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Topic: Ecosystem: Structure and Types

Paper: 402 Ecology and Animal Behavior

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INTRODUCTION

- The term ecosystem was coined in 1935 by the Oxford ecologist A.G. Tansley to encompass the interactions among biotic and abiotic components of the environment at a given site.
- Ecosystem was defined in its presently accepted form by Eugene Odum, “an unit that includes all the organisms, i.e., the community in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles, i.e., exchange of materials between living and non-living, within the system”.

Characteristics of Ecosystem

- The ecosystem is a major structural and functional unit of ecology.
- The structure of an ecosystem is related to its species diversity in the sense that complex ecosystem have high species diversity.
- The function of ecosystem is related to energy flow and material cycles within and outside the system.

- Young ecosystems develop and change from less complex to more complex ecosystems, through the process called succession.
- Each ecosystem has its own energy budget, which cannot be exceeded.
- Adaptation to local environmental conditions is the important feature of the biotic components of an ecosystem, failing which they might perish.

Structure of Ecosystem

- All ecosystems consist of the following basic components:
 1. Abiotic components
 2. Biotic components
- The structure of an ecosystem is basically a description of the organisms and physical features of environment including the amount and distribution of nutrients in a particular habitat.

Abiotic Components

- Ecological relationships are manifested in physicochemical environment.
- Abiotic component of ecosystem includes basic inorganic elements and compounds, such as soil, water, oxygen, calcium carbonates, phosphates and a variety of organic compounds.
- It also includes such physical factors and ingredients as moisture, wind currents and solar radiation.
- Radiant energy of sun is the only significant energy source for any ecosystem.

Biotic Components

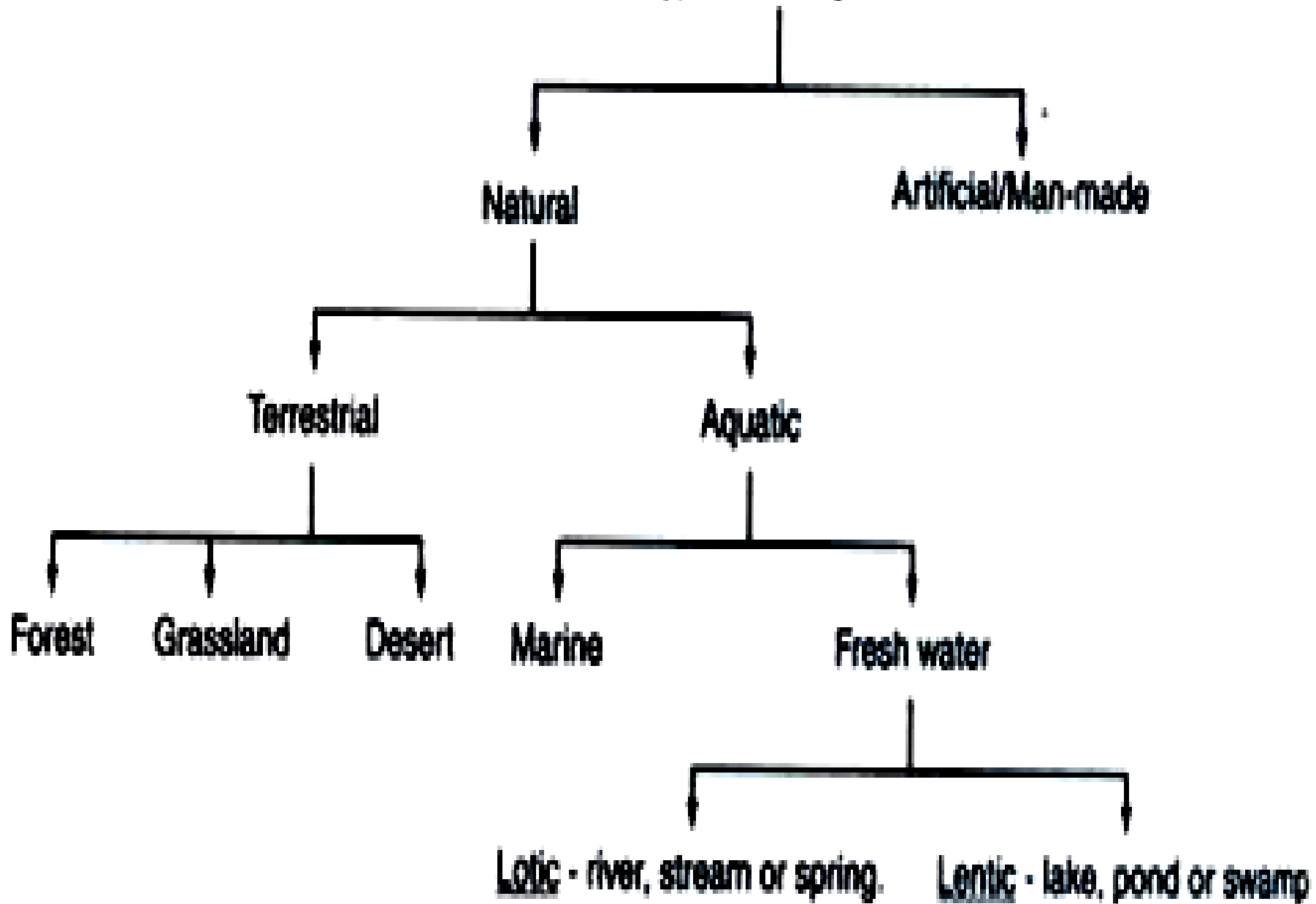
- The biotic components include all living organisms present in the environmental system.
- The biotic components can be grouped into two basic nutritive components:
 - (i) Autotrophic components
 - (ii) Heterotrophic components

