Date: 13/04/2023

To whom it may concern

Subject: Completion of ENVS Project by CNDV Gr. A students of Semester II in 2022

The undersigned hereby certifies that the students mentioned in the table given below have completed their AECC 2 - ENVS projects for the University of Calcutta B.A/B.Sc. Semester-II Examination, 2022. These students are mentioned in the modified template of Metric 1.3.2 (for DVV compliance) as ENVS-CNDV Gr. Awith pdf link of their projects stated alongside.

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ECOSYSTEM

NAME: MILLAT NAAZ
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CU ROLL NO: 213013-13-0004
COLLEGE ROLL NO: 21/BSCV/0053
SUBJECT : ENVS(AECC 2)
TOPIC : ECOSYSTEM
SEMESTER: 2
DEPARTMENT : CLINICAL NUTRITION AND DIETETICS
COLLEGE NAME: GOKHALE MEMORIAL GIRLS COLLEGE

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude
To my Prof. Mahua Dutta for her able guidance and support in completing this project. I am also grateful to her for giving me this golden opportunity to do this wonderful project from which I came to know so many things.

CONTENTS : TYPES OF ECOSYSTEM

- Pond Ecosystem
- River Ecosystem
- Wetland Ecosystem
- Forest Ecosystem
- Estuary Ecosystem
- Agro Ecosystem


Tropical Rainforest


Temperate Forest

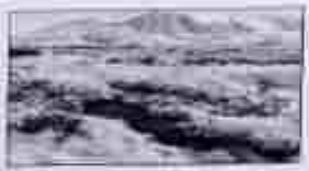

Coniferous Forest (Taiga)


Tropical Grassland (Savannah)


Temperate Grassland


Mediterranean


Desert


Tundra


Mountain

TYPES OF ECOSYSTEM

Pond Ecosystem :

A pond ecosystem is a community of organism that live in a pond . It is a freshwater ecosystem in which the various organism rely on one another. The biotic factors of the pond ecosystem are classified into three categories. They are known as producers , consumers and decomposers.

River ecosystem

River ecosystems are flowing waters that drain the landscape, and include the biotic (living) interactions amongst plants, animals and micro-organisms, as well as abiotic (nonliving) physical and chemical interactions of its many parts.

WETLAND ECOSYSTEM

A wetland is a place in which the land is covered by water—salt, fresh, or somewhere in between—either seasonally or permanently. It functions a its own distinct ecosystem.

FOREST ECOSYSTEM

The terrestrial system in which living things such as trees, insects, animals, and people interact is referred to as a forest ecosystem. It is the smaller classification of the ecosystem as a whole, which is the biggest functional unit comprising all the geographical features and living organisms on Earth. There are many

ESTUARY ECOSYSTEM

Estuaries and their surrounding wetlands are bodies of water usually found where rivers meet the sea. Estuaries are home to unique plant and animal communities that have adapted to brackish water—a mixture of fresh water draining from the land and salty seawater.

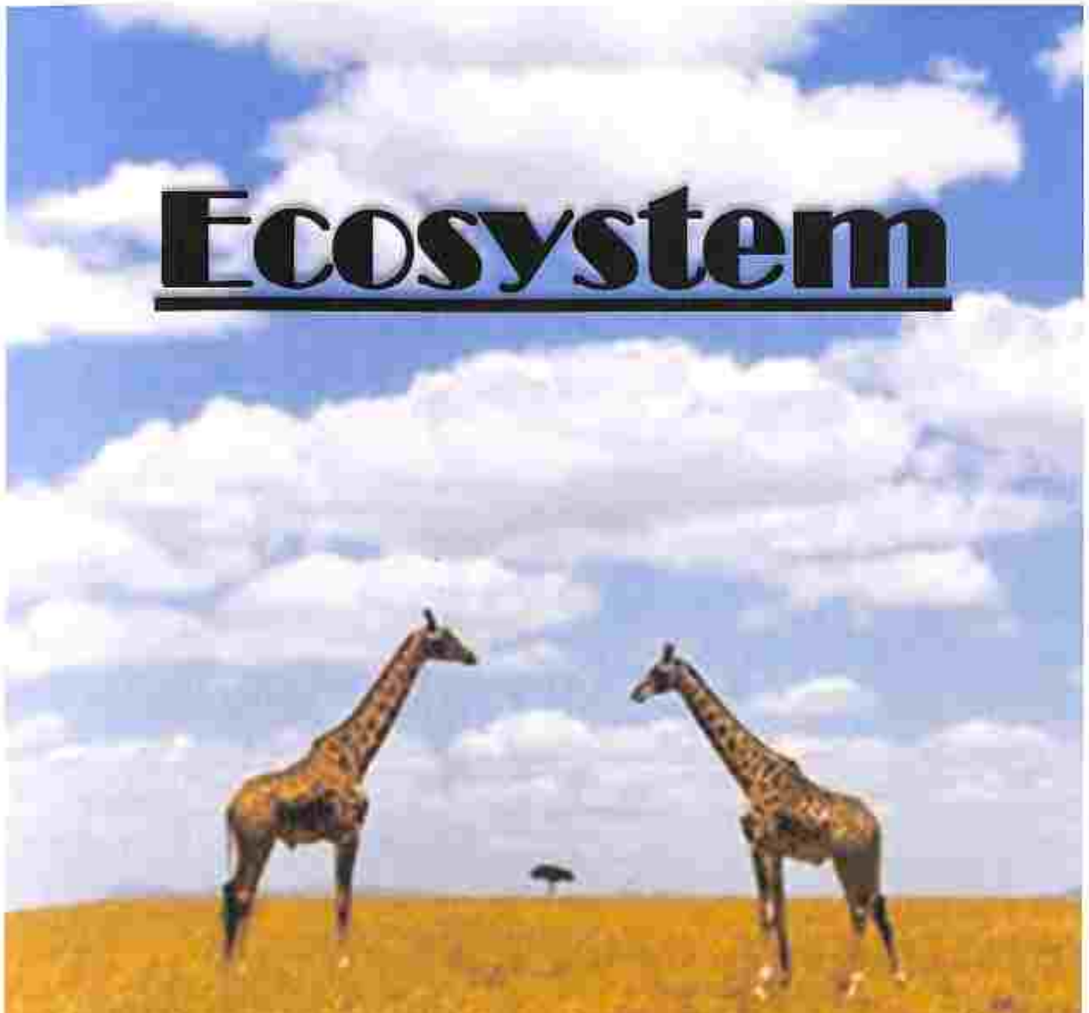
AGRO ECOSYSTEM

An agroecosystem is a cultivated ecosystem, generally corresponding to the spatial unit of a farm and whose ecosystem functions are valued by humans in the form of agricultural goods and services. It is thus co-produced by nature and humans

CONCLUSION

Everyone in the world depends completely on the earth's ecosystem and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfilment and aesthetic enjoyment. The transformation of the planet has contributed substantial net gains in human wellbeing and economic development. An ecosystem is balanced when the natural animals and plants and non-living components are in harmony.

Ecosystem



Name: Suvhasree Bhattacharya

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CU Roll No.: 213013-13-0005

College Roll No.: 21/BSCV/0038

Subject: ENVS (AECC 2) Semester: 2

Contents

Acknowledgment

I express my deepest gratitude to my guide, Prof. Mahua Dutta, for giving her effort and guidance in this project. I am also grateful to her for giving me a wonderful insight into the various aspects which regard to my project work.

Sincere thanks to all my friends and group members for staying by my side and helping me in every step of completing this project.

I would also like to appreciate the cooperation offered by my family members which made this project presentable.

Ecosystem

An **ecosystem** refers to a practical unit of nature where living organisms act together among themselves and with the surrounding physical environment. Environmentalists look at the whole biosphere as a global ecosystem. Moreover, the forest ecosystem is a part of the terrestrial ecosystem.

However, it can differ generally in size; for example, it can be a small pond, sea, or huge forest. Typically, these are self-sustaining. We can split the ecosystems into two comprehensive classifications, terrestrial and aquatic ecosystems.

The terrestrial ecosystem includes grassland, desert, and forest, but the lake, pond, river, and wetland ecosystems fall under the umbrella of the aquatic ecosystem.

POND ECOSYSTEM

Pond Ecosystem

A pond is either a natural or an artificial freshwater body that is enclosed. Ponds can occur naturally in the world or they can be human-made (such as a garden pond). It can either be temporary or permanent and consists of a wide variety of aquatic plants and animals interacting with the surrounding aquatic conditions.

An ecosystem is a technical term for a community of organisms. For such a community to form an ecosystem, it needs to be a distinct system where the organisms live and interact.

The pond Ecosystem differs from other water ecosystems. Unlike the river ecosystem, which is categorized under the Lotic systems, the pond ecosystem falls under the Lentic ecosystem for the reason that the water remains stagnant in ponds for a relatively long period.

Types of Pond Ecosystems

- ***Salt ponds***

Salt ponds contain brackish (i.e., salty) water and can occur close to the seaside where waterlogged ground creates natural pools. Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools. It is also possible to find salt ponds inland, thanks to the presence of brackish streams created through streams flowing through salty rocks.

- ***Garden ponds***

These are man-made artificial pond ecosystems that comprise ornamental plants and animal species that are exported from all over the world (non-native species).

- ***Freshwater ponds***

Freshwater ponds can form anywhere inland, either from rainfall or from the presence of water saturating the soil. They

can also be created by rivers flowing into a depression in the ground. They can be home to fish, birds, amphibians, crustaceans, and many other kinds of wildlife.

- ***Vernal ponds***

Vernal ponds are seasonal ponds. They form in depressions in the ground, but only during certain types of the year when the

rainfall is heaviest. As a result, they will attract certain types of animals and birds that need a drink whenever they appear and at other times of the year will be relatively deserted – one example for instance is a seasonal oasis in the desert. These types of pond ecosystems are sometimes referred to as ephemeral pools as well, to reflect the fact that they only exist at certain times of the year.

- ***Underground ponds***

Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, lichens, and so on.

- ***Mountain ponds***

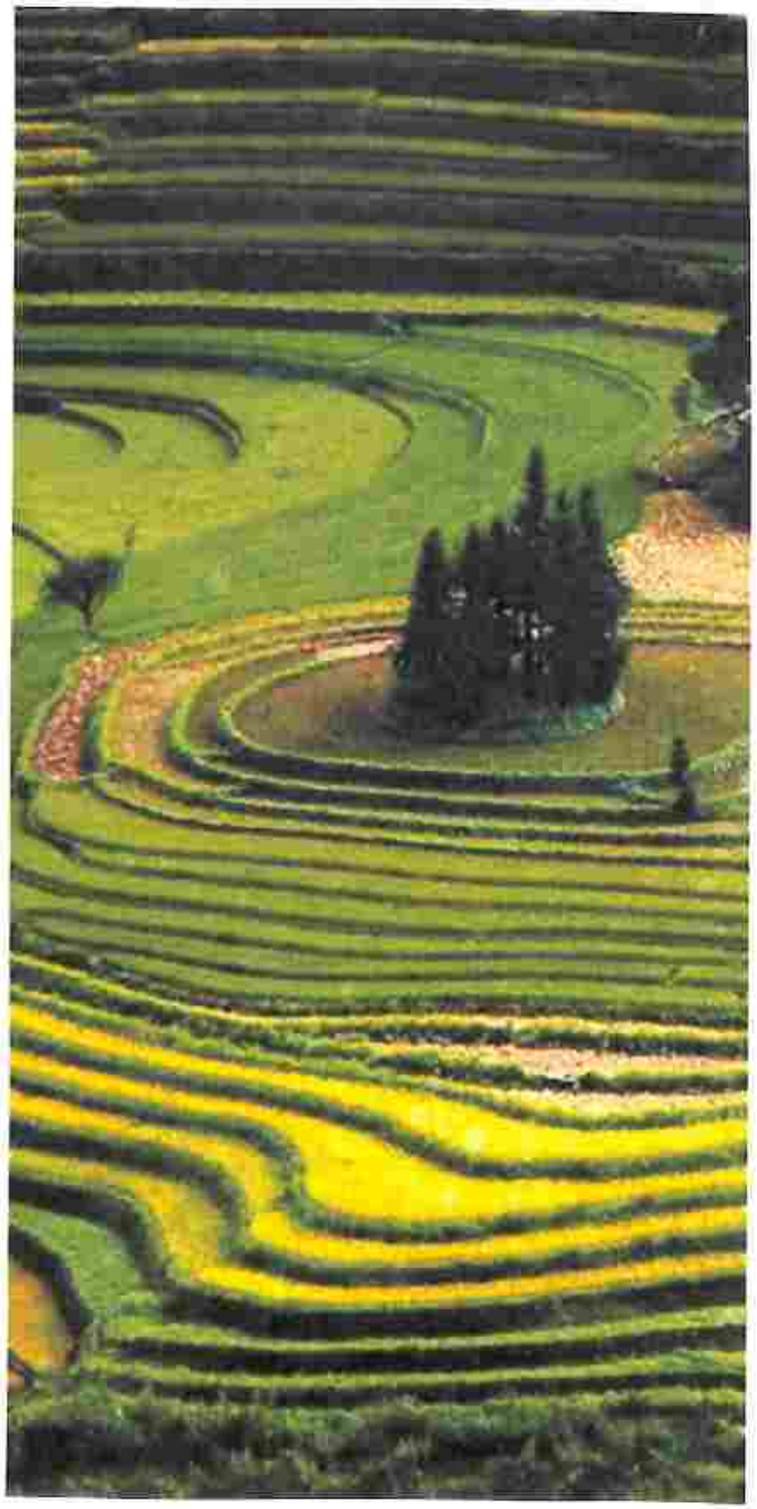
These are naturally formed ponds found in mountain regions. These are formed due to the shifting of rocks and the melting of snow. They accommodate rare or endangered aquatic species.

Characteristics of Pond Ecosystem

Several things mark pond ecosystems out from other types of ecosystems. Below, you will find a list of some of the main features of these ecosystems.

- Still waters: Pond ecosystems are lentic ecosystems; i.e., they involve stagnant or standing water.
- Surrounded by banks: by definition, pond ecosystems are surrounded by either artificial or natural banks.
- Wet: These ecosystems are wet and humid.
- The pond ecosystem exhibits three distinct zones, the littoral zone, limnetic zone, profundal zone, and benthic zone.
- The biotic components of the pond ecosystem occupy different levels in the pond ecosystem, therefore, avoiding the competition for survival. Scavengers and decomposers occupy the bottom level, and the middle level is occupied by fish. The plants enclose the boundaries of the pond and provide shelter to small animals and insects.
- Variable in size: some pond ecosystems can be very small (such as a rockpool) whilst others can be almost as large as a lake.

AGRO ECOSYSTEM



Agro Ecosystem

An agroecosystem is the basic unit of study in agroecology, and is somewhat arbitrarily defined as a spatially and functionally coherent unit of agricultural activity, and includes the living and non-living components involved in that unit as well as their interactions.

An agroecosystem can be viewed as a subset of a conventional ecosystem. As the name implies, at the core of an agroecosystem lies the human activity of agriculture. However, an agroecosystem is not restricted to the immediate site of agricultural activity (e.g., the farm), but rather includes the region that is impacted by this activity, usually by changes to the complexity of species assemblages and energy flows, as well as the net nutrient balance. Traditionally an agroecosystem, particularly one managed intensively, is characterized as having a simpler species composition and simpler energy and nutrient flows than a "natural" ecosystem. Likewise, agroecosystems are often associated with elevated nutrient input, much of which exits the farm leading to the eutrophication of connected ecosystems not directly engaged in agriculture.

Components of Agro Ecosystem

- ***Abiotic Components-***
  - **Water:** Agriculture uses 70% of total global "blue water" withdrawals, most of which is for irrigation.
  - **Climate:** Climate determines to a great extent which crops can grow in an agricultural ecosystem (e.g., precipitation, temperature, winds). Climate change can have both positive and negative effects on agriculture. The challenge for agriculture is to adapt fast enough to a changing climate and to shift production practices to reduce and preferably mitigate the "carbon footprint" of the food production system.
  - **Land, Soil, and Nutrients:** Land, soil, and nutrients are key factors that are often linked in agricultural management practices. For example, the health of an agricultural ecosystem depends on the way the land is used, the quality of the soil, and the input and output of nutrients.

- ***Biotic Components-***
  - **Primary Producers:** Crops and weeds of the field are the primary producers of agroecosystems. e.g., In a Rice field, there are many producers like durba, mutha, Syma, etc also present with rice.
  - **Consumers:** Among consumers grasshoppers, aphids, bugs, ants, rats, birds, men, etc are macro consumers, and frogs, snakes, and hacks are micro consumers.

Properties of Agro Ecosystem

- ***Productivity-*** It is a net increment of values products per unit of resources (land, labour, energy, capital) and is commonly measured as annual yield /hectare.
- ***Stability-*** It is the degree to which, productivity remains constant, despite normal small-scale fluctuation in environmental variables such as climate or the economic condition of the market.
- ***Sustainability-*** The system can maintain its productivity when subject to stress or perturbation. Stress is defined as a regular, sometimes continuous, relatively small, and predictable disturbance. effect of growing soil salinity. A perturbation, by contrast, is an irregular, frequent relatively long, and unpredictable disturbance such as drought or flood, or a new pest.
- ***Equitability-*** It is a measure of how evenly the produce is distributed among its human benefits. The more equitable the system, the more evenly the products to be fed and shared among the population of the farm, village, region, or nation.

Conclusion

Everyone in the world depends completely on the earth's ecosystems and the services they provide. The transformation of the planet has contributed to substantial net gains in human well-being and economic development. An ecosystem is balanced when the natural animals and plants and non-living components are in harmony. With increasing pollution, change in migratory patterns and rise of human population, many ecosystems are in danger of loosing that harmony. Human beings are an integral part of ecological systems and depend on nature for survival and quality of life. Thus, saving nature will save the ecosystems and ourselves.

