TOPIC: ECOSYSTEM

LECTURE NO:01
B.SC PART 1
ZOOLOGY(HONS.)-PAPER I-GROUP B
CHAPTER 2
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OBJECTIVES

The study of Major ecosystems (Freshwater, marine, forest and desert). Concept, component and their function, energy flows, food chain, food web, trophic structures, ecological pyramid. Introduction of law of limiting factor.

INTRODUCTION

The structural and functional system of communities and their environment is called an ecosystem. Thus ecosystem is the basic structural and functional unit of ecology. The term ecosystem was proposed by A.G.Tansley in 1935. It may be defined as a system formed by the community and the environment. The ecological study of ecosystems or "Ecosystem ecology" is considered the most important aspect of ecology. There are many other parallel terms or synonyms for the ecosystem which have been proposed by various ecologist e.g., biocoenonsis (Karl Mobius, 1877), microcosm

(S.A.Forbes, 1887), holocoen (Friederichs, 1930), biosystem (Thienemann, 1939).

MAJOR ECOSYSTEM

FRESHWATER ECOSYSTEM

The Freshwater pond as a whole represents a complete self-maintaining and self-regulating ecosystem. The pond can be defind as a body of shallow standing water characterized by relatively quiet water and abundant vegetation with thousand of micro-organism, large plant and animal. In the pond ecosystem all the four basic unit of an ecosystem are well represented these are:

1. **Abiotic substances**-:

These are non- living components of the pond eco system and include basic inorganic and organic compound such as water, carbon dioxide, oxygen, calcium, Nitrogen and phosphorus and their compound, amino and humus etc. Only a small amount of these vital nutrients is

found in soluble state in the pond water, but much large proportion is held in reserve solid form especially in the bottom sediments, as well as in the organisms themselves.

The rate of release of the nutrients from the solids, the solar input and cycle of temperature, day length and other climatic conditions regulate the rate of function of the entire ecosystem of pond on day-to-day basic.

2. Biotic Component:

The biotic component of a pond ecosystem comprised the producers and variety of consumers. In a pond the produces organism are of following main types:-

(i) Phytoplankton's- These are minute floating plants usually algae, distributed throughout the pond as deep as light penetrates. When in abundance, phytoplankonts give a greenish colour to pond water. These are very important in the production of basic food for the ecosystem such as lakes, deep ponds and even oceans. The phytoplankton of a pond usually comprise of Eudorina, Volvox, Closterium, Mycrocystis, Anabaena, Oscillatoria , Euglena, Ceratium and Malosira. The phytoplanktons are more important as producers in a pond ecosystem than the large plants.

(**ii) Filamentous algae:-**These also occur floating in water and include Spirogyra, Oedogonium, Nitella and chara.

(iii) Marginal and emergent plants- These are Ipomea, Jussiae which are found floating on the surface and Phragmities, Typha and Acorus, which are rooted plants or sedges.

(iv) Sub-merged plants- These are Vallisneria, Potamogeton, Naias and Otelli, which are rooted to the bottom. Utricularia and Ceratophyllum and rootless sub-merged plants.

(v) Surface- floating plants- These are Pistia, lemnaea, wolffia and Ecichorina.

3. Marco- consumers' organisms-

The macro -consumers represents animal fauna of a pond ecosystem. These are categorized as primary consumers or herbivores, secondary consumers or carnivores and the tertiary consumers. Then primary marco-consumers feed directly upon living plants plat remains and are of the following topics-

(i) Zooplanktons- These animals drift on the water surface through the agencies of water current and include dinoflagellates, hellizoans and copepods.

(ii) **Nektons**- These are free- swimming aquatic animals which swim independent of wave and current action. There for, these possess definite locomotory organs. Insecet and insect larvae which feed upon plants are included in this category.

(iii) Benthos-These are bottom-dwelling forms found crawling or attached t o the bottom. These include mollusks and annelids.The secondary consumers or carnivores are predaceous insects and tertiary consumers are game fish.

4. Saprotophic or saprophytic organisms-

The fungi and saprophytic bacte ria and flagellates are especially abundant in the mud water and bottoms of the ponds, where dead bodies of plants and animals are deposited. These decompose the dead bodies of th e organisms and derive

their nourishment. Decomposition is more rapid when temperature conditions are favorable.