- The autotrophic components include all green plants which fix the radiant energy of sun and manufacture food from inorganic substances.
- The heterotrophic components include non-green plants and all animals which take food from autotrophs.

Biotic components of an ecosystem can be described under the following three heads:

1. Producers (Autotrophic components)
 2. Consumers
 3. Decomposers or reducers and transformers
- The amount of biomass at any time in an ecosystem is known as standing crop which is usually expressed as fresh weight, dry weight or as free energy in terms of calories/meter.

Types of Ecosystem



Natural Ecosystem

- These ecosystems are capable of operating and maintaining themselves without any major interference by man.
- **A classification based on their habitat:**
- Terrestrial ecosystems
- Aquatic ecosystems

Terrestrial Ecosystem

- Terrestrial ecosystems are many because there are so many different sorts of places on Earth.
- Some of the most common terrestrial ecosystems that are found are the following:

Forest ecosystem

Grassland ecosystem

Desert ecosystem

Forest Ecosystem

- Forests occupy roughly 40 percent of the land.
- In India these occupy roughly one-tenth of the total land area.
- The different components of forest ecosystem include:
- **Abiotic components:** Include inorganic and organic substances present in soil and atmosphere. Dead organic debris is also present in forests.

- **Biotic components:** These include producers like trees, shrubs and ground vegetation .
- Among the primary consumers are the herbivores which include animals feeding on tree leaves as ants, flies, beetles, spiders etc. and larger animals like elephants, deer etc.
- Secondary consumers are the carnivores like snakes, birds and fox etc.
- Tertiary consumers are the top carnivores like lion, tiger etc.
- Decomposers include microorganisms like fungi, bacteria and actinomycetes.

Grassland Ecosystem

- These occupy a comparatively fewer area, roughly 19 percent of the earth's surface.
- The various components of grassland ecosystem are:
 - **Abiotic components:** These include the nutrients present in soil and the aerial environment.
 - C, H, O, N, P, S are supplied by Carbon dioxide, water, nitrates, phosphates and sulphates.

- **Biotic components:** These may be categorized as:
- **Producers:** These are mainly grasses e.g. Cynodont species, Dicanthium species etc. Shrubs may also be present.
- **Consumers:** These occur in the following sequence:
- Primary consumers are the herbivores feeding on grasses are mainly grazing animals as cows, deer's and rabbit etc. Besides them there are insects, termites and millipedes that feed on leaves.
- **Secondary consumers:** Carnivores feeding on herbivores e.g. Fox, Snakes, frogs, Lizards etc.
- **Decomposers:** Microbes including fungi like Mucor, Aspergillus, Rhizopus etc and some bacteria and actinomycetes.