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author Nandi Midya Santra

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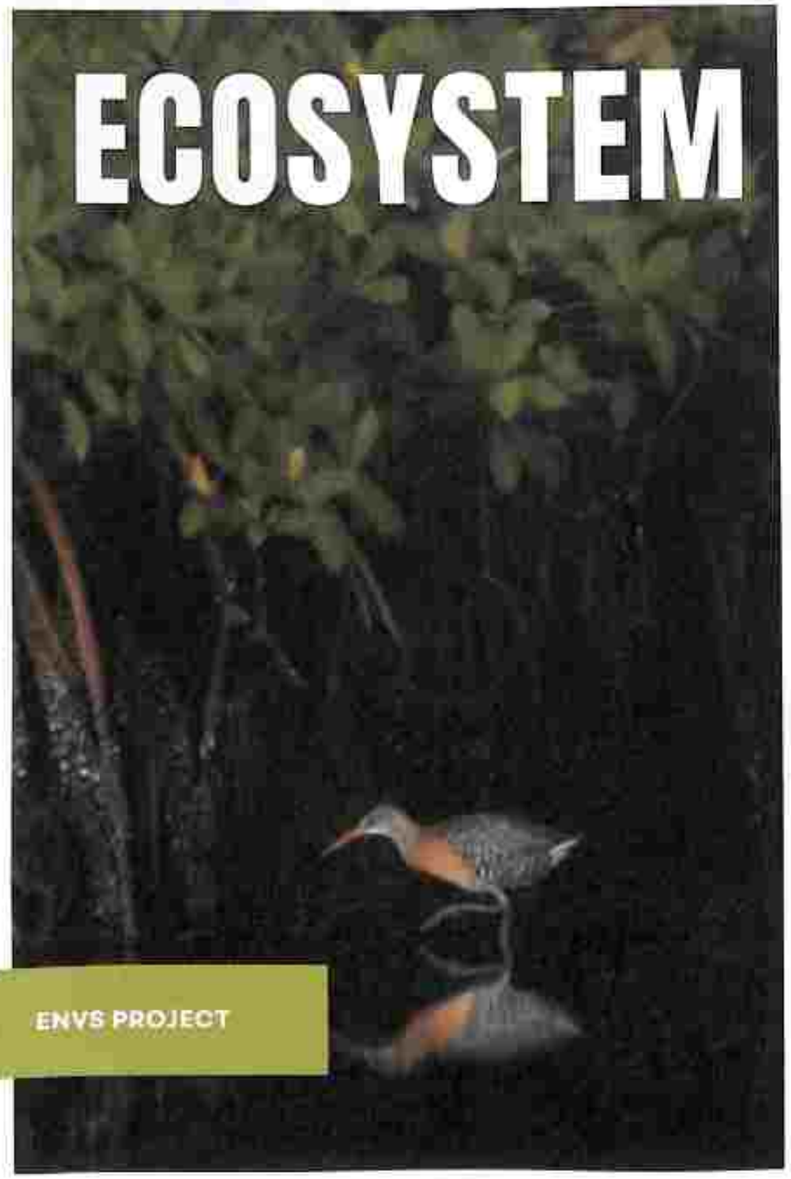
ECOSYSTEM



ENVS PROJECT

SEMESTER 02
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CU REGISTRATION - 013-1211-0236-21
CU ROLL NUMBER - 213013-13-0006

18/6

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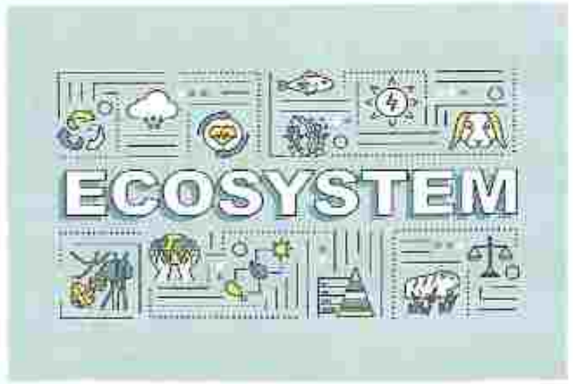
CONTENT

ECOSYSTEM

An ecosystem refers to a practical unit of nature where living organisms act together among themselves and with the surrounding physical environment. Environmentalists look at the whole biosphere as a global ecosystem. Moreover, the forest ecosystem is a part of the terrestrial ecosystem.

However, it can differ generally in size; for example, it can be a small pond or a sea, or a huge forest. Typically, these are self-sustaining. We can split the ecosystems into two comprehensives classifications, specifically, terrestrial ecosystem and aquatic ecosystem.



The terrestrial ecosystem includes grassland, desert, and forest ecosystem, but the lake, pond, river, and wetland ecosystems fall under the aquatic ecosystem umbrella.

Ecosystems are controlled by external and internal factors. External factors such as climate, parent material that forms the soil, and topography control the overall structure of an ecosystem but are not themselves influenced by the ecosystem. Internal factors are controlled by decomposition, root competition, shading, disturbance, succession, and the types of species present.

POND ECOSYSTEM

Introduction: A pond is either a natural or an artificial body of water that is enclosed. Ponds can occur naturally in the world or they can be human-made (such as a garden pond).

An ecosystem is a technical term for a community of organisms. For such a community to form an ecosystem, it needs to be a distinct system where the organisms live and interact.

The pond Ecosys differ from other water ecosystems. Unlike the river ecosystem, which is categorized under the Lotic systems, a point he d ecosystem falls under the Lentic

ecosystem for the reason that the water remains stagnant in ponds for a relatively long period.

Meaning of Pond Ecosystem:

A pond ecosystem is a system of organisms that live together in a pond. A pond ecosystem can be defined in three ways:

1. A closed community of organisms in a body of water
2. An enclosed body of water that houses numerous different creatures.
3. A biological system that includes water and plant and animal life interacting with each other.

So, to summarize, a pond ecosystem is:

- A community of organisms living together
- Within a body of water that can be either artificially enclosed or naturally enclosed.
- A distinct community with its ecology.

Types of pond ecosystem:

Ponds can come in many different forms, and they all have their differentiating characteristics. Below, you will find a discussion of some of the key types of pond ecosystem.

1. Salt ponds.

Salt ponds contain brackish (i.e., salty) water and can occur close to the seaside where waterlogged ground creates natural pools. Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools. It is also possible to find salt ponds inland, thanks to the presence of brackish streams created through streams flowing through salty rocks.

2. Garden ponds.

These artificially created ponds can contain ornamental plant and animal species that come from all over the world (i.e., non-native species).

3. Freshwater pools.

Freshwater pools can form anywhere inland, either from rainfall or from the presence of water saturating the soil. They can also be created by rivers flowing into a depression in the ground. They can be home to fish, birds, amphibians, crustaceans, and many other kinds of wildlife.

4. Vernal pools.

Vernal pools are seasonal ponds. They form in depressions in the ground, but only during certain types of the year when the rainfall is heaviest. As a result, they will attract certain types of animals and birds that need a drink whenever they

appear and at other times of the year will be relatively deserted - one example for instance is a seasonal oasis in the desert. These types of pond ecosystems are sometimes referred to as ephemeral pools as well, to reflect the fact that they only exist at certain times of the year.

5. Underground ponds.

Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, lichens, and so on.

Characteristics of pond ecosystems.

Several things mark pond ecosystems out from other types of ecosystems. Below, you will find a list of some of the main features of these ecosystems.

1. Still waters: pond ecosystems are lentic ecosystems i.e.; they involve stagnant or standing water.
2. Surrounded banks: by definition, pond ecosystems are surrounded by either artificial or natural banks.
3. Wet: these ecosystems are wet and humid.
4. Different levels: distinct communities of creatures will live at different levels of a pond. Crustaceans and deep-water fish may live at the lower level, for example, whilst birds and blooming plants may live towards the surface.
5. Variable in size: some pond ecosystems can be very small (such as a rockpool) whilst others can be almost as large as a lake.

Importance of pond ecosystems:

Pond ecosystems are very important, and for this reason, we must take steps to protect and nurture them. Below, you will find some significant reasons why this is the case.

1.Biodiversity

Pond ecosystems are very important habitats for so many different types of fish, birds, plants, and crustaceans as well as insects such as dragonflies, damselflies, and pond skaters.

2. Ubiquity.

Pond ecosystems can be found on every continent on the planet. That makes them very important for the life of organisms all over the world.

3. Abundance.

Pond ecosystems are very abundant. Not only can they be found

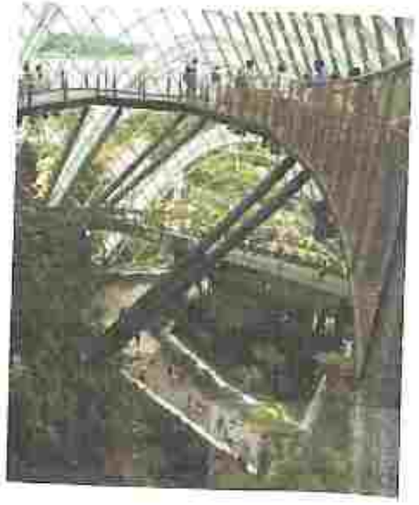
Autotrophs and heterotrophs are biotic component of ecosystems. Green plants take simple inorganic materials and produce their own foods, these organisms are called autotrophs. All other form of life which do not possess chlorophyll can't produce their own foods and depend upon others are known as heterotrophs. E.g.- fungus, most of bacteria and animal etc.

Abiotic Component

Abiotic component is non-living environment are usually of 2 Types.

Materials like water, mineral salts, atmospheric gases etc.

Energy like light, heat, stored energy in chemical bonds etc.



Conclusion:

Everyone in the world depends completely on the earth's ecosystem and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfilment and aesthetic enjoyment. The transformation of the planet has contributed substantial net gains in human wellbeing and economic development. An ecosystem is balanced when the natural animals and plants and non-living components are in harmony. With increasing pollution change in migratory patterns and rise of human population, many ecosystems are in danger of losing that harmony. Human beings are an integral part of ecological systems and depend on nature for survival and quality of life. Thus, saving nature will save the ecosystems and ourselves.

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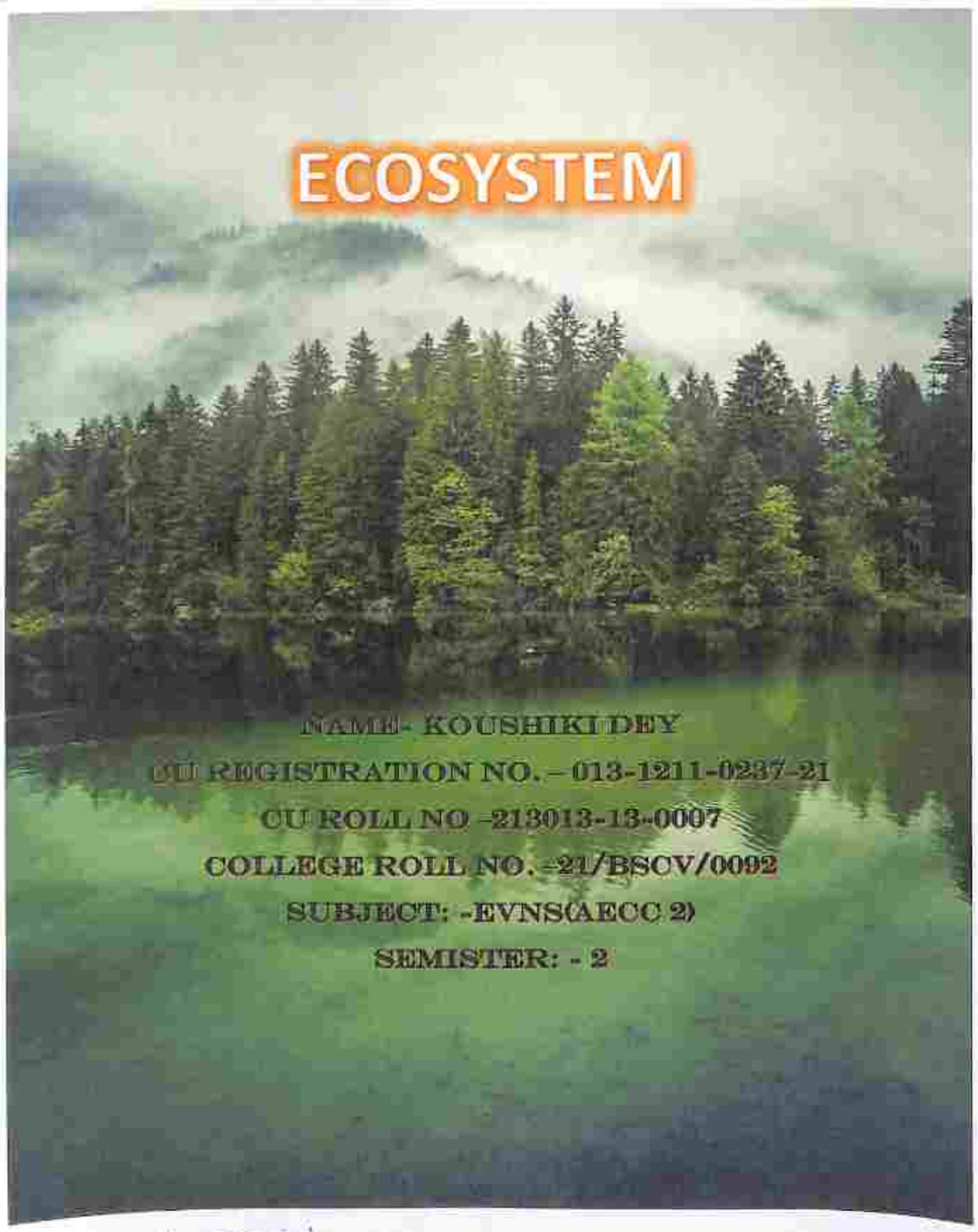


ECOSYSTEM

NAME- KOUSHIKI DEY

CU REGISTRATION NO. – 013-1211-0237-21

CU ROLL NO -213013-13-0007

COLLEGE ROLL NO. -21/BSCV/0092

SUBJECT: -EVNS(AECC 2)

SEMISTER: - 2

CONTENTS

ECOSYSTEM

An ecosystem (or ecological system) consists of all the organisms and the physical environment with which they interact. These biotic and abiotic components are linked together through nutrient cycles and energy flows. Energy enters the system through photosynthesis and is incorporated into plant tissue. By feeding on plants and on one another, animals play an important role in the movement of matter and energy through the system. They also influence the quantity of plant and microbial biomass present. By breaking down dead organic matter, decomposers release carbon back to the atmosphere and facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and microbes.

Ecosystems are controlled by external and internal factors. External factors such as climate, parent material which forms the soil and topography, control the overall structure of an ecosystem but are not themselves influenced by the ecosystem. Internal factors are controlled, for example, by decomposition, root competition, shading, disturbance, succession, and the types of species present. While the resource inputs are generally controlled by external processes, the availability of these resources within the ecosystem is controlled by internal factors. Therefore, internal factors not only control ecosystem processes but are also controlled by them.

Ecosystems are dynamic entities—they are subject to periodic disturbances and are always in the process of recovering from some past disturbance. The tendency of an ecosystem to remain close to its equilibrium state, despite that disturbance, is termed its resistance. The capacity of a system to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity, and feedbacks is termed its ecological resilience. Ecosystems can be studied through a variety of approaches—theoretical studies, studies monitoring specific ecosystems over long periods of time, those that look at differences between ecosystems to elucidate how they work and direct manipulative experimentation. Biomes are general classes or categories of ecosystems. However, there is no clear distinction between biomes and ecosystems. Ecosystem classifications are specific kinds of ecological classifications that consider all four elements of the definition of ecosystems: a biotic component, an abiotic complex, the interactions between and within them, and the physical space they occupy.

TYPES OF ECOSYSTEM

- **Pond Ecosystem.**
- **River Ecosystem.**
- **Wetland Ecosystem.**
- **Forest Ecosystem.**
- **Estuary Ecosystem.**
- **Agro Ecosystem.**

POND ECOSYSTEM

A pond is either a natural or artificial body of water that is enclosed. Ponds can occur naturally in the world or they can be human made (such as garden pond).

An ecosystem is a technical term for a community of organisms. For such a community to form an ecosystem ,its need to be distinct system where the organisms live and interact.

Ponds ecosystem differs from other ecosystem unlike the river ecosystem, which is categorized under the lotic system, pond ecosystem, falls under the lentic ecosystem for the reason that the water remains stagnant in ponds for a relatively longer period of time.

A pond ecosystem is a system of organisms that live together in a pond. A pond ecosystem can be defined in three ways:

- A closed community of organisms in a body of water.
- An enclosed body of water that houses numerous different creatures.

- A biological system that includes water and plant and animal life interacting with each other.

A pond is a quiet body of water that is too small for wave action and too shallow for major temperature differences from top to bottom. It usually has a muddy or silty bottom with aquatic plants around the edges and throughout. However, it is often difficult to classify the differences between a pond and a lake, since the two terms are artificial and the ecosystems really exist on a continuum. Generally, in a pond, the temperature changes with the air temperature and is relatively uniform. Lakes are similar to ponds, but because they are larger, temperature layering or stratification takes place in summer and winter, and these layers turnover in spring and fall. Ponds get their energy from the sun. As with other ecosystems, plants are the primary producers. The chlorophyll in aquatic plants captures energy from the sun to convert carbon dioxide and water to organic compounds and oxygen through the process of photosynthesis. Nitrogen and phosphorus are important nutrients for plants. The addition of these substances may increase primary productivity. However, too many nutrients can cause algal blooms, leading to eutrophication (Read Ponds & Eutrophication for more information).

Types of pond ecosystem

- Salt ponds-Salt ponds contain brackish (i.e. salty) water and can occur close to the sea side where waterlogged ground creates natural pools. Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools. It is also possible to find salt ponds inland, thanks to the presence of brackish streams created through streams flowing through salty rocks.
- Garden ponds-These artificially created ponds can contain ornamental plant and animal species that come from all over the world (i.e., nonnative species).

