auto – self, tropos - feeder). Most of the autotrophs are photosynthetic and to a much lesser extent the chemosynthetic microorganisms.

Primary Productivity is defined as “the rate at which radiant energy is stored (organic matter is produced) by photosynthetic and chemosynthetic activity of producers”. Primary Productivity is further distinguished as :

- **Gross Primary Productivity and**
- **Net Primary Productivity**
- **Gross Primary Productivity :** It is the total rate of photosynthesis including the organic matter used up by producers for their own metabolic activities (in respiration and growth i.e. tissue building) during the measurement period. It is usually expressed in units of mass per unit surface (or volume) per unit time, for instance gram per square meter per day (gm⁻²d⁻¹). The mass unit may relate to dry matter or to the mass of carbon generated.

- **Net Primary Productivity:** Only about half of the gross productivity accumulates as new plant matter, because almost half of the chemical energy is mobilized by the plant's own respiration and released to the environment as heat. The net gain in plant matter is called the Net Primary Productivity.

Thus,

The **Net Primary Productivity = Gross Primary Productivity – Plant Respiration**

❖ **Secondary Productivity:**

Secondary Productivity is defined as the rate of formation of new organic matter (or rate of energy storage) by heterotrophs (i.e. consumers). Of the net primary productivity available in a forest, herbivores (eg. insects, deer etc.) eat only about 1-3%. In grassland, as much as 15% of the vegetation may be eaten by herbivores. In oceans, 80% of the net primary productivity is consumed by herbivores. Very little of the plant matter that is consumed is actually converted to animal tissue. In terms of energy content, the conversion is only about 10 %. To summarize, although there are large variations from ecosystem to ecosystem as a generalization, for every 10 Kcal of plant tissue available in herbivores, about 1 Kcal will be eaten and only about 0.1 Kcal will be stored in the form of body weight. Carnivores that eat herbivores are likewise insufficient in converting food to food, so the energy available to the carnivores is even less. It is obvious, then, that the amount of usable energy decreases, as it is transferred from sunlight to plants to animals.

Note: This answer own productivity is a bit lengthy. It is suitable for answering full length question on productivity. For short note answer the matter given here may be shortened as per the need.