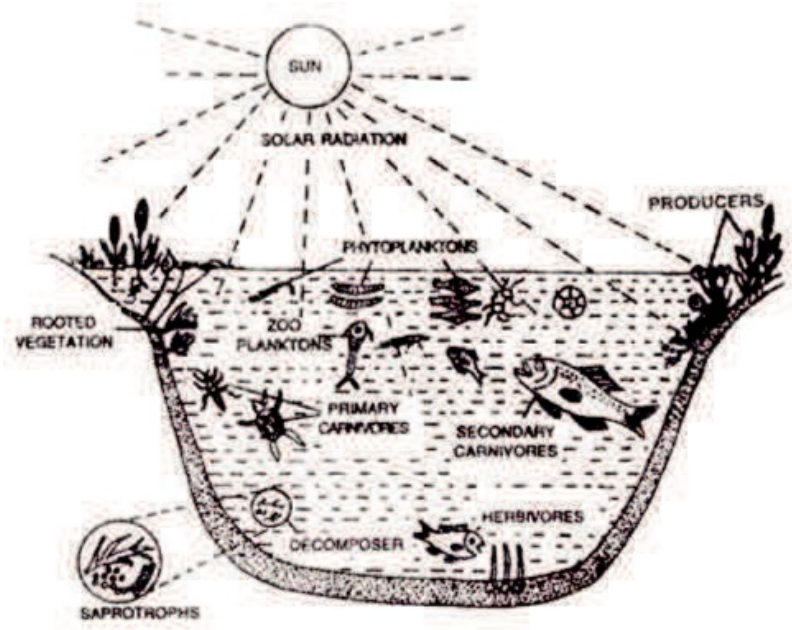

Fig.3.1 Pond ecosystem

3.3.2 MARINE ECOSYSTEM

Marine ecosystem is the biggest ecosystem, which cover around 71%of earth's surface and contain 97% of out planet's

wa ter. Water in Marine ecosystems features in high amounts minerals and salts dissolved in them. Each ocean indeed represents a very large and stable ecosystem. Marine environments as compared with fresh water appear to be more stable in their chemical composition due to being saline, and moreover other such physico- chemical as dissolved oxygen

content, light and temperature are also different. The biotic components of an ocean ecosystem are of the following orders:

Producers:

These are autotrophs and also designated as primary producers, since they are responsible for trapping the radiant energy of sun with the help of their pigments. Producers are mainly the phytoplankton, such as diatoms, dinoflagellates and some macroscopic algae. Besides them, a number of macroscopic seaweeds, as brown and red algae, also contribute significantly to primary production. These organism show a distinct zonation at different depths of water in the sea.

Consumers: -

These all are heterotrophic macro-consumers, being dependent for their nutrition on the primary producers.

Primary consumer:-

The primary consumers are the herbivores, that feed directly on producers, are chiefly crustaceans, mollusks Fish etc.

Secondary consumer:-

Secondary consumers which are carnivorous fish, as Herring, Shad, Mackerel etc., feeding on the herbivores.

Tertiary consumers: -

Tertiary consumers are other carnivorous fishes like cod haddock, Halibut etc. that feed on other carnivores of the secondary consumers level. Thus these are the top carnivores in the food chain.

Decomposers:

Decomposers are mainly the microbes active in the decay of dead organic matter of producers and macro consumers are chiefly bacteria and some fungi.

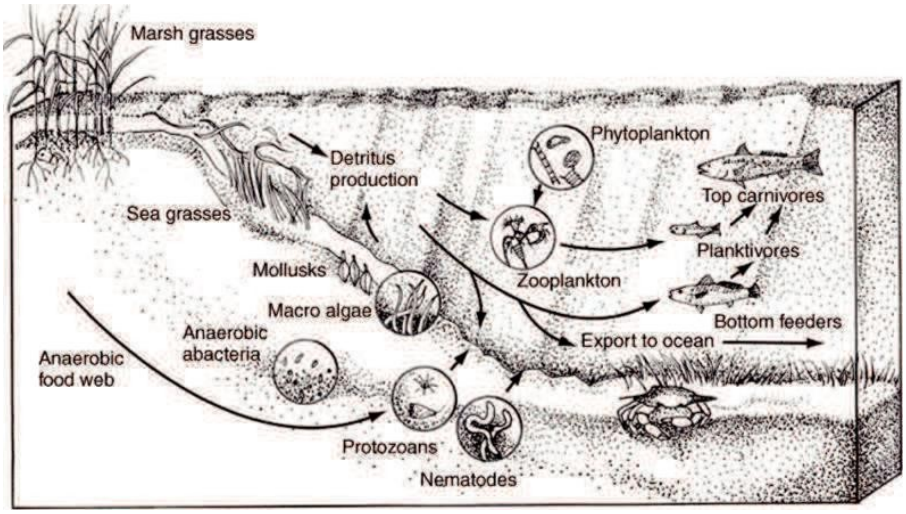

Fig. 3.2 Marine ecosystem

3.3.3 FOREST ECOSYSTEM

Forest occupy roughly 40%of the land in India, the forests occupy roughly one –tenth of the total land area. The different components of a forest ecosystem are abiotic and biotic component.