- Freshwater pools-Freshwater pools can form anywhere inland, either from rainfall or from the presence of water saturating the soil. They can also be created by rivers flowing in to a depression in the ground. They can be home to fish, birds, amphibians, crustaceans and many other kinds of wildlife.
- Vernal pools-Vernal pools are seasonal ponds. They form in depressions in the ground, but only during certain types of the year when the rainfall is heaviest. As a result, they will attract certain types of animals and birds that are in need of a drink whenever they appear and at other times of the year will be relatively deserted – one example for instance is a seasonal oasis in the desert. These types of pond ecosystems are sometimes referred to as ephemeral pools as well, to reflect the fact that they only exist at certain times of year.

- Underground ponds-Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, lichens and so on

Characteristics of pond ecosystem:

There are several things that mark pond ecosystems out from other types of ecosystems. Below, you will find a list of some of the characteristics of pond ecosystems.

There are several things that mark pond ecosystems out from other types of ecosystems. Below, you will find a list of some of the main features of these ecosystems.

1. Still waters: pond ecosystems are lentic ecosystems – i.e. they involve stagnant or standing water.

2. Surrounded by banks: by definition, pond ecosystems are surrounded by either artificial or natural banks.

3. Wet: these ecosystems are wet and humid ones.

4. Different levels: distinct communities of creatures will live at different levels of a pond. Crustaceans and deep water fish may live at the lower level, for example, whilst birds and blooming plants may live towards the surface.

5. Variable in size: some pond ecosystems can be very small (such as a rockpool) whilst others can be almost as large as a lake.

Importance of pond Ecosystem

Pond ecosystems are very important, and for this reason it is vital that we take steps to protect and nurture them.

1. Biodiversity-Pond ecosystems are very important habitats for so many different types of fish, birds, plants and crustaceans as well as insects such as dragonflies, damsel flies and pond skaters.

2. Ubiquity-Pond ecosystems can be found on every continent on the planet. That makes them very important for the life of organisms all over the world.

3. Abundance-Pond ecosystems are very abundant. Not only can they be found almost everywhere, they can be found plentifully. That, again, makes them a key habitat for many different species.

4. Source of hydration-Even if they do not actually live in the pond ecosystem, many species of animals will come to pond ecosystems whenever they need a drink. A key example is a watering hole in a prairie or desert. Humans can also use these ecosystems as a source of water.

5. Beauty-Pond ecosystems are very beautiful as well. As we watch the sunlight reflecting off the surface of a pond we can feel inspired, calm and in touch with nature in features of these ecosystem.

Abiotic Components of the Pond Ecosystem

Abiotic components are the non-living components of an ecosystem that matters for the survival of the aquatic species. There are the following main abiotic components of a pond ecosystem:

Light: Light serves as a main abiotic component required for the photosynthetic activities of the phytoplankton. The littoral zone has the maximum penetration of light, whereas the profound zone has the least penetration of light.

Temperature: As the depth of the pond increases, the temperature of the water gradually decreases due to the gradual decrease in the light penetration.

Dissolved oxygen: The amount of dissolved oxygen is maximum in the shallow water and gradually decreases while moving from the surface to the depth of the pond. Dissolved oxygen: The amount of dissolved oxygen is maximum in the shallow water and gradually decreases while moving from the surface to the depth of the pond.

Biotic Components of the Pond Ecosystem

Biotic components are living components. A wide variety of living components are found in the pond ecosystem can be discussed as follows:

Producers: These include species of rooted, submerged, emerged, floating plants and algae. The most common filamentous algae found in ponds is Spirogyra. Mougeotia and Zygnema are some other algae found in the pond. Azolla, Hydrilla, Pistia, Wolffia, Lemna, Eichhornia, Nymphaea, Potamogeton, Jussiaea, etc., are a few examples of green plants that are found in the pond ecosystem.

Primary consumers: A large population of zooplanktons are the main primary consumers. Besides these, small herbivores such as snails, insects, small fishes, tadpoles, and larvae of aquatic animals are the primary consumers often found in the pond.

Secondary consumers: These include large animal species such as frogs, big fishes, water snakes, crabs, etc. The consumers of the highest order might include mammals like water shrews, water voles, herons, ducks, kingfishers, etc.

Decomposers: These include different types of bacteria and fungi that feed upon dead and decaying part of the aquatic species.

Food Chain in the Pond Ecosystem

The food chain is a sequence of organisms in which each organism eats the lower member and is being eaten up by the next higher member.

Phytoplankton and algae serve as producers that convert solar energy into chemical energy.

Phytoplankton is being consumed by zooplankton (primary consumers).

The food chain further proceeds with the small pond species that feed on zooplankton.

Small pond species are eaten by large pond species.

A number of bacteria and fungi feed on dead and decaying parts of the animal species and are therefore called decomposers. Decomposers convert the organic matter (dead plants and animals) into their inorganic components that are again utilized by producers, and hence a continuous flow of energy is maintained.

RIVER ECOSYSTEM

Introduction: -

Ecosystems are classified into aquatic and terrestrial ecosystems. The aquatic ecosystems are water-borne and the terrestrial ecosystems are land-based. Based on the quality of water involved, the aquatic ecosystems are further classified into fresh water and marine types. Being potable and pure, fresh water is mostly used for domestic, agricultural and industrial consumption. In addition to natural water bodies, artificial reservoirs and Dams are constructed to preserve the freshwater, without letting them into seas or natural lakes. Freshwater ecosystems deal with both running and standing water bodies and their life. Lentic ecosystems and lotic ecosystems are the names given to standing and flowing water bodies, respectively. Almost all ecological factors like temperature, light, pH, dissolved gases and salts of water, turbidity, alkalinity, salinity, depth and areal distribution play an active role in controlling the habitat of these ecosystems.

River ecosystems have:

- flowing water that is mostly unidirectional
- a state of continuous physical change
- many different (and changing) microhabitats
- variability in the flow rates of water
- plants and animals that have adapted to live within water flow conditions.

Water flow

Water flow is the main factor that makes river ecology different from other water ecosystems. This is known as a lotic (flowing water) system. The strength of water flow varies from torrential rapids to slow backwaters. The speed of water also varies and is subject to chaotic turbulence. Flow can be affected by sudden water input from snowmelt, rain and groundwater. Water flow can alter the shape of riverbeds through erosion and sedimentation, creating a variety of changing habitats.

Substrate

The substrate is the surface on which the river organisms live. It may be inorganic, consisting of geological material from the catchment area such as boulders, pebbles, gravel, sand or silt, or it may be organic, including fine particles, leaves, wood, moss and plants. Substrate is generally not permanent and is subject to large changes during flooding events.

Light

Light provides energy for photosynthesis, which produces the primary food source for the river. It also provides refuges for prey species in the shadows it casts. The amount of light received in a flowing waterway is variable, for example, depending on whether it's a stream within a forest shaded by overhanging trees or a wide exposed river where the Sun has open access to its surface. Deep rivers tend to be more turbulent, and particles in the water increasingly weaken light penetration as depth increases.

Plants are most successful in slower currents. Some plants such as mosses attach themselves to solid objects. Some plants are free-floating such as duckweed or water hyacinth. Others are rooted in

areas of reduced current where sediment is found. Water currents provide oxygen and nutrients for plants. Plants protect animals from the current and predators and provide a food source.

Invertebrates

Invertebrates have no backbone or spinal column and include crayfish, snails, limpets, clams and mussels found in rivers. A large number of the invertebrates in river systems are insects. They can be found in almost every available habitat – on the water surface, on and under stones, in or below the substrate or adrift in the current. Some avoid high currents by living in the substrate area, while others have adapted by living on the sheltered downstream side of rocks. Invertebrates rely on the current to bring them food and oxygen. They are both consumers and prey in river systems.

Fish

The ability of fish to live in a river system depends on their speed and duration of that speed – it takes enormous energy to swim against a current. This ability varies and is related to the area of habitat the fish may occupy in the river. Most fish tend to remain close to the bottom, the banks or behind obstacles, swimming in the current only to feed or change location. Some species never go into the current. Most river systems are typically connected to other lotic systems (springs, wetlands, waterways, streams, oceans), and many fish have life cycles that require stages in other systems. Eels, for example, move between freshwater and saltwater. Fish are important consumers and prey species.

thought of as seasonal or occasional rivers, and they are known as episodic because they only exist after an episode of a heavy downpour of rain.

- Exotic River
- Any river that flows through a very dry region is called an exotic river. Most commonly, exotic rivers flow through the desert and are found in places such as Saudi Arabia and the countries that surround it..
- The Tigris and Euphrates rivers are perfect examples of exotic rivers, and they flow from the Persian Gulf into northern Iraq. Essentially, a river is called exotic because it stands out on the landscape, so a river that sits in the middle of an otherwise dry, barren region such as a desert is always called an exotic river.
- Intermittent Rivers
- These are rivers that have a semi-permanent nature and are known because of their seasonal flow. During wet periods when runoff is related to both heavy rain or a temporary rise of the water table, the rivers will flow fully. In the summertime, which is considered a dry period, the river bed may be dry because of a falling water table and reduced rainfall.
- Mature river-A mature river is not very steep and has a slow flow when compared to youthful rivers. Youthful rivers have several tributaries feeding into it, and they have less of a sediment deposit than youthful rivers. Examples include the River Thames, the St. Lawrence River, and the Ohio River. Ture Rivers
- Old Rivers-Old rivers have a low gradient and they depend on floodplains. The Nile, Euphrates, and Ganges rivers are perfect examples of old rivers.
- Periodic Rivers-Periodic rivers have dry spells throughout the year, especially if they are located in very dry climates where the precipitation is less frequent than the amount of evaporation. Also called nonperennial rivers, they usually flow best right after a heavy rain.
- Permanent Rivers-Permanent rivers are those which have water all year around. These are also called perennial rivers, and the water comes mostly from groundwater. Also contributing to the water flow is surface water runoff. The only time these rivers do not have water is during periods of extreme drought, which is seldom.
- Youthful Rivers-With a steep gradient and only a few tributaries, youthful rivers flow swiftly and quickly. Examples include the U.S. rivers of Trinity and Brazos and the Ebro River in Spain.
- Biotic Classification-Biotic classification refers to each river's ecosystem type, and it includes everything from the purest and cleanest rivers to the most contaminated ones. Biotic classification is broken down into three different zones, described below.

- ❖ Crenon zone – This is the area right near the source of the river. In other words, it is the zone where the river gets its start. It is broken down into two main zones – the eucrenon, which encompasses the spring zone; and the hypocrenon, also known as the headstream zone. The Crenon zone has flow speeds that are slower than speeds found in the Rhithron zone, and it has lower oxygen levels and colder temperatures as well.
- ❖ Rhithron zone – This is the upstream area of the river, characterized by quicker and more intense flowing speeds. The Rhithron zone has very cool temperatures and a higher oxygen level than the Potamon zone.
- ❖ Potamon zone – The Potamon zone is the downstream area of the river. It has slower flowing speeds and is usually warmer than other areas of the river. It also consists of a lower oxygen content and a very sandy river bed.
- ❖ Experts use the biotic classification system to identify recovery time from and sensitivity to the surrounding habitat's environmental disturbances. In this example, wetlands are not very sensitive to disturbance but need longer recovery times from environmental disturbances.
- ❖ Microhabitats, on the other hand, have fast recovery times but are also extremely sensitive to any type of disturbance.
- ❖ Chronological Classification-Chronological classifications go by the river's age, which experts can study by researching its patterns of erosion. They can be classified further into these three types of rivers:
- ❖ Mature rivers – Mature rivers have grades that are not very steep, and they have several tributaries, along with a fast discharge speed.
- ❖ Old rivers – You can identify old rivers with their floodplains.
- ❖ Rejuvenated rivers – These rivers have various gradients, and they are raised by tectonic movement.
- ❖ Young rivers – Young rivers flow quickly, have deep instead of wide channels, and no tributaries.
- ❖ Topographic Classification-Topographic classification involves the shape, physical makeup, and specific features of the river, and all rivers fall into one of the three separate categories that are described below.
- ❖ Alluvial rivers –
  - o Alluvial rivers have floodplains, which is land found next to the river that is flooded quite often; and channels, or river routes, that are formed in sediment that is consolidated loosely.
  - o Because of flooding, alluvial rivers maintain a primary route filled with water and they form side channels, wetlands, and oxbow lakes. When the water in this type of river rises, the banks are

eroded, and the resulting sediment is deposited into the sandbars or floodplains, usually in the middle of the river.

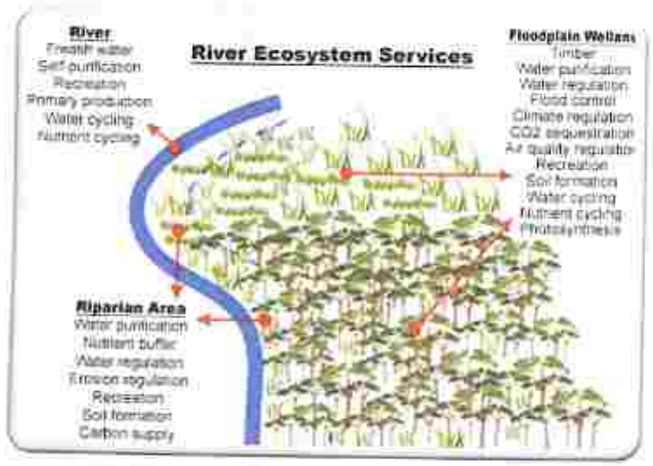
- o Alluvial rivers contain habitats that range from shallow to deep pools and very turbulent waters, and they are further broken down into types that include braided, straight, meandering, wandering, and anastomose.

- ❖ Bedrock rivers –
  - o Bedrock rivers are formed when water cuts through new levels of sediment, resulting in the bedrock below.
  - o They are more commonly found in areas where the earth's surface has experienced an upward shift – including uplands and mountainous regions.
  - o Bedrock rivers have a lot of alluvium, or loose sediment and soil. This alluvium moves with the water and shapes and erodes the river while moving along.
  - o The Colorado River in the United States is a perfect example of a bedrock river.
- ❖ Mixed bedrock-alluvial rivers.
  - o Just as the name implies, these rivers have a characteristic that falls into both of the above categories.
  - o They usually flow through different bedrock layers and areas with alluvial deposits.
- ❖ Whitewater Classification-Rivers contribute to healthy ecosystems and provide fresh water, but they can also be important aspects of a recreational activity.

Importance of river ecosystem

A river ecosystem consists of inter-related living & non-living parts. The river ecosystem provides us with free ecosystem services. For this reason, there is a noticeable difference between the environment and the living communities of rivers with those of the ponds.

In the river there are different types of algae fishes like Hilsha, Pungas, Chital, Boal etc. live in the rivers. The bodies of these fishes are laterally compressed. For this feature of their body shape, they are capable of moving easily in the strong current. Near the bank of the river where the current is less, living communities like those of the ponds grow there. In the ecosystem of rivers, the food chain is short e.g. Algae, Hilsa, Boal



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WETLANDS ECOSYSTEM

A wetland is a distinct ecosystem that is flooded by water, either permanently (for years or decades) or seasonally (for weeks or months). Flooding results in oxygen-free (anoxic) processes prevailing, especially in the soils.[1] The primary factor that distinguishes wetlands from terrestrial land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique anoxic hydric soils.[2] Wetlands are considered among the most biologically diverse of all ecosystems, serving as home to a wide range of plant and animal species. Methods for assessing wetland functions, wetland ecological health, and general wetland condition have been developed for many regions of the world. These methods have contributed to wetland conservation partly by raising public awareness of the functions some wetlands provide.

Technical Definitions

A wetland is "an ecosystem that arises when inundation by water produces soils dominated by anaerobic and aerobic processes, which, in turn, forces the biota, particularly rooted plants, to adapt to flooding."

5 Types of Wetlands in the Discovery Islands

- BOG – nutrient-poor, acidic wetland that supports Sphagnum peat-mosses and shrubs such as bog-rosemary and Labrador tea. Their primary source of water is from rainfall.
- FEN – nutrient-medium peat-land, receiving some mineral-bearing ground water. The dominant vegetation consists of brown mosses and sedges.
- MARSH – nutrient-rich, permanently or seasonal flooded, and usually dominated by a few grass-like species (grasses, rushes, sedges) that grow up out of the water. Salt-marshes in estuaries usually experience diurnal tidal flooding.

- SWAMP – wetland with sufficient dry period or micro-sites elevated above the water-saturated surface, so that at least 25% is covered with flood-tolerant trees or shrubs. There is a well-developed low plant (herb) layer and an abundant inflow of freshwater rich in nutrients.
- SHALLOW-WATER WETLAND – permanently flooded up to 2 metres in depth, where rooted vegetation has leaves either floating or submerged, and where less than 10% is covered by vegetation growing above the surface. Shallow-water wetlands may provide the transition to Freshwater Pond and Lake ecosystems.

Look For Typical Species in Wetland Ecosystems

- TYPICAL FAUNA Beaver, blue dasher dragonfly, bufflehead, common yellow-throat, dun skipper butterfly, hooded merganser, little brown myotis, long-toed salamander, marsh wren, muskrat, northern red-legged frog, olive-sided flycatcher, Pacific chorus frog, Pacific forktail damselfly, purplish copper butterfly, red-wing blackbird, ring-necked duck, rough-skinned newt, Virginia rail, western pondhawk dragonfly, western toad, wood duck
- TYPICAL FLORA Peatmosses, western bog laurel, Labrador tea,buckbean, cattail, common butterwort, hardhack (Spirea), Labrador tea, marsh cinquefoil, narrow-leaved bur-reed, Pacific water parsely, Sitka spruce, sweet gale, red alder, round-leaved sundew, shore pine, skunk cabbage, slough sedge, other sedges, water plantain, water smartweed, watershield, western bog laurel, western redcedar, willow, yellow pond-lily
- SPECIES AT RISK Water bur-weed (Blue), waterwort water-milfoil (Blue), white adder's-mouth orchid (Blue), olive-sided flycatcher (Blue, Threatened), blue dasher (dragonfly) (Blue), little brown myotis (bat) (Yellow, Endangered), western toad (Blue, Special Concern), northern red-legged frog (Blue, Special Concern)

ECOLOGICAL COMMUNITIES AT RISK Common cattail marsh, Sitka sedge/Pacific water parsley; Labrador tea/western bog laurel/peat mosses; sweet gale/Sitka sedge, lodgepole pine/peat mosses; western redcedar/slough sedge

Importance of wetlands:-

- Biological supermarkets: Wetlands are amongst the most productive ecosystems and are often called the "biological supermarkets" as they produce a huge amount of food which attracts many animal species.
- Flood control: they act as natural sponges, helping in avoiding floods. They temporarily storing and gradually releasing stormwater.