Desert Ecosystem

- Desert occupy about 17 percent of land, occurring in the regions with an annual rainfall of about 25 centimeters.
- The species composition of such an ecosystem is varied and typical due to the extremes of temperature and water factors.
- The biotic components include:
- Producers are shrubs, especially bushes, some grasses and a few trees.

- Consumers include animals like reptiles and insects which are able to live under xeric conditions. In addition, there are some nocturnal rodents and birds. The camel feeds on tender shoots of the plants.
- Decomposers are very few, as due to poor vegetation the amount of dead organic matter is correspondingly less. They are some fungi and bacteria.



Forest Ecosystem



Grassland Ecosystem



Desert Ecosystem

GETTY

Aquatic ecosystem

- **An aquatic ecosystem** is an ecosystem that exists in water.
- Within an aquatic ecosystem, the environment is a watery one.
- Aquatic ecosystems can be divided into freshwater ecosystems (such as fresh rivers or freshwater lakes) and marine ecosystems such as the sea and rock pools.

Pond Ecosystem

- Pond serves as an example of freshwater ecosystem.
- It exhibits a self-sufficient and self-regulating system.
- The components of the pond ecosystem are as follows:
- **Abiotic components:** The chief substances are heat, light, pH value of water and the basic inorganic and organic compounds .

- **Biotic components:** These include;
- Producers are autotrophic, green plants and some photosynthetic bacteria. These are of following types:
- **Macrophytes** are mainly rooted larger plants e.g Trapa, Typha, Nymphae etc. Some free floating forms like Azolla, Wolffia, Lemma etc also occur in the pond.
- **Phytoplanktons** are minute floating or suspended lower plants e.g Zygnema, Spirogyra etc

- **Consumers** are heterotrophs. Most of the consumers are herbivore, a few are insects and large fishes are carnivorous feeding on herbivores.
- The herbivores are further differentiated as Benthos and zooplanktons.
- Secondary consumers are carnivores which include insects and fish.
- Tertiary consumers are also carnivores and include some large fish feeding on smaller ones.
- Decomposers include variety of microbes chiefly bacteria, actinomycetes & fungi.

Ocean Ecosystem

- The oceans cover about 70 percent of the earth's surface.
- Each ocean represents a stable ecosystem.
- The biotic components of an ecosystem are as follows:
- **Producers** are autotrophs which include the phytoplankton's such as diatoms and dinoflagellates. In addition, brown and red algae also contribute.
- **Consumers** include herbivores e.g. crustaceans, molluscs, carnivores (Herring, shad) feeding on herbivores.
- **Tertiary consumers** include carnivorous fishes like Cods, Haddock etc. that feed on secondary consumers.
- **Decomposers** are the microbes that feed on dead organic matter of producers and macroconsumers e.g. Bacteria and fungi.

Cropland Ecosystem

- In nature we find another kind of ecosystems, where man is very much involved in their operation.
- These are called as cropland ecosystems, that are artificial or man engineered.
- In order to obtain more food, timber etc. Man becomes responsible for the replacement of natural ecosystems.
- Thus, a Cropland ecosystem is an artificial ecosystem aimed primarily to grow a single species of one's choice e.g. Wheat, maize, paddy etc.

CONCLUSIONS

- The unit of living organisms interacting with their non -living environment in an orderly self sufficient manner is known as an ecosystem.
- The structure of an ecosystem is basically a description of the organisms and physical features of environment including the amount and distribution of nutrients in a particular habitat.
- Ecosystem can be broadly divided into natural and artificial ecosystems. Natural ecosystems are further classified as terrestrial and aquatic ecosystems.

REFERENCES

- Environment & Ecology by P.D. Sharma
- Life Sciences by Pranav Kumar and Usha Meena.