Abiotic Component:-

These are the inorganic as well as organic substances present in the soil and atmosphere. In addition to the minerals present in forests we find the dead organic debris-the litter accumulation chiefly in temperate climate. The light conditions are different due to complex stratification in the plant communities.

Biotic component:-

The living organisms present in the food chain occur in the following order-

Producers:-

These are mainly trees that show much species diversity and greater degree of stratification especially in tropical moist deciduous forests. The trees are of different kinds depending upon the kind of the forest formation developing in that climate. Besides trees, there are also present shrubs and ground vegetation/grass.In these in forest, dominant members of the flora, the producers, are such trees as Tectona grandis, Butea frondosa. Shorea rubsta and Lagerstromia

Parvifioria. In temperate coniferous forest, shrubs and ground flora are

insignificant. In temperate deciduous forests the dominant trees are species of Quercus, Acer, Betula,Thuja, Picea etc., whereas in a temperature coniferous forest, the producer tress are species of Abies, Picea, Pinus, Cedrus, Juniperus Rhododndron etc.

Consumers:

Consumers are categorized under the followings:

Primary consumers

Primary consumers are the herbivores that include the animals feeding on trees leaves as ants, flies, beetles, leafhoppers, bugs and spiders Etc., and large animals grazing on shoots and/ or fruits of the producers the elephant, nigai, deer, moles, squirrels, shrews, flying foxes, fruit bats, mongooses etc.

Secondary consumers

Secondary consumers are the carnivores like snakes, birds, lizards, fox etc. feeding on the herbivores.

Tertiary consumers

Tertiary consumers are the top carnivores like lion, tiger etc. That eats carnivores of secondary consumers level.

Decomposers:

These are wide variety of microorganism including fungi (species of Aspergillus, Coprinus, Polyporus, Ganoderma, Fusariu m, Alternaria, Trichoderma etc.) bacteria (specie s of Bacillus, Clostridium, Pseudomonas, A ngiococcus etc.) and actinomycetes, like speices of streptomyces etc. Rate of

decomposition in tropical and subtropical forest is m ore rapid than that in the temperate ones.

3.3.4 DESERT ECOSYST EM

The deserts ecosystem are located in regions that receive an annual rain fall less than 25%.They occupy about 17%of all the land on our planet. Due to extremes of temperature, the species composition of d esert ecosystem is less varied and typical. The various components of a desert ecosyste m are-

1.Producers:-The shrubs, bushe s, grass and some trees are the main producer in deserts. The shrubs have extensive and muc h branched root system with the stems and leaves variously modified. Some succulent cacti a re also found in deserts. These store water in their stem to be used during the time of water scarcity. Some lower plants such as lichens, xero phytic mosses and blue green algae are also found there.

2.Consumers:- Only a few animals are found in deserts. The most commo n animals are those reptiles and insects whi ch are able to live under xeric conditions. Mammals are represented by a few species of nocturnal rodents. Some birds are also present. The camel, called the ship of desert, feeds on

tender shoots of the plants and conserves large quantities of water in its stomach.

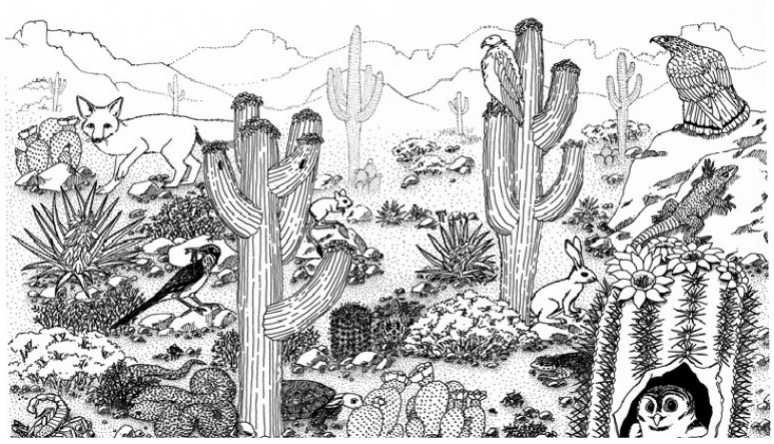

Fig. 3.3 Desert Ecosyste