- Water purification: They help in improving water quality through removing or retaining inorganic nutrients or by processing organic wastes and reducing suspended nutrients.
  - For this function, wetlands are often referred to as "Kidneys of the Earth".
- Help in carbon sequestration: they act as carbon sinks and wetland soil contains a high amount of carbon.
  - They also provide the conditions needed for the removal of nitrogen and phosphorus from surface water.
- Groundwater recharge: by storing water, they help in increasing the water level by recharging the groundwater aquifers. Further, they discharge groundwater into lakes, rivers, and streams during dry periods, helping fulfill the people's freshwater needs.
  - Helps in ecological conservation: by hosting a large number of species of microbes, plants, insects, amphibians, reptiles, birds, fish, and mammals.
  - They also help in countering certain environmental problems such as algal blooms, dead zones, and fish kills that are generally related to nutrient overloading.
  - Economic benefits:
- Support various plants and animals having medicinal and commercial values.
- Many countries have their fishing and shellfishing industries dependent on wetlands.
- Acts as a source of livelihood for local people as many of them are dependent upon wetlands resources for their employment.
  - Provides recreational, educational, and tourism opportunities: for example, many people visit these places for birdwatching or wildlife photography.

Biota:-

The biota of a wetland system includes its flora and fauna as described below. The most important factor affecting the biota is the duration of flooding. Other important factors include fertility and salinity. In fens, species are highly dependent on water chemistry. The chemistry of water flowing into wetlands depends on the source of water and the geological material in which it flows through as well as the nutrients discharged from organic matter in the soils and plants at higher elevations in slope wetlands. Biota may vary within a wetland due to season or recent flood regimes.

Flora:-

Bud of Nelumbo nucifera, an aquatic plant.

There are four main groups of hydrophytes that are found in wetland systems throughout the world.

Submerged wetland vegetation can grow in saline and fresh-water conditions. Some species have underwater flowers, while others have long stems to allow the flowers to reach the surface. Submerged species provide a food source for native fauna, habitat for invertebrates, and also possess filtration capabilities. Examples include seagrasses and eelgrass.

Floating water plants or floating vegetation are usually small, like those in the Lemnoideae subfamily. Emergent vegetation like the arrow arum (*Peltandra virginica*) rise above the surface of the water.

Trees and shrubs, where they comprise much of the cover in saturated soils, qualify those areas in most cases as swamps. The upland boundary of swamps is determined partly by water levels. This can be affected by dams. Some swamps can be dominated by a single species, such as silver maple swamps around the Great Lakes. Others, like those of the Amazon basin, have large numbers of different tree species. Examples include cypress (*Taxodium*) and mangrove.

Fauna:-

Many species of frogs live in wetlands, while others visit them each year to lay eggs.

Snapping turtles are one of the many kinds of turtles found in wetlands.

Fish are more dependent on wetland ecosystems than any other type of habitat. Seventy-five percent of the United States' commercial fish and shellfish stocks depend solely on estuaries to survive. Tropical fish species need mangroves for critical hatchery and nursery grounds and the coral reef system for food.

Amphibians such as frogs need both terrestrial and aquatic habitats in which to reproduce and feed. While tadpoles control algal populations, adult frogs forage on insects. Frogs are used as an indicator of ecosystem health due to their thin skin which absorbs both nutrient and toxins from the surrounding environment resulting in an above average extinction rate in unfavourable and polluted environmental conditions.

Reptiles such as alligators and crocodiles are common in wetlands of some regions. Alligators occur in fresh water along with the fresh water species of the crocodile. The Florida Everglades is the only place in the world where both crocodiles and alligators coexist. The saltwater crocodile inhabits estuaries and mangroves and can be seen in the coastline bordering the Great Barrier Reef in Australia. Snakes, lizards and turtles also can be seen throughout wetlands. Snapping turtles are one of the many kinds of turtles found in wetlands.

Birds, particularly waterfowl and wading birds, use wetlands extensively.

Mammals include numerous small and medium-sized species such as voles, bats, and platypus in addition to large herbivorous and apex species such as the beaver, coypu, swamp rabbit, Florida panther, and moose. Wetlands attract many mammals due to abundant seeds, berries, and other vegetation components, as well as abundant populations of prey such as invertebrates, small reptiles and amphibians.

Invertebrates:-

Invertebrates of wetlands include aquatic insects (such as dragonflies, aquatic bugs and beetles, midges, mosquitoes), crustaceans (such as crabs, crayfish, shrimps, microcrustaceans), mollusks (such as clams, mussels, snails), and worms (such as polychaetes, oligochaetes, leeches), among others. Invertebrates comprise more than half of the known animal species in wetlands, and are considered the primary food web link between plants and higher animals (such as fish and birds). The low oxygen conditions in wetland water and their frequent flooding and drying (daily in tidal wetlands, seasonally in temporary ponds and floodplains) prevent many invertebrates from inhabiting wetlands, and thus the invertebrate fauna of wetlands is often less diverse than some other kinds of habitat (such as streams, coral reefs, and forests). Some wetland invertebrates thrive in habitats that lack predatory fish. Many insects only inhabit wetlands as aquatic immatures (nymphs, larvae) and the flying adults inhabit upland habitats, returning to the wetlands to lay eggs. For instance, a common hoverfly *Syritta pipiens* inhabits wetlands as larvae (maggots), living in wet, rotting organic matter; these insects then visit terrestrial flowers as adult flies.

Algae:-

Algae are diverse plant-like organisms that can vary in size, color, and shape. Algae occur naturally in habitats such as inland lakes, inter-tidal zones, and

damp soil and provide a dedicated food source for many animals, including some invertebrates, fish, turtles, and frogs. There are three main groups of algae:

- Plankton are algae which are microscopic, free-floating algae. This algae is so tiny that on average, if 50 of these microscopic algae were lined up end-to-end, it would only measure one millimetre. Plankton are the basis of the food web and are responsible for primary production in the ocean using photosynthesis to make food.
- Filamentous algae are long strands of algae cells that form floating mats.
- *Chara* and *Nitella* algae are upright algae that look like a submerged plant with root

Characteristics of wetland Ecosystem

For an ecosystem to be considered a wetland, it must meet the following characteristics:

- Are considered transition areas or gradual changes between aquatic and terrestrial systems. That is, they are considered mixed ecosystems because they preserve some of the characteristics of one ecosystem and another. We found that some parts are more focused on terrestrial ecosystems, while others are more focused on marine ecosystems.
- They are flood zones, so they can be temporary or permanent areas. Temporary areas appear in places with small depressions, which flood easily when it rains heavily.
- Wetland waters must be stagnant water, small streams, fresh water or salt water, and include small oceanic areas with a certain depth. The tidal effect of wetlands is very low. Usually this effect will not exceed 6 meters.

- The limit of a wetland will be determined by its type of vegetation in each terrain. The vegetation is hydrophilic, that is, it needs a good tendency to water. It is also possible to distinguish between non-hydrophilic vegetation and vegetation that represents the boundary of a wetland, where another ecosystem ends and begins with a completely terrestrial environment.
- Wetlands are ideal habitats for a large number of species especially plants and animals such as mammals, reptiles, amphibians, fish and insects.

FOREST ECOSYSTEM

A Forest Ecosystem refers to the terrestrial system in which living organisms such as trees, insects, animals and human beings interact with each other. It is the smaller classification of the ecosystem as a whole, which is the biggest functional unit comprising of all the geographical features and living organisms on Earth. There are many types of forest ecosystems and the classifications are based on the temperature and rainfall in the area of the particular forest ecosystem under observation.

A forest ecosystem is the most robust of all as it does not undergo major changes by the effect of weather, forces of nature or human intervention. The ecosystem consists of different varieties of wild animals, trees and herb species, different types of insects and micro-organisms. This article covers the complete topic in detail in an easy-to-understand way. Continue reading to know more about forest ecosystem and its types.

Types of Forest Ecosystem:-

There are a few types of forest ecosystems listed below:

- Tropical Evergreen Rainforest: Only a small percentage of tropical forests are rainforests where average rainfall is 80–40080–400 inches in a year. This forest is characterised by deep and dense vegetation consisting of tall trees reaching different levels.
- Tropical Deciduous Rainforest: The main characteristic of tropical deciduous rainforest are broad-leaved trees along with dense bushes, shrubs, etc. Two main seasons- summer and winter are distinctly visible there. This type of forest is found in many parts of the world. A large variety of flora and fauna are found here.
- Temperate Evergreen Forest: Temperate evergreen forest is a type of forest that is characterised by a smaller number of trees but an adequate number of ferns and mosses.
- Temperate Deciduous Forest: Temperate deciduous forest evolves in the moist temperate region with sufficient rainfall. Here also, winter and summer are well defined, and trees shed their leaves during winter. Dominant trees are maple, oak, peach, etc.
- Taiga/Boreal: Situated just south of the Tundra, Taiga is characterised by evergreen conifers. The average temperature is below the freezing point for almost half of the year.

Components of Forest Ecosystem

- Producers: Producers can synthesise their own food by the photosynthesis process. All green plants are considered producers of the ecosystem as they convert sunlight into the chemical energy of food.
- Primary Consumers: Since the consumers can not prepare their own food, they depend on producers. Herbivorous animals get their food by eating the producers (plants) directly. Examples of primary consumers are grasshoppers, deer, etc.
- Secondary Consumers: Secondary consumers draw their food from primary consumers.
- Decomposers: The decomposers of the forest ecosystem break down dead plants and animals, returning the nutrients to the soil so that they can be used by the producers. Apart from bacteria, ants and termites are important decomposers in the Amazon rainforest. Millipedes and earthworms also help to break down dead matter.
- Nutrient Cycle: The nutrient cycle is cyclic. For the proper functioning of ecosystems, nutrients are required. Carbon, hydrogen, oxygen, and nitrogen constitute about 95%95% of the mass of living organisms.

About 1515 to 2020 other elements are also needed in relatively small amounts. These are recycled repeatedly between the living and non-living components of the ecosystem.

- Energy Flow: In a forest ecosystem, the grass, which draws its nutrition from sun, soil and water, is eaten by the grasshopper, which in turn is eaten by frogs, snakes and vultures in succession (different trophic levels). In this process of eating and being eaten, nutrients are passed from one step to the next in a food chain. The flow of energy that occurs along a food chain is called energy flow. The pyramid of energy represents the total quantity of energy at each trophic level of a food chain. The flow of energy is always unidirectional.

Characteristics of Forest Ecosystem

1. Forests are characterised by warm temperature and adequate rainfall, which make the generation of a number of ponds, lakes etc.
2. The forest maintains climate and rainfall.
3. The forest supports many wild animals and protects biodiversity.
4. The soil is rich in organic matter and nutrients, which support the growth of trees.

Functions of Forest Ecosystem

1. Goods Obtained from Forests: There are various types of food products such as honey, wild meat, fruits, mushrooms, palm oil and wine, medicinal plants, etc., obtained from forests. Other than edible parts, we can obtain timber, wood biomass, cork, etc., from forests. The fuel can be extracted from old trees that are buried under the soil.
2. Ecological Functions: Forests play an important role in maintaining ecological factors such as climate, carbon storage, nutrient cycling and rainfall.
3. Culture and Social Benefits: The tribal people who live in the forests treat forests as nature goddesses. The traditional beliefs and spirituality saves wild animals from hunters and cutting down of trees by urban people. Few modern people visit forests for recreation.

Forest Biome

Forests can be divided into 5 main categories, depending on the types of trees found in them. They are –

1) Coniferous Forest-As the name suggests, the trees found in these forests mainly consists of cone-bearing trees like the spruce, pine, fir, and hemlock. These are found mostly in the northern parts of North America, Asia, and Europe.

2) Deciduous Forest-The trees of these forests are broadleaved and are shed between late summer to early autumn. The leaves are usually green but later acquires yellow, red and orange colours gradually. These forests are found in America, Western and Central Europe, and North-eastern Asia where the winters are cold and summers are warm.

3) Mixed Forests-Deciduous and Coniferous trees as both types constitute mixed forests, which are mostly found in mountainous areas. These are found almost every part of the world.

4) Mediterranean Forests-They are also called scrublands as its temperature is suitable for short oaks and pines to grow. The Mediterranean forest contains a wide variety of wildflowers and insect-eating birds. This forest is also termed as "maquis".

5) Tropical Rainforest-These forests are situated in the areas with hot temperatures like South America, Africa, Asia and Australia. Thus they are called Tropical and due to continuous rainfall throughout the year, they are called Rainforests. It is a habitat for various insects, colourful birds and mammals.

- Process of Biogeochemical Cycles
- Nitrogen Cycle – A Biogeochemical Cycle

The Importance of Forest Ecosystems.

Forest ecosystems are so important not just for the community close to the forest but for the whole world. Read on to find some reasons why.

1. The lungs of the world: The Amazon rain forest is described as a biotic pump – like a giant green lung that releases oxygen into the atmosphere and locks away carbon.

2. Ancient: Some of our forests are truly ancient, and much older than many human civilizations.

3. Biodiversity: All of our forest ecosystems are so important for biodiversity. In fact, biologists very often claim that they are still discovering new species in the Amazon rain forest on a regular basis.

4. Homes for humans: Forest ecosystems are not just habitats for animals. Many human communities, including indigenous communities, live in forests all over the world.

5. Protecting the earth: Forests keep the earth rich in minerals, protect it from desertification by providing a shield against winds, and so on.

List of Forest Animals

Animals that live in the forest must adapt to the unique structure of the forest ecosystem and may call a single layer home, such as sloths within tropical rainforests which rarely leave their position in the canopy.

Alternatively, animals may utilize several layers while still benefiting from many trees, such as many bird species that may nest in the canopy, traverse through the understory, and feed on the bugs of the forest floor. Below, explore the unique animals of the forest by type.

Mammals

Mammals are warm-blooded, furred animals that nurse their young and are often found within forests. The word "mammals" is in reference to the mammary glands only found within these organisms.

Forest Layers	Types of Mammals
Canopy	Forest canopies are ideal for arboreal mammals such as orangutans, squirrels, and lemurs.

Understory	Large mammals such as deer can forage on herbaceous leaves and rut their horns on tree bark in the understory.
Forest floor	The floor is an excellent, well-covered habitat for small mammals such as rabbits, mice, and rats.

Carnivorous mammals of the forest, such as bears, large cats, and foxes, come in various shapes and sizes and may utilize multiple layers to find their prey.

The variety and number of mammals within a forest are often limited by the type of forest observed. Mammals are one of the few animal types abundant within taiga forests; despite their cold temperatures, unique mammals, such as beavers, badgers, and lynx, can thrive in boreal forests. Some common forest mammals of temperate forests include:

- Black bears
- Squirrels
- Bobcats
- White-tailed deer
- Cottontails
- Striped skunks

ESTUARY ECOSYSTEM

An estuary is a partially enclosed body of coastal water where freshwater from rivers and streams mixes with salt water from the oceans. Estuaries and their surrounding lands are thought about locations of transition from land to sea. Although influenced by tides, they are likewise secured from the full hits of ocean waves, winds, and storms by landforms such as barrier islands or peninsulas.

Estuarine ecosystems are among the most efficient in the world, developing more organic matter each year than similar-sized locations of the forest, grassland, or farming land. Protected estuary waters also home to unique communities of plants and animals that have actually adapted to life on the edge of the sea.

It is the part in which the watercourses mix into the ocean circulation. They are typically located in areas where the tides are large with beaches to the sides, that when they disappear, display their flora.

Characteristics of Estuarine Ecosystem

Salinity:-The inflow of freshwater from one side and the open sea at the other gives rise to a gradient of increasing salinity from the interior to the estuary mouth. The salinity likewise changes with the tides and the season. Brackish waters are poorer in species variety than either the sea or freshwater.

Seasonal variations in salinity influence the circulation of organisms in the estuary. Continuous rains during the monsoon harm marine fauna. When salinity returns to regular after a couple of months, the marine animals re-establish themselves. Estuarine animals either adapt to prevent damaging salinities or endure a range in salinity by using physiological mechanisms.

Temperature:-Temperatures vary commonly in estuaries owing to the blending of water of various temperatures and the shallowness of the water. In shallow estuaries, the water is much cooler in the winter season and warmer in the summer season. These temperature level variations affect the species composition and remove most animals that cannot endure wide changes.

Sediments:-The sediment formation affects the organisms living in the estuary, especially plants and benthic animals. Mudflats prevail. The substrate here is made up of soft, loose mud or a mixture of mud and sand. Particular plants such as eelgrass in temperate areas and mangroves in the tropics develop on mudflats, making estuarine communities extremely efficient and at the same time providing special habitat for animals. Mangroves are found in the majority of estuaries.

Turbidity:-Silt suspended in the water in estuaries causes the water to be turbid. The degree of turbidity varies extensively throughout the year; it is at a maximum during the rainy season. It likewise varies from place to place within the estuary.

Turbid water avoids light from permeating even one meter below the water surface. This reduces the level of photosynthesis by phytoplankton in the deeper layers. Shore plants that are not covered by turbid waters are therefore the most important producers of raw material.

Animal life of the Estuarine Ecosystem

Due to the diversity and intricacy of habitats, we can find a fantastic variety of species that occupy these ecosystems. Amongst these, there is a fantastic range of mollusks such as mangrove cockle, salmon, and black oyster. You can also find a variety of shellfishes, such as blue crab, shrimp, and shrimp handgun. Apart from fish, we also find mammals such as the crab raccoon and the otter. The most typical fish are marine catfish. And amongst the birds that populate the location, we find nighttime herons, cormorants, and pelicans, to name a few. There are also caimans and alligators.

It is common that during the night, the waters fill with zooplankton; and after that, they hide in the low and dark parts of the environment

throughout the day. The zooplankton feeds on phytoplankton and suspended organic matter, which in turn feeds little fish.

Plant life of Estuarine Ecosystem

The estuaries' flora is very diverse and is identified by marine greenery such as reed and bulrush. Mangroves can be found, where trees adjust to humid soils exposed to saline conditions and marine flooding. For this function, the mangroves have actually developed aerial roots formed by stirrups, which allow them to attach themselves to the ground. Other plants that are found in them and connected with the mangrove are the walls of sea turfs, such as *Thalassia testudium*, which grow on sand substrates in shallow waters.

Look For Typical & Rare Species in Estuarine Ecosystems
FAUNA Black bear, mink, great blue heron, bald eagle, mallard duck, American widgeon, common merganser, Canada goose, trumpeter swan, belted kingfisher, western garter snake, raccoon, Pacific lamprey, beach crab, pale tiger swallowtail, American dipper, river otter, coho salmon.
FLORA Alaska plantain, ditch-grass, eel grass, entire-leaved gumweed, hard-stemmed bulrush, Lyngby's sedge, northern rice-root, seashore salt-grass, sickle-leaved rush, dune wildrye, common spike-rush.
SPECIES AT RISK Small spike-rush (Blue), Vancouver Island beggerticks (Blue, Special Concern), Henderson's checker-mallow (Blue), salt marsh Philadelphia fleabane (Red), double-crested cormorant (Blue) green heron (Blue), pointed rush (Blue), yellow sand verbena.
Benefits of estuarine ecosystem:

Environmental benefits:-

- Water quality regulation and groundwater recharge.
- Habitat, breeding and nursery grounds for plants and animals.
- Biological productivity.
- Social benefits
- Community values
- Indigenous values
- Recreation values
- Knowledge/research values
- Economic benefits
- Commercial fishing
- Ports and harbours
- Navigation and tourism

Importance of Estuaries

- They are the most productive (more productive than wetlands) water bodies in the world because of the mixing of freshwater and saline water zone where marine organisms of both the ecosystems meet.
- Ecotone regions (transitional zones) like mangroves, wetlands, estuaries, grasslands etc. have far greater productivity compared to natural ecosystems like a forest ecosystem, ocean ecosystem, pond ecosystem, riverine ecosystem, desert ecosystem etc. This is because of the wide-ranging species from the adjacent ecosystems being present in the ecotone.
- Also, an estuary has very little wave action, so it provides a calm refuge from the open sea and hence becomes ideal for the survival of numerous aquatic species.
- Estuaries are most heavily populated areas throughout the world, with about 60% of the world's population living along estuaries and the coast.
- The vast mangrove forests on the seaward side of an estuary act as a barrier for the coastal habitat to check the wind speed during cyclones and high velocity landward winds.
- Mangroves act as a filter trapping suspended mud and sand carried by rivers which leads to delta formations around estuaries.
- Precipitation of clay and alluvium particles in the estuarine region is high because of the exposure to saline water (saline water precipitates fine alluvium).
- Estuaries store and recycle nutrients, traps sediment and forms a buffer between coastal catchments and the marine environment.
- They also absorb, trap and detoxify pollutants, acting as a natural water filter.
- Estuaries with their wetlands, creeks, lagoons, mangroves and sea-grass beds are rich in natural resources including fisheries.
- They are deep and well protected from marine transgressions, and hence they are ideal locations for the construction of ports and harbours.

- The banks of estuarine channels form a favoured location for human settlements, which use the estuaries for fishing and commerce but nowadays also for dumping civic and industrial waste.
- Storm and erosion protection

Types of Estuaries

There are four different kinds of estuaries, each created a different way: 1) coastal plain estuaries; 2) tectonic estuaries; 3) bar-built estuaries; and 4) fjord estuaries.

Coastal plain estuaries (1) are created when sea levels rise and fill in an existing river valley. The Chesapeake Bay, on the East Coast of the United States, is a coastal plain estuary.

Chesapeake Bay was formed at the end of the last ice age. Massive glaciers retreated, leaving a carved-out landscape behind. The Atlantic Ocean rushed to fill in the wide coastal plain around the Susquehanna River, creating a large estuary known as a ria: a drowned river mouth.

- Tectonic activity, the shifting together and rifting apart of the Earth's crust, creates tectonic estuaries (2). California's San Francisco Bay is a tectonic estuary.The San Francisco Bay lies at the junction of the San Andreas fault and the Hayward fault. The complex tectonic activity in the area has created earthquakes for thousands of years. The San Andreas fault is on the coastal side of the bay, where it meets the Pacific Ocean at a strait known as the Golden Gate. The Hayward fault lies on the East Bay, near where the Sacramento and San Joaquin Rivers enter the estuary. The interaction of the San Andreas and Hayward faults contributes to downwarping, the process of an area of the Earth sinking.

Like the Chesapeake, the San Francisco Bay was only filled with water during the last ice age. As glaciers retreated, land

around the bay experienced post-glacial rebound—without the massive weight of the glacier on top of it, the land gained elevation. The Pacific Ocean rushed in through the Golden Gate to flood the downwarped valley.

- . When a lagoon or bay is protected from the ocean by a sandbar or barrier island, it is called a bar-built estuary (3). The Outer Banks, a series of narrow barrier islands in North Carolina and Virginia, create sandy, bar-built estuaries.

The Outer Banks protect the region's coast from waves and wind brought by Atlantic Ocean hurricanes. The islands and sandbars also protect the delicate, brackish ecosystems created by the outflow of many rivers, such as the Roanoke and Pamlico. For these reasons, engineers monitor the shifting sandbars of the Outer Banks, and constantly work to maintain them.

Fjord estuaries (4) are a type of estuary created by glaciers. Fjord estuaries occur when glaciers carve out a deep, steep valley. Glaciers retreat and the ocean rushes into fill the narrow, deep depression. Puget Sound is a series of fjord estuaries in the U.S. state of Washington.

AGRO ECOSYSTEM

An agroecosystem is the basic unit of study in agroecology, and is somewhat arbitrarily defined as a spatially and functionally coherent unit of agricultural activity, and includes the living and nonliving components involved in that unit as well as their interactions.[1]

An agroecosystem can be viewed as a subset of a conventional ecosystem. As the name implies, at the core of an agroecosystem lies the human activity of agriculture. However, an agroecosystem is not restricted to the immediate site of agricultural activity (e.g. the farm), but rather includes the region that is impacted by this activity, usually by changes to the complexity of species assemblages and energy flows, as well as to the net nutrient balance.

Traditionally an agroecosystem, particularly one managed intensively, is characterized as having a simpler species composition and simpler energy and nutrient flows than "natural" ecosystem.[2] Likewise, agroecosystems are often associated with elevated nutrient input, much of which exits the farm leading to eutrophication of connected ecosystems not directly engaged in agriculture.

Components of Agro ecosystem

Primary producer: Crops and weeds of the field are the primary producer of agro ecosystem. e.g. In a Rice field, there are many producer like durba, mutha, syma etc also present with rice.

Consumer: Among consumer grasshoppers, aphids, bugs, ants, rats, birds, man etc are macro consumer and frog, snake, hack are micro consumer.

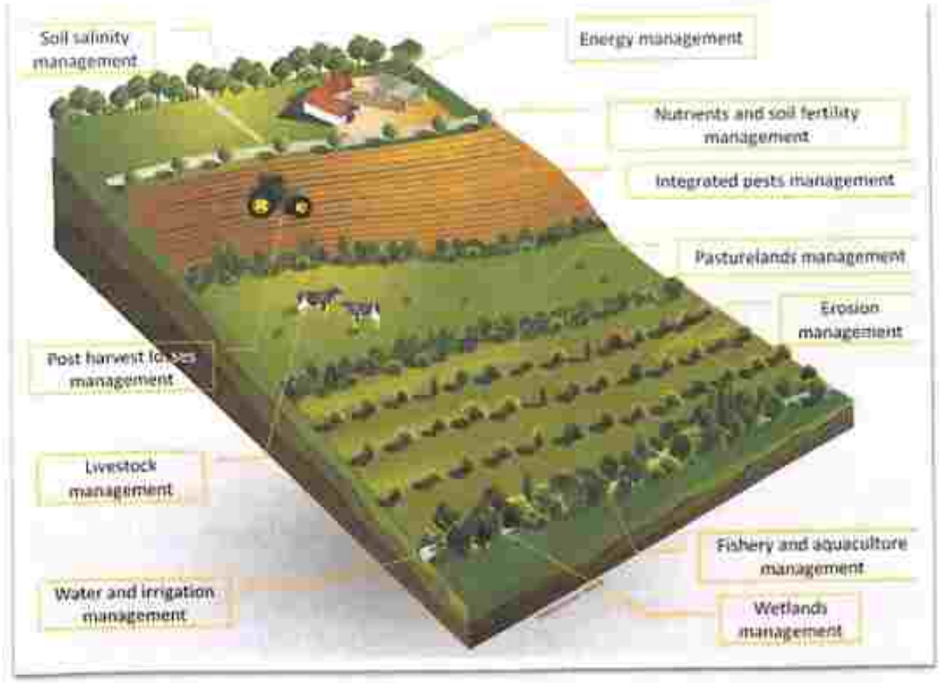
Properties of Agro ecosystem

1. Productivity- It is net increment of values products per unit resources (land, labour, energy, capital) and is commonly measured as annual yield /hectare.

2. Stability-
It is the degree to which, productivity remain constant, inspite of normal small scale fluctuation in environmental variables such as climate or in the economic condition in market.

3. Sustainability- It is defined as the ability of the system to maintain its productivity when subject
to stress or perturbation. A stress is defined as regular, sometim es continues, relatively small and predictable disturbance. e.g. Affect of growing soil salinity. A perturbation by contrast is an irregular, in frequent relatively long and unpredictable disturbance such as drought or flood or a new pest.

4. Equitability- It is a measure of how evenly the produce of Agro ecosystem is distributed among its human beneficial. The more equitable the system, the more evenly are the products to fed shared among the population of the farm, village, regions or nation.



It's different from a natural ecosystem for four main characteristics:

- simplification: a farmer favours a plant species removing all other animal or plant species which could damage it
- the energy intake employed by men in the form of machinery, fertilizers, pesticides, selected seeds, processings
- the biomass (harvest) which is removed when ripe. This makes the ecosystem an open system, which means it depends from external processes to reintroduce fertilizing substances suitable to nourish a new growth and development process of organic material (plants). A natural ecosystem, instead, self-fertilizes as the biomass remains in its original setting
- the introduction of pollutant substances which, in the case of intensive agriculture, are chemical fertilizers, antiparasitics and other chemical non-biodegradable substances which accumulate

in the ecosystem or which seep in the subsoil, in some cases getting to the point of seriously polluting groundwaters, seas and rivers.

A home is also a small artifical ecosystem. Objects, food, solar energy, water, etc. are introduced inside houses from outdoor and solid and liquid waste generated by human activities is removed outdoor. The city functions in the same way. A city, in fact, depends from external areas for water and food supplies as well as building materials and other resources necessary for its development and waste generated in a city is unloaded outside the urban area (in landfills and incinerators), which means everything which doesn't contribute to the survival of the urban ecosystem is deposited in these areas.

1. Biotic Components: The biotic components include the living things (crop plants and farm animals). The biotic components can be grouped into two classes. These are heterotrophism and autotrophism.

i. Autotrophism: This is a group of organisms which can use sunlight or chemicals to manufacture their food from inorganic substance during the process of photosynthesis.

In other words, autotrophs are organisms mainly crop plants which are capable of synthesizing their own food hence they are called producers. Producers are green plants or autotrophs which traps the energy of sunlight, radiant energy or solar energy and converts it to chemical energy in order to form organic compounds during photosynthesis using carbon dioxide and water or simple inorganic substance as raw materials.

Producers or autotrophs provide food for the other organisms in the farm.

ii. Heterotrophism: Heterotrophism is a group of organisms mainly farm animals, which can not manufacture their own food but depend directly or indirectly on plants for their food, hence they are called consumers.

Farm animals that feed directly on green plants (producers) are called herbivores or primary consumers e.g. Cattle, sheep, goat and rabbit while animals or organisms that feed on primary consumers are called carnivores or secondary consumers.

Animals that feed on the secondary consumers are called tertiary consumers. Heterotrophs includes all farm animals, fungi and some bacteria.

2. Abiotic Components: The abiotic components of an ecosystem include the non-living things which are:

i. Climatic factors like temperature, wind, humidity, sunlight and rainfall.

ii. Inorganic materials and nutrients such as carbon dioxide, oxygen, nitrogen, calcium and phosphorous.

iii. Edaphic factors like soils, rocks, topography.

iv. Other factors like dust, storm, fire and water.

General Interaction Among The Components Of Ecosystem

There is a unique interaction among the various components of an ecosystem. Green crop plants are carbon dioxide, water and chlorophyll in the presence of sunlight to produce carbohydrate or starch.

Farm animals feed on these carbohydrates or plants and release carbon dioxide for crop plant to take in.

Micro-organisms and other decomposers break down dead plants and animal Dung's to release nutrients to the soil. These nutrients are absorbed by pants for use in food production.

Crop plants gives out oxygen during photosynthesis which is used by animals for their normal respiration.

conclusion

The earth is a non-isolated system. There is almost no exchange of matter with the outer space (the earth loses a little hydrogen and receives meteorites). To be able to utilize the matter many times during the evolution or from one year and decade to the next, cycling is necessary. Cycling implies that the ecosystem components are linked in an interacting network .

Ecosystems must be, as the earth, non-isolated because otherwise they could not receive the energy needed to maintain the ecosystems far from thermodynamic equilibrium and even move further away from thermodynamic equilibrium. Ecosystems are actually open systems because they need to exchange at least water (precipitation and evaporation) with their environment. In addition, it is practical that suitable solutions (for instance species with new emergent properties that facilitate survival under a combination of new and emergent conditions) in one ecosystem can be exported to other ecosystems. Moreover, it is easy to observe that ecosystems are open systems.

The flow of energy from the sun to the ecosystems is also limited. It is important that an ecosystem captures as much sunlight as possible to cover its energy needs. Therefore, ecosystems, with increased biomass, can increase net primary productivity. But even the best photosystems can only capture a certain part of the solar radiation, which anyhow is limited to about 1017 W on average. Therefore moving further away from thermodynamic equilibrium requires that an ecosystem develop better utilization of the exergy that it is able to capture. Network development, where the components have been fitted together, provides improved exergy efficiencies . Another possibility is to increase information in the form of better process efficiencies . Increased sizes of the organisms imply also that the exergy lost for respiration decreases relatively to the biomass

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A PROJECT ON STUDY ON ECO SYSTEM

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Introduction

The term ecosystem is defined as the system resulting from the integration of all the living and non-living factors of the environment. The term ecosystem is preferred most where eco refers the environment and system implies an interacting and interdependant complex. The biotic and abiotic components are linked together through nutrient cycles and energy flows. Energy enters the system through photosynthesis incorporated into plant tissue. The term 'ecosystem' was first proposed by British ecologist A. G Tansley.

There are normally two types of ecosystem-

i) Natural Ecosystem — These operate under natural condition without any major interferance by man. It may further divided into —

a) Terrestrial — Forest grassland desert

b) Aquatic — river, pond, Estuary.

ii) Artificial (Man engineered) ecosystem :- These are maintained artificially by man whereby addition of energy and planned manipulation, natural balance is disturbed regularly, e.g → Cropland ecosystem.

All ecosystems whether terristrial, fresh water, marine or artificial, consist of following major components —

i) Species component
ii) Stratification
iii) Trophic organisation — Relationship of food between various layers.
iv) Nutrients — required for living organism.

The function of the ecosystem is to allow flow of energy and cycling of materials which ensures stability of the system and continuity of life.

Pond Ecosystem

A pond ecosystem refers to the fresh water ecosystem where there are communities of organism that are dependant on eachother and with the prevailing water environment for their nutrients and survival. Usually ponds are shallow (hardly 12-15 feet) water bodies in which sunlight can reach to its bottom, permitting the growth of the plants that grow there.

On the basis of water depth and types of vegetation and animals, there may be three zones in a lake or pond. The different zones are as follows :

i) Littoral
ii) Limnetic
iii) Pro-fundal

i) Littoral Zone :—
It is the shallow water region which is usually occupied by rooted plants.

ii) Limnetic Zone :—
It ranges from the shallow to the depth of effective light penetration and associate

organisms are small crustaceans, rotifers, insects, and their larvae and algae.

iii) Pro-fundal zone :—
It is the deep-water parts where there is no effective light penetration. The associated organism are muscle, crab, worms etc.

The organisms inhabiting the fresh water ecosystem include algae, fungi, micro-organism plants and fish. These organism can be further classified as Producers, consumers and decomposers based on their mode of nutrition.
The energy in a ecosystem flows from the producers to the consumers.
Decomposers on the other hand get nutrients from dead organism by decomposing them.

There are mainly two main components of pond ecosystem —
i) Biotic Component
ii) Abiotic Component

i) Biotic Component :—
Biotic Components are the living things that

have an direct or indirect influence on other organisms in an environment. e.g - plants, animals and micro-organism and their waste materials. It include producers, consumers and decomposers.

iiy Abiotic Component :—

Abiotic factors are non-living factors that can have an impact on the ecosystem. The main factors of pond include — water quality, temperature, light, soil and seasonal change. Water is an important abiotic factor. The quality of water is a crucial for living organism in the pond. The temperature could impact the ecosystem if they are at the extreme. Water that is too hot will not have as much oxygen for the fish and they will in return become weak and prone to parasites and disease. Too much sunlight can impact the pond because the algae is growing too fast therefore crowding space for the fish.

River Ecosystem

River ecosystem are flowing waters that drain the landscape, and include the biotic (living) interactions amongst plants, animals and micro-organism as well as abiotic (non-living) physical and chemical interaction of its many parts.

The profile of every river can be divided into three zones —

Source zone :— Mountains stream that slope rapidly downhill and formed V shaped river valleys, often forming waterfalls. These rapids shape and carry large size sediments downstream.

Transfer zone :—

Characterized by a lower altitude. The flow velocity is slower, the river bed become wider, and meanders form. Some of the large sediments settle at the interim area between the source zone and the transfer zone, thus forming the so-called sediment cones.

Deposition zone :– Deposition zone of rather low slope; flow velocities are slow forming wide meanders. Most of the sediments, including the finest ones, settle in this area. The river mouth often opens into a wide delta bottomed by fine sediments and the river splits into many arms.

The following are the terms used to denote the small portions of river—

Pond :– is a segment where the water is deeper and moving slowly.

Riffle :– is a segment where the flow is shallower and more turbulant.

Headwater :– is the point of origin of the stream.

Channel :– is the river courses developed by constant erosion.

The major abiotic factors controlling the lotic ecosystem are—

a) Slope and geomorphic condition including the nature of substratum.
b) Physio-chemical properties of water. Temperature, colour, alkalinity, pH etc.

c) Flow velocity and quantity.
d) Type and amount of suspended bed-load sediments.
e) Turbidity.

The unique characteristics of running water habitat are :—

i) Establisment of a firm attachment with the substratum. Most of the sponges, diatoms are the example of it.

ii) The swimmers are expected to have hooks or suckers to maintain the grip.

iii) Some of them build nests or nets around them for food trapping.

iv) Some have a flat body to stay in the cracks of rocks.

v) They have swimming habbits in running water.

vi) Some of them like snails and worms have sticky bottom to grip.

Wetland Ecosystem

A wetland is a distinct ecosystem that is flooded by water, either permanently (for years or decades) or seasonally (for weeks or months). The primary factor that distinguish wetland from terrestrial land forms or water bodies in the characteristics vegetation of aquatic plants, adapted to the unique anoxic hydric soils. Wetlands considered among the most biologically diverse of all ecosystems, serving as home to a wide range of plant and animal species. The water in wetlands is either freshwater, brackish or saltwater. The main wetland types are classified based on the dominant plants and the source of water. e.g → Marshes are wetland dominant by emergent vegetation such as reeds, cattails and sedges; swamps are the ones dominated by woody vegetation such as trees, shrubs, etc.

Wetland contribute a number of function that benifit people. These are called ecosystem services and include water purification, groundwater replenishment, stabiligation of shorelines and storm protection, water storage, food control, processing of carbon (carbon fixation, decomposition and sequenstation) other nutrients and pollutants and support of plants and animals. Wetlands are reservoirs of biodiversity and provide wetland products. They also play a role in climate change, migration and adaptation. However some wetlands are a significant source of methane emission and some are also emitters of nitrous oxide. Constructed wetland are designed and built to treat municipal and industrial wastewater as well as to divert storm water runoff. Constructed wetland may also play a role in water sensitive urban design.

The world's largest wetland include the Amazon River Basin, the West Siberian Plain, the Sundarbans in the Granges Bhramaputra delta.

Biodiversity loss occurs in wetland system through land use changes, habitat destruction, pollution, exploitation of resource, and invasive species. Vulnerable threatened and endangered species number at 17% of water fowl, 38% of fresh water dependant mammals, 33% of fresh water fish, 26% of freshwater amphibians, 72% freshwater turtles, 43% of crocodilians and 27% of coral reef-building species. Introduced hydrophytes in different wetland system can have devasting results. The introduction of water hyacinth, a native plant of South America into Lake Victoria in East Africa as well as duckweed into non-native areas of Queensland, Australia have overtaken entire wetlang systems suffocating the wetlands and reducing diversity of other plants and animals. This is largely due to their phenomenal growth rate and ability to float and grow on the surface of the water.

Forest Ecosystem

Forests are the collections of living and non-living things found in the same place. Their many components are connected to each other as food chain for inter dependance. Food chains move the basic requirement of life — energy, water, carbon air and nutrients — in a series of connection and process.

All food consists of —

Producers — Organism that produce

Consumers — Organism that consume producers and other consumers

Decomposers — Organism that consume producers and consumers, provide nutrients into the soil.

The sun provides energy to the forest. Trees and other plants (producers) use photosynthesis to transform the suns' energy into glucose.

consumers — Plant eating animals such as caterpillar, deer, animals, spider

Decomposers such as sowbugs, fungi, bactria get their energy from dead plants and animals. Several food chains linked together are known as food web. Every collection of individuals, connections or process that regularly interacts and depends on other individuals, connections or processes from a unified whole called a system. While each system dependson all other systems, when change occurs (as it always does), the web adapts and adjust flexibly. Oxygen, carbon dioxide, water and nitrogen all are the natural cycle of forests. Many forests contain several different hieghs or layers of plants. And as different animals are often found within each layer, the diversity of animals is often related to plant diversity in the forest. The number of animal diversity of animal species depends on the amount of available food, predators, acess to clean. Some animals such as deer, moose, rabbits and insects use a broad number of plant species.

Estuary Ecosystem

An estuary is the areas of water and shoreline where a freshwater stream or river emerges or merges with the ocean. Estuary can be partially enclosed body of water (such as bays, Lagoon, sounds or sloughs) where two different bodies of water meet and mix. They often bordered by salt marches or intertidal mudflats. Salinity varies within the estuary from nearly freshwater to ocean water. It also varies daily in these areas due to rise and fall of tides. They are productive due to nutrients brought by river.

Estuaries have a diverse flora and fauna and tremendous productivity.

- Salt marshes, algae and phytoplankton are the major products
- Many species annelids, oysters, crabs, and fish are present
- Many marine invertebrates and fish breed in estuaries or migrate from fresh water.

Human activities are having a large impact on estuaries.

* Estuaries reciene pollutants dumped into the stream and rivers that feed them.
* Residential and commercial development not only adds to pollution but eliminates some estuaries due to land filling.

Common Estuarian Haleitats —

i) Oyester reefs ii) Kelp forest
iii) Coastal marshes iv) Deep water swamps and riverine forest
v) Submerged aquatic vegetation vi) Mangrove forests.

Estuaries are areas of great diversity, with complex and interrelated trophic patterns and they support a large number of top predators including humans. Estuaries have several types of primary producers Primary producers include phytoplankton, algae, sea grasses and salt marsh plants. Large estuary serve as food for some grazing aquatic animals but are more important food sources after the begin to decompose. Zooplankton grave on phytoplankton and become

and become food for the carnivores plankton eating fishes such as small fish, and larvae and young of larger fishes. Estuaries are nurni nurseries of the sea because juvenile forms of many marine animals line in and feed in estuaries before returning to the sea. Bacteria and fungi promote the breakdown of the dead material organic detritus - an essential source nutrition for detritus-eating animals and supports a detrital food web. Deposit feeders, such as various kinds of worms found in the estuary, move over and through bottom sediments where they find food deposits in or on the sediments.

Ensuring the health of our estuary is vital to the survival of the plant and animal communities that can call them home and the humans depend on them for their way of life. To preserve the estuarine, the National Estuarine Research Centre was established more than 1.3 million acres of estuarine habitats for long term research, monitoring, education and stewardship throughout the United states

Agro-ecosystem

An agroecosystem is the basic unit of study in agroecology and is somewhat arbitarily defined as a spatially and functionally co-herent unit of agricultural activity and includes the living and non-living components involved in that unit as well as their interactions. An agroecosystem consists of lesser diversity of animal and plant species and six to ten major pest species in comparison to forest.

India has a variety of landscapes and climate conditions and this is reflected in the development of different soils and types of vegetation. Based on 50 years of climatic data and an up-to date soil database, the country has been divided into 20 agro-ecological zones (AEZs).

Agro-ecosystem are made up of non-living (abiotic) and living (biotic) components in a human-managed agricultural system. Agro-ecosystems are the arenas in which crop evolution occurs, presenting both stresses and opportunities to which crop and farmers must adapt in order to thrive. Abiotic components of agro-ecosystem include temperature, soil, water, relative humidity, light and wind. Biotic factors include parasitic and herbivorous pests, competition between crops and other plants, and favourable (symbiotic) relationships among organisms, such as below ground organisms and pollinators. The farmer who manage these factors via, irrigation, nutrient input pest control, land preparation, mixed/relay cropping, and other practices are also a 'biotic component' of agro-ecosystem

Forest gardens are probably the world's oldest and most resilient agroecosystem Forest gardens are originated in pre-historic time along jungle-clad river banks and in the wet foothills of monsoon regions.

Conclusion

It should be kept in mind that the numerous individual ecosystem services listed on the previous pages do not function in isolation but interact to different degress and in many different ways with each other. The vegetation e.g contributes significantly to the atmospheric configuration on composition by taking carbon dioxide and producing oxygen at the same time, it influences ground water levels and the movement of water and wind across the landscape.

Many ecosystem services have been shown to have significant economic value in terms of their contribution to production and consumption. Still, most ecosystem services remain free of charge at the point of use. In this content the continuos failure of ecosystem services (or to reward the provision of ecosystem services) has become increasingly severe constraint on sustainable development.

Acknowledgement

I would like to express my speacial thanks of gratitude to our professon Mrs Mahua Dutta as well as our principal Dr. Ata shi Karpha who gave us the opportunity to make this project on — Study of ecosystem which help me in doing a lot of research and I came to know about many new things. So, I am very thankful to them.

Secondly, I would like to thank my parents and freinds who helped in making the project with a limited frame of the time.

Acknowledgement

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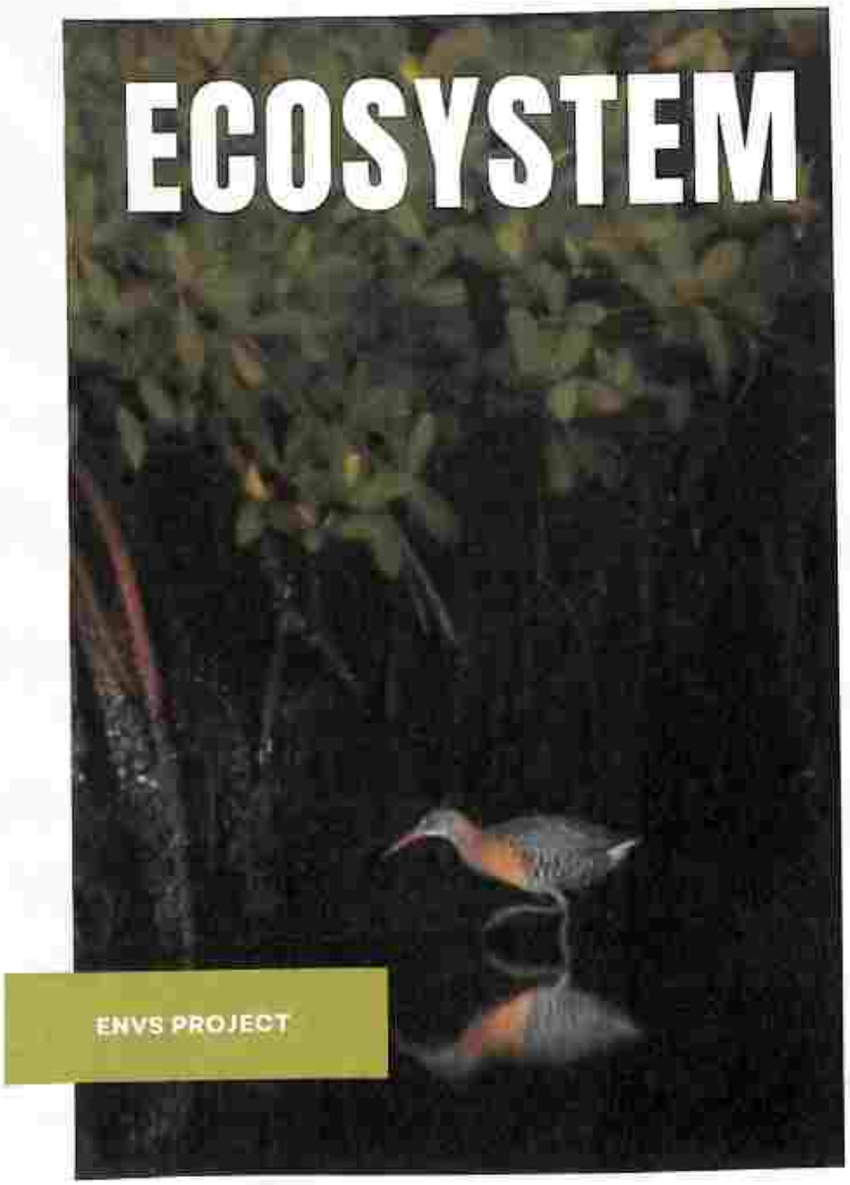


SEMESTER 02

NAME - Sabarni Dutta.

CU REGISTRATION NO - 013-1211-0239-21

CU ROLL NO - 213013-13-0009

CONTENT

CONTENT

1. Salt ponds.
Salt ponds contain brackish (i.e., salty) water and can occur close to the seaside where waterlogged ground creates natural pools. Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools. It is also possible to find salt ponds inland, thanks to the presence of brackish streams created through streams flowing through salty rocks.

2. Garden ponds.
These artificially created ponds can contain ornamental plant and animal species that come from all over the world (i.e., non-native species).

3. Freshwater pools.
Freshwater pools can form anywhere inland, either from rainfall or from the presence of water saturating the soil. They can also be created by rivers flowing into a depression in the ground. They can be home to fish, birds, amphibians, crustaceans, and many other kinds of wildlife.

4. Vernal pools.
Vernal pools are seasonal ponds. They form in depressions in the ground, but only during certain types of the year when the rainfall is heaviest. As a result, they will attract certain types of animals and birds that need a drink whenever they

Though they can be found all over the globe, pond ecosystems are often neglected by conservationists. All of our wetland ecosystems ought to be safeguarded because they are vital habitats for an abundance of different species. This includes pond ecosystems which, as we have seen, can come in many different shapes and forms and can perform many different functions.

RIVER AS AN ECOSYSTEM:

Water is an essential component of life.
Surface water resources are the most preferred locations for life settlements. Most of the human civilizations originated near water courwatercoursesly along the major rivers.
A River is a large natural course of flowing water obtained from precipitation. The surface water moves down along the slopes due to the action of gravity. Streams, tributaries, brooks, creeks, and springs are the different types of watercourses classified based on their dimension and distribution.

- A river is also termed major, medium, and minor, based on its number and length of tributaries, stage of development, area of catchment,t and geomorphological conditions.
- Every major river must have a place of origin on the upstream side, which is called the headwaters, and a point of confluence with the sea or water body at the downstream end. A reverter is always on the move.
- Every river has its longitudinal profile and different cross-sections.
- The longitudinal profile indicates the nature of the slope existing at different places and levels. The cross-section of a river varies the fromheadwater to the mouth.

These are called river valleys which may be ranging from sharp canyons and gorges to wider flat streams nearer to the delta. The level at which water flows in a river is called as river stage. The velocity of water flowing in a stream is not uniform along with the longitudinal profile, also within their cross-sections.
A river is a powerful geological agent. It can erode, transport, and deposit sediments. These are called river alluvium.

- The alluvial deposits, clay, and silt of a river are the materials preferred for different activities.

A river may be into the following 3 types:
a) In a perennial river, there will be a continuous flow of water throughout the year
b) In intermittent streams, the flow is seasonal.
c) In ephemeral streams, the flow is occasional or rare.
We frequently overlook the fact that rivers have four spatial dimensions - length, width, height (depth), and time.Evenn if it seems that the river height is the water level and the width is the distance between its two banks, this is not a completely accurate perception considering the contemporary concepts of the river, its ecosystems ,and the rriverr corridor, which are much broader.

River runoff and flooding:

Water transfer from precipitation into rivers and oceans and vice versa, including its vaporization, is known as the "water cycle". This is the main driving force of the river ecosystem. The river runoff is the quantity of water that moves through a spot of the river over a certain time. This indicator can vary within very wide limits for the same river. For instance, in some torrential catchment basins then runoff may increase 100 times after a downpour.
The seasonal increase of water runoff and associated flooding are natural and unavoidable processes.
About people, flooding may cause serious consequences - from positive (the ancient Egypt civilization developed on the banks of the Nile River) to disastrous ones.

Pollution:

River pollution can include but is not limited to: increasing sediment export, excess nutrients from fertilizer urban runoff sewage and septic inputs, plastic pollution nanoparticles, pharmaceuticals ,and personal care products, synthetic chemicals, road salt, [72 Inorganic contaminants (e.g., heavy metals), and even heat via thermal pollutions. The effects of pollution often depend on the context and materia, but can reduce ecosystem functioning, limit ecosystem services, reduce stream biodiversity, and impact human health.
Trees are also helpful. Not only do they look beautiful when they grow, but these natural items reduce erosion that washes pollution into the water and help protect the nearby water supply from pollutants. Fauna also limits the Carbon Dioxide in the water, which balances out its pH level.
Rivers are the lifeline for all life forms. All the civilizations in our world were born, grew, and developed on the banks of

Alternately, the value of a wetland is an estimate of the importance or worth of one or more of its functions to society. For example, a value can be determined by the revenue generated from the sale of fish that depend on the wetland, by the tourist dollars associated with the wetland, or by public support for protecting fish and wildlife. Although large-scale benefits of functions can be valued, determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well.

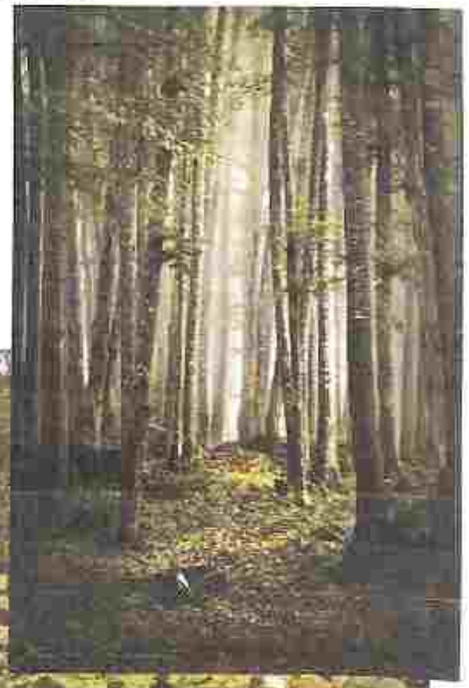
What is Wetland Restoration?

Wetlands are one of the most valuable and fragile components of a watershed, but for many years they were filled and drained for agriculture and development. Now we are learning that wetlands are crucial to the health of our waters and wildlife. Wetland restoration, the renewal of natural and historical wetlands that have been lost, is a growing activity. It can improve water quality and wildlife habitat across the nation.

Conclusion of wetlands:

Wetlands jurisdiction is diffused and falls under various departments like agriculture, fisheries irrigation, revenue, tourism, water resources, and local bodies. For instance, all mangroves in the country fall under the direct control of the forest department. The lack of a comprehensive wetlands policy, with each department having its developmental priorities, works against the interests of the conservation of wetlands resulting in intended or unintended spill-over that further aggravates the problem.

Forest ecosystem:



A forest ecosystem is a functional unit or a classification that includes birds, insects, trees, animals, soil, and humans as its networking units.

A forest is a big and multifaceted ecosystem and therefore has more species diversity. Furthermore, it is much more unchanging and unaffected by harmful alterations in comparison to smaller ecosystems like wetlands and grasslands.

Forest ecosystems, like any other ecosystem, also consist of abiotic and biotic components. Abiotic components are

Seasonal variation:

The forest ecosystem of a particular region depends on the seasonal variation of the country in which the forest falls. For example- tropical rainforests receive heavy rainfall every year, whereas temperate forests experience four seasonal variations. Deciduous or evergreen in nature.

A forest ecosystem may be deciduous or evergreen, or it may be a mix of both. The trees of a deciduous forest shed their leaves during the winter season, whereas evergreen trees always remain green. The canopy layer is one of the most distinguishing characteristics of a forest ecosystem. The dense canopy layers act as a barrier against wind, rain, snow, etc. to protect various species. Some forest ecosystems, such as rainforests, are characterized by distinct layers of the canopy like treetops, upper canopy layer, lower canopy layer, and forest floor. The forest ecosystem provides the most favourable conditions to various species of birds. As a result, these species get attracted by the forest ecosystem and take shelter in trees.

Functions of a forest ecosystem:

1. Goods Obtained from Forests: There are various types of food products such as honey, wild meat, fruits, mushrooms, palm oil and wine, medicinal plants, etc., obtained from forests. Other than edible parts, we can obtain timber, wood biomass, cork, etc., from forests. The fuel can be extracted from old trees that are buried under the soil.

2. Ecological Functions: Forests play an important role in maintaining ecological factors such as climate, carbon storage, nutrient cycling, and rainfall,

3. Culture and Social Benefits: The tribal people who live in the forests treat forests as nature goddesses. The traditional beliefs and spirituality save wild animals from hunting and cutting down of trees by urban people. Few modern people visit forests for recreation.

Threats to forest ecosystem:

- **Deforestation**

One of the major challenges faced by the forest ecosystem is deforestation. Deforestation is nothing but cutting the forests for some other purpose other than for forest use. Huge amounts of forests are cut down every year by the state governments for agriculture, settlements, constructing multipurpose projects, etc.

Some contractors even do illegal deforestation for monetary benefits. As a result of deforestation, the quality of soil also gets degraded because of soil erosion which in turn cannot sustain forests further.

Barren Quality:

Nearly half of the forests in India are there only for the namesake. Only the remaining half of the forests have a green cover. If we

- The mouths of the Mississippi, Columbia and Hudson rivers are examples of salt wedge estuaries.
- The water circulation is controlled by the river that pushes back the seawater. This circulation creates a sharp boundary that separates an upper less salty layer from an intruding wedge-shaped salty bottom layer.

Fjord

- Fjord type estuaries are characterized by a deep elongated machine that is 'U' shaped and a ledge or barrier that separates the basin from the sea.
- Fjord type estuaries are found along glaciated coasts such as Alaska, Chile, New Zealand.
- They have moderately high river input and little tidal mixing.

Slightly Stratified or Partially Mixed Estuary

- Partially mixed estuaries have a tidal flow that provides a means of easing the salt wedge.
- Deeper estuaries such as Puget Sound and San Francisco Bay are examples of partially mixed estuaries.
- The salt water is mixed upward and fresh water is mixed downward.
- The lower layers of water typically remain saltier than the upper layers

Vertically Stratified or Well Mixed Estuaries

- Well-mixed estuaries have strong tidal mixing and low river flow that mix the sea water throughout the shallow estuary.
- Shallow estuaries such as the Delaware Hay are well-mixed estuaries.
- The mixing is so complete that the salinity is the same top to bottom and decreases from the ocean to the river.

Freshwater Estuaries

- Freshwater estuaries occur where massive freshwater systems, as the Great Lakes, are diluted by river or stream waters draining from adjacent lands
- Freshwater estuaries do not contain saltwater, but they are unique combinations of river and lake.
- Freshwater estuaries are storm-driven while brackish estuaries that are tidally driven.
- Storm surges and subsequent seiches (vertical oscillations, or sloshing, of lake water) regulate the composition of the estuary water.
- Though the Great Lakes do exhibit small tides, Seiches acting like tides, exchanging water between the river and the lake.
- Changes in temperature differences between stream water and lake waters can cause stratification and mixing of the water.

Common Estuarine Habitats:

- Oyster reefs
- Kelp forests
- Rocky and soft shorelines
- Submerged aquatic vegetation
- Coastal marshes
- Mangroves forests

POINT AND NON-POINT SOURCE POLLUTION:

- Pollutants pose a large threat to estuarine organisms.
- Pollutants are introduced into estuaries from either point sources or non-point sources.
- Point sources are clearly defined, localized inputs such as pipes, industrial plants, sewer systems, oil spills from tankers, and the state governments regulate them.
- Non-point sources are indistinct inputs that do not have a clearly defined source, such as runoff of petroleum products from roadways or pesticides from farmland Estuary Preservation.
- Ensuring the health of our estuaries is vital to the survival of the plant and animal communities that call them home and the humans that depend on them for their way of life.
- A majority of pollutants find their wat into estuaries from non-point sources.
- Non-point sources are harder to detect and to control.
- Reduction of pollution requires substantial individuals and collective efforts.

ESTUARY PRESERVATION

Ensuring the health of our estuaries is vital to the survival of the plant and animal communities that all of home and the humans that depend on them for their way of life.

To preserve our estuaries, the NATIONAL EUSTARINE RESEARCH RESERVE SYSTEM was established to protect more than 1.3 million areas od estuaries habitat for long-term research, mentoring education and stewardship throughout the coastal U.S.

Components of Agro Ecosystem

There are are 2 main components of ecosystem

1. living (Biotic component).
2. Non-living (Abiotic component)

Biotic Component

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Examined

"An ecosystem that has the maximum amount of diversity is the richest."
— Robert Lyzenga

STUDY OF ECOSYSTEMS

NAME :- AHONA SARKAR
CU. ROLL NO. :- 213013-13-0010
CU. REGD. NO :- 013-1211-0240-21
COLLEGE ROLL NO :- 21/BSCV/0027
SUBJECT :- AECC2 (ENVS)

CONTENTS

INTRODUCTION

In the year 1935, A.G. Tansley, an English botanist coined the term 'ecosystem'. According to him, ecosystem consists of organisms and inorganic components in a relatively stable equilibrium.

Ecosystem or ecological system is the structural and functional unit of ecology. It is a geographic area created by the interrelationships between a community of living organisms and the physical environments they inhabit (land, water, air). These biotic and abiotic components are linked together through nutrient cycles and energy flows. Along with nutrient cycle and energy flow, the productivity and decomposition are also the important components of an ecosystem.

Ecosystems obtain 99 percent of their energy through photosynthesis which is incarporated into plant tissue with the rest coming from bacteria that use chemical means. The energy that flows through ecosystems is obtained primarily from the sun.

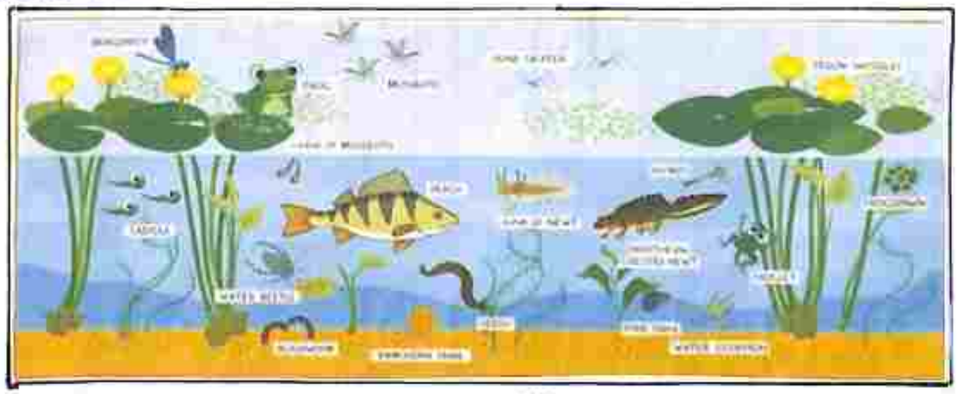
People, animals and plants depend on healthy ecosystems. Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in the temperature of an ecosystem will often affect what plants will grow there, for instance. Animals that depend on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish. The whole series of Earth is a series of connected ecosystem and the part of the earth where it operates is called biosphere.

Diagrams called food chains show this flow of energy from one organism with another and several food chains are interlinked to form food webs. Ecosystems can be small such as tide pools found near the rocky shores of many oceans or very large, such as the Amazon Rainforest in South America.

Ecosystems with higher biodiversity tend to be more stable with greater resistance and resilience in the face of disturbances, or disruptive events.

Broad categories of terrestrial ecosystems are called biomes.

POND ECOSYSTEM :-



POND ECOSYSTEM

A pond ecosystem refers to the freshwater ecosystem where there are communities of organisms that are dependent on each other and with the prevailing water environment for their nutrients and survival. A well-demarcated area formed by rain or overflowing water is called a pond, which are shallow (hardly 12-15 feet) water bodies in which sunlight can reach to its bottom, permitting the growth of the plants that grow there. A pond ecosystem can be temporary or permanent. The pond ecosystem falls under the category of a lentic ecosystem because the water remains stagnant for a longer period.

Types ⇒ 1) Garden pond ecosystems : These are man-made artificial pond ecosystems that comprise ornamental plants and animal species that are exported from all over the world.

2) Salt pond ecosystems : These ecosystems are naturally formed at the seaside and contain brackish water. These are formed due to waterlogging. These can also be found in rocky areas on the beach and are called rock pools. Since it contains brackish water, it can accomodate sea plants and animals.

3) Freshwater pond ecosystems : These ecosystems are naturally formed due to rainfall or due to water saturation of the soil due to continuous rainfall. Moreover, they can also be formed due to the flow of river water into a large and deep depression. These ecosystems serve as a home to freshwater fishes, amphibians etc.

4) Vernal pond ecosystems : These are seasonal ponds that are temporarily formed during the heaviest rainfall due to the accumulation of water in the depressions in the ground. With the change in the season, they often turn into desert-land.

5) Mountain pond ecosystems : These are found naturally formed ponds in the mountain regions. These are formed due to the shifting of rocks and the melting of snow. They accomodate rare or endangered aquatic species.

Characteristics ⇒ 1) The water in the pond ecosystem is stagnant.

2) The pond ecosystem is surrounded by either natural or artificial boundaries.

3) The pond ecosystem exhibits three distinct zones, the littoral zone, limnetic zone and profundal zone.

4) The biotic components of the pond ecosystem occupy different levels in the pond ecosystem, therefore, avoid the competition for survival. Scavengers and decomposers occupy the bottom level, and the middle level is occupied by fish. The plants enclose the boundaries of the pond and provide shelter to small animals and insects.

5) Pond ecosystems show a wide range of variety in their size.

Stratification ⇒ Different factors such as distance from the shore, penetration of light, depth of water, plant and animal species, etc. determine the following zones found in the pond ecosystem.

1) **Littoral Zone** : It is the zone closer to the share. It contains shallow water and allows easy penetration of light. It is occupied by rooted plant species. Animal species include reeds, crawfish, snails, insects, etc.

2) **Limnetic Zone** : The limnetic zone refers to the open water of the pond with an effective penetration of light. This zone is dominated by phytoplankton. Animal species mainly include small fishes and insects.

3) **Profundal Zone** : The region of a pond below the limnetic zone is called a profound zone with no effective light penetration. It is occupied by some amphibians, and snale turtles.

4) **Benthic Zone** : The bottom zone of a pond is termed benthic and is occupied by a community of organisms called decomposers. The decomposers are called benthos.

STRATIFICATION OF THE POND ECOSYSTEM

Abiotic Components ⇒ Abiotic components are the non-living components of an ecosystem that matters for the survival of the aquatic species.

1) **Light** : Light serves as a main abiotic component required for the photosynthetic activities of the phytoplankton. The littoral zone has the maximum penetration of light, whereas the profound zone has the least penetration of light.

2) **Temperature** : As the depth of the pond increases, the temperature of the water gradually decreases due to the gradual decrease in the light penetration.

3) **Dissolved oxygen** : The amount of dissolved oxygen is maximum in the shallow water and gradually decreases while moving from the surface to the depth of the pond.

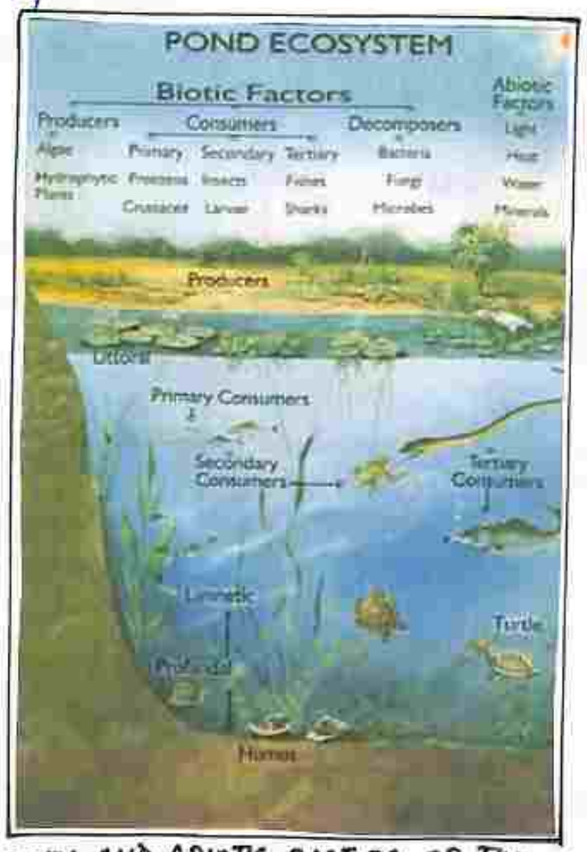
Biotic Components ⇒ Biotic components are living components. A wide variety of living components are found in the pond ecosystem can be discussed as follows:

1) **Producers** : These include species of rooted, submerged emerged, floating plants and algae. The most common filamentous algae found in ponds is Spirogyra. Mougeotia and Zygnema. Some other algae found in the pond. Azolla, Hydrilla, Pistia, Wolffia, Lemna, Eichhornia, Nymphea Potamogeton, Tussiaea, etc, are a few examples of green plants found in the pond ecosystem.

2) Primary consumers ⇒ A large population of zooplanktons are the main primary consumers. Besides these small herbivores such as snails, insects, small fishes, tadpoles and larvae of aquatic animals are the primary consumers often found in the pond.

3) Secondary consumers ⇒ These include large animal species such as frogs, big fishes, water snakes, crabs, etc. The consumers of the highest order might include mammals like water shrews, water voles, herons, ducks, kingfishers, etc.

4) Decomposers ⇒ These include different types of bacteria and fungi that feed upon dead and decaying parts of the aquatic species.



BIOTIC AND ABIOTIC FACTORS OF THE POND ECOSYSTEM

Food Chain in the Pond Ecosystem ⇒

1) The food chain is a sequence of organisms in which each organism eats the lower member and is being eaten up by the next higher member.
2) Phytoplankton and algae serve as producers that convert solar energy into chemical energy.
3) Phytoplankton and algae serve as producers that convert solar energy into chemical energy.
4) Phytoplankton is being consumed by zooplankton (primary consumers).
5) The food chain further proceeds with the small pond species that feed on zooplankton.
6) Small pond species are eaten by large pond species.
7) A number of bacteria and fungi feed on dead and decaying parts of the animal species and are therefore called decomposers. Decomposers convert the organic matter (dead plants and animals) into their inorganic components that are again utilised by producers, and hence a continuous flow of energy is maintained.

Algae → tadpole → fish → stork

Importance of Pond Ecosystem ⇒

The importance of the pond ecosystem can be discussed as follows:

1) Some aquatic plants help to improve the water quality by absorbing pollutants and heavy metals.
2) The shorelike plants absorb nitrogen and phosphorus and therefore prevent the algal bloom and maintain the oxygen level in the pond. Moreover, aquatic plants absorb animal wastes to reduce the nutrient availability for plants and therefore prevent the growth of algae.
3) The pond ecosystem is one of the sites for the conservation of biodiversity as different types of plants and consumers occupy different strata in the pond and live together by interacting with each other. Ponds in mountain regions conserve the endangered species.

3) Culture and Social Benefits :- The tribal people who live in the forests treat forests as nature goddesses. The traditional beliefs and spirituality saves wild animals from hunters and cutting down of trees by urban people. Few modern people visit forests for recreation.

Threats to forest ecosystem

- Deforestation :-

One of the major challenges faced by forest ecosystem is deforestation. Deforestation is nothing but cutting the forests for some other purpose other than for forest use.

Huge amounts of forests are cut down every year by the state governments for agriculture, settlements, constructing multipurpose projects, etc. Some contractors even do illegal deforestation for monetary benefits. As a result of deforestation, the quality of soil also gets degraded because of soil erosion which in turn cannot sustain forests further.

- Barren Quality :-

Nearly half of the forests in India are there only for the namesake. Only the remaining half of the forests have green cover. If we remove the barren forests from the list of forests, the ratio of forests to lands in India will be around 11%, which is far short of the current estimate. So, it is important to grow forests in order to increase the ratio further.

- Construction of Multipurpose Projects :-

Forests are being cleared by the State Governments for constructing multipurpose projects and their associated canals. To support these projects, additional infrastructure is provided like constructing roads, buildings, etc. Similarly, roads are constructed for transportation facilities which in turn leads to fragmentation of forests.

fires are also responsible for the destruction of huge forest covers, hence fire fighting techniques should be adopted to conserve the forest. However, forest fires are an important part of the ecosystem and it helps replenish nutrients in the soil from dead and decaying matter.

3) More trees should be planted to increase the forest cover. Trees should be selected according to the geographical conditions of a particular region and proper care should be taken during the growth of trees.

4) Prevention of exploitation of forestry and forest products is necessary for the conservation of forest.

5) The existing forests should be protected from diseases by spraying chemicals, antibiotics or development of pest resistant strains of trees.

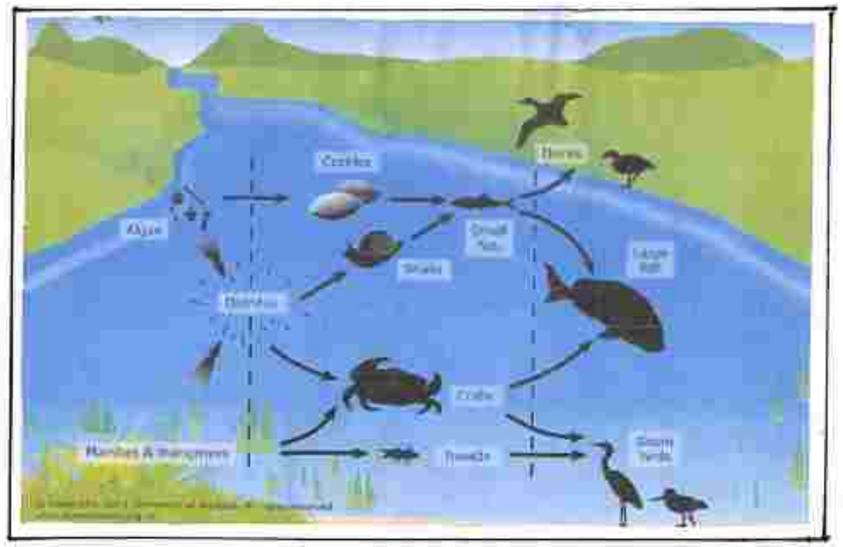
ESTUARINE ECOSYSTEM

Coastal bays, river mouths and tidal marshes form estuaries. Here, freshwater from the rivers mixes with the ocean water. The degree of salinity depends upon the amount of freshwater flow and tidal inflow. Estuaries are more productive than adjacent rivers or oceans due to the high concentration of the nutrients received from land as well as the sea. Rooted plants are supported in shallow water of lesser salinity than the sea.

ESTUARINE ECOSYSTEM

Organisms present in estuaries are those which are capable of tolerating fluctuation in the salinity of water. Some oysters, crabs and sea shrimps are found here. Estuaries contain producers, such as seaweed, marsh grasses, benthic algae and phytoplanktons. They are also used as nurseries by deep-water fishes to bring up their younger ones.

An estuary is a partially enclosed coastal area at the mouth of a river where fresh water and salty sea water meet. These are the transition zones which are strongly affected by tidal action. Constant mixing of water stirs up the silt which makes the nutrients available for the primary producers. There are wide variations in the stream flow and tidal flow at any given location diurnally, monthly and seasonally. Therefore, the organisms present in estuaries show a wide range of tolerance to temperature also. Such organisms are known as eurythermal and organisms which are tolerant to salinity are known as euryhaline.



ESTUARINE FOOD WEB

Estuaries have a rich biodiversity and many of the species are endemic. There are many migratory species of fishes like eels and salmons in which half of the life is spent in fresh water and half in salty water. For them estuaries are ideal places for resting during migration, where they also get abundant food. Estuaries are highly productive ecosystems. The river flow and tidal action provide energy subsidies for the estuary thereby enhancing its productivity. Estuaries are much use to human beings due to their high food potential. However, these ecosystems need to be managed judiciously and protected from pollution.

AGRO-ECOSYSTEM

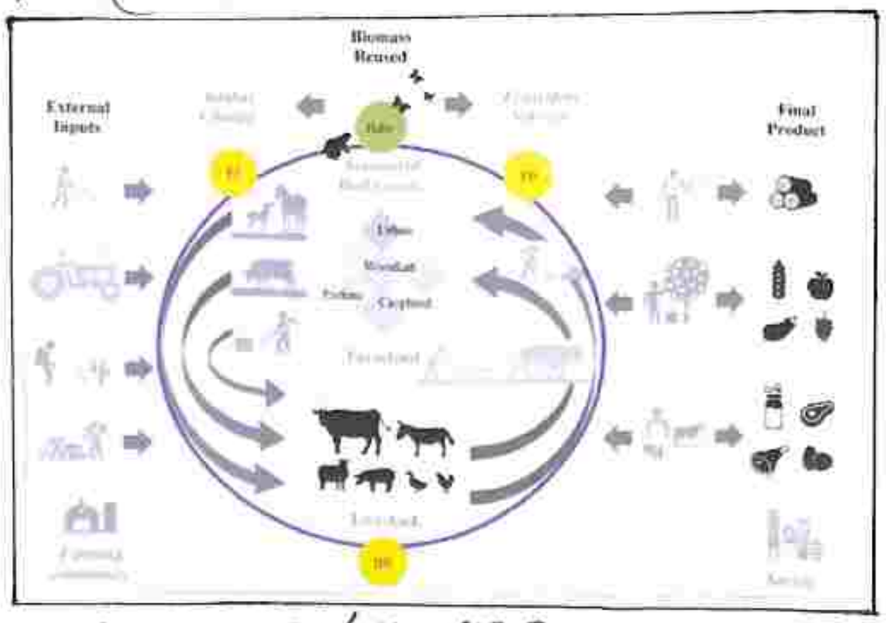
SUSTAINABLE AGROECOSYSTEMS

Agro-ecosystem is an artificial ecosystem. It is the interaction of agriculture and living organism with environment.

Components

Primary producer : Crops and weeds of the field are the primary producer of agro ecosystem -e.g. In a Rice field, there are many producers like durba, moltha, syma etc also present with rice.

Consumer : Among consumer grasshoppers, aphids, bugs, ants, rats, birds, man etc are macro consumer and frog, snake, hack are micro consumer.



AGRO-ECOSYSTEM'S MULTIPLE FUNCTIONALITY

Properties of Agro Ecosystem

1) **Productivity** – It is net increment of values, products per unit resources (land, labour, energy, capital) and is commonly measured as annual yield/hectare.

2) **Stability** – It is the degree to which productivity remain constant, inspite of normal small scale fluctuation in environmental variables such as climate or in the economic condition in market.

3) **Sustainability** – It is defined as the ability of the system to maintain its productivity when subject to stress or perturbation. A stress is defined as regular, sometimes continues, relatively small and predictable disturbance. e.g. Affect of growing soil salinity. A perturbation by contrast is an irregular, infrequent, relatively long and unpredictable disturbance such as drought or flood or a new pest.

4) **Equitability** – It is a measure of how evenly the production of agro ecosystem is distributed among its human beneficial. The more equitable the system, the more evenly are the products to fed shared among the population of the farm, village, regions or nation.

CONCLUSION

Everyone in the world depends completely on earth's ecosystems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfillment and aesthetic enjoyment. The transformation of the planet has contributed to substantial net gains in human well being and economic development. An ecosystem is balanced when the natural animals and plants and non-living components are in harmony. With increasing pollution, change in migratory pattern and rise of human population, many ecosystems are in danger of loosing that harmony.

Human beings also an integral part of ecosystems, as well as manipulaters of ecosystems. As such we are dependent on ecosystem for survival and quality of life, as well as responsible for, the ecological health of the ecosystems we inhabit.

The ecosystems of the natural world support the web of life. Energy flows from the sun, and one species' waste is another species' food. Matter cycles through ecosystems, creating a balance.

Sustainable living comes from a "sustainable environment". We usually take our ecosystem for granted. We survive because our ecosystem is thriving. We take nature as a decorative feature of our lives but the truth is we are our living because our ecosystem is.

ACKNOWLEDGEMENT

I would like to convey my heartfelt gratitude to our Subject (ENVS) teacher for her tremendous direction and assistance in the completion of my project.

I would also like to thank our Principal Ma'am for providing me with this wonderful opportunity to work on a project with such an interesting topic. I came to know a lot of new things while doing this project. Therefore, working on this project has also enhanced my knowledge.

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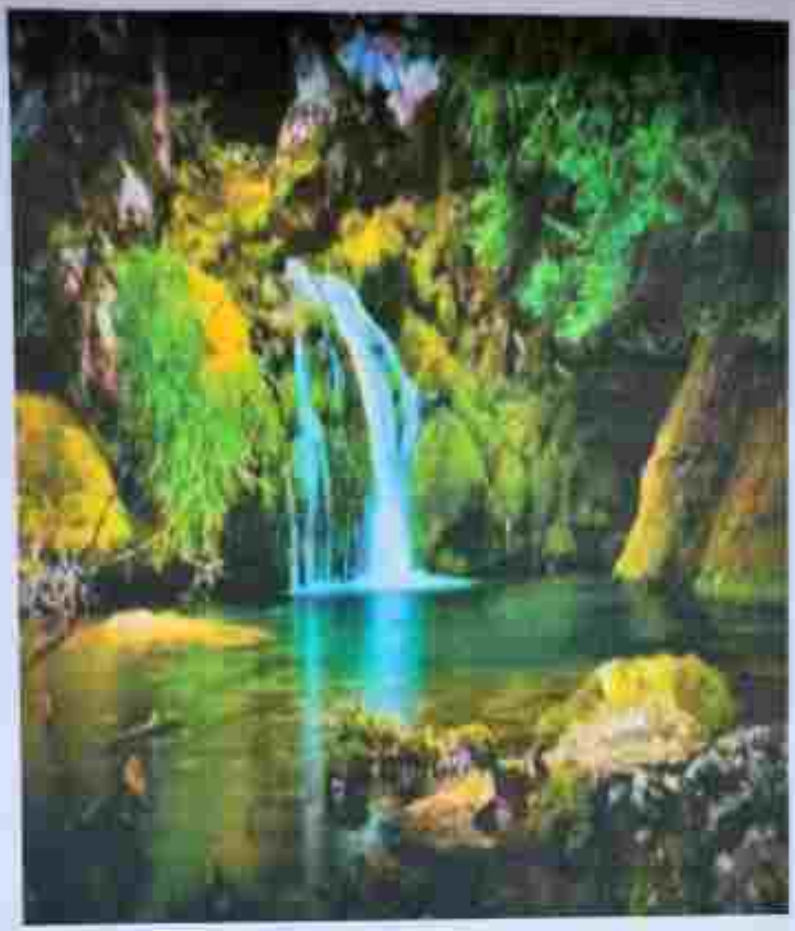
Last but not the least, I really want to acknowledge the fact that my parents have been a constant supporter. Without their encouragement I couldn't have completed the project within the limited time frame.



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TOPIC: ECOSYSTEM

SEMESTER 2

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CONTENTS: TYPES OF ECOSYSTEM

Ecosystem

An **ecosystem** refers to a practical unit of nature where living organisms act together among themselves and with the surrounding physical environment. Environmentalists look at the whole biosphere as a global ecosystem.

Pond Ecosystem

A pond is either a natural or an artificial freshwater body that is enclosed. Ponds can occur naturally in the world or they can be human-made (such as a garden pond). The pond Ecosystem differs from other water ecosystems. Unlike the river ecosystem, which is categorized under the Lotic systems, the pond ecosystem falls under the Lentic ecosystem for the reason that the water remains stagnant in ponds for a relatively long period.

River Ecosystem

River ecosystems are a prime example of a Lotic Ecosystem. These are flowing waters that drain the landscape, and include the biotic (living) interactions amongst plants, animals, and micro-organisms, as well as abiotic (non-living) physical and chemical interactions of its many parts.

Wetland Ecosystem

A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other landforms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil.

Forest Ecosystem

A forest ecosystem is a functional unit or a classification that includes birds, insects, trees, animals, soil, and humans as its networking units. A forest is a big and multifaceted ecosystem and therefore has more species diversity

Estuary Ecosystem

An estuary is an area of water and shoreline where a freshwater stream or river merges with the ocean. Estuaries can be partially enclosed bodies of water (such as bays, lagoons, sounds, or sloughs) where two different bodies of water meet and mix. They are often bordered by salt marshes or intertidal mudflats. A unique combination of salt and fresh water creates a variety of habitats in which plants and animals survive in various brackish water combinations. Estuaries have diverse flora and fauna and tremendous productivity.

Agro Ecosystem

An agroecosystem is the basic unit of study in agroecology, and is somewhat arbitrarily defined as a spatially and functionally coherent unit of agricultural activity, and includes the living and non-living components involved in that unit as well as their interactions.

Conclusion

Everyone in the world depends completely on the earth's ecosystems and the services they provide. The transformation of the planet has contributed to substantial net gains in human well-being and economic development. With increasing pollution, change in migratory patterns and rise of human populations, many ecosystems are in danger of loosing that harmony. Human beings are an integral part of ecological systems and depend on nature for survival and quality of life. Thus, saving nature will save the ecosystems and ourselves.

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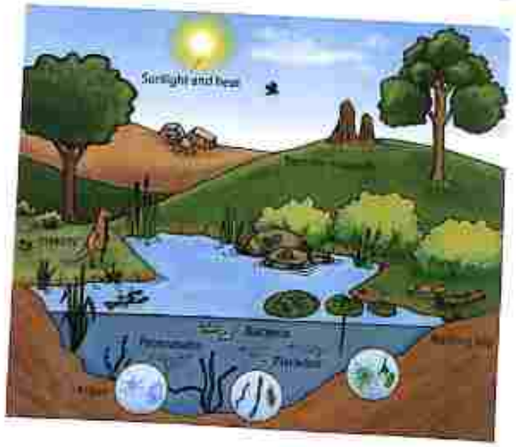
AECC-2 ENVS PROJECT

CONTENTS

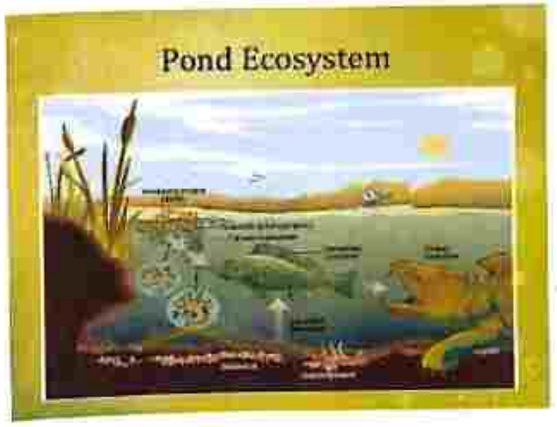
ECOSYSTEM



An ecosystem refers to a practical unit of nature where living organisms act together among themselves and with the surrounding physical environment. Environmentalists look at the whole biosphere as a global ecosystem. However, it can differ generally in size; for example it can be a small pond or a sea or a huge forest. Typically these are self-sustaining. We can split the ecosystem into two comprehensive classifications, specifically terrestial ecosystem and aquatic ecosystem.

The terrestial ecosystem includes grassland, dessert and forest ecosystem; but lake, pond and river and wetlands ecosystem fall under the aquatic ecosystem umbrella.

POND ECOSYSTEM



A pond ecosystem is a system of organisms that live together in a pond. A pond ecosystem can be defined as a closed community of organisms in a body of water or an enclosed body of water that houses numerous different creatures.

TYPES OF POND ECOSYSTEM:

Ponds can come in many different forms and they all have their own differentiating characteristics:

1. Salt Ponds – They contain brackish (salty) water and can be found close to the sea side where water logged ground creates natural pools.
2. Garden Ponds – These are artificially created ponds and can contain ornamental plants and animal species.
3. Freshwater Pools – They can form anywhere in land either from rainfall or from the presence of water saturating the soil. They can also be created by river.
4. Vernal Pools – They are seasonal pond. They form in depression in the pond but only during certain time in the year where the rainfall is heaviest.
5. Underground Ponds – Ponds can also form underground in the rocky environment of caves. A surprising amount of life can be found including fish, bacteria, lichens and so on.

CHARACTERISTICS OF POND ECOSYSTEM:

There are several things that mark pond ecosystem out from other types of ecosystem. Some of the main features are:

1. Still waters – They are lentik ecosystem — i.e; they involve stagnant or standing water.
2. Surrounded by banks – By defination, pond ecosystem are surrounded by either natural or artificial banks.
3. Wet – These ecosystem are wet and humid.
4. Different level – Distinct communities of creatures will live at different level of pond. For example, fish may live at a lower level, while birds and blooming plants may live towards the surface.
5. Variable in size – Some pond ecosystems can be very small and some as large as a lake.

IMPORTANCE OF POND ECOSYSTEM:

Pond ecosystem are very important and for this reason it is vital that we take steps to protect and nurture them.

1. Biodiversity – Pond ecosystem are important habitat for so many types of fish, birds, Plants, crustaceans as well as insects such as dragon flies.
2. Ubiquity — Pond ecosystem can be found everywhere around the earth, and it makes them very important for the life of organisms all around the earth.
3. Abundance – They are very abundant, and can be found Plentifully. That, again makes them a key habitat for various species.
4. Source of hydration — Even if they do not actually live in the pond, many species of animal will come to the Pond ecosystem whenever they need to drink.

CONCLUSION

– Though they can be found all over the globe, Pond ecosystem are always neglected by conservationists. All of our wetland ecosystem ought to be safe guard because they are vital habitat for an abundance of species. This includes pond ecosystem which can be seen in different shapes and forms and can perform many different functions.

RIVER ECOSYSTEM

A river is a large natural course of flowing water obtained from precipitation. A river can be divided into three types:

1. Perenial river, which has water throughout the year.
2. Intermitten stream, the flow is seasonal.
3. Ephemeral, the flow is rare or occasional.

River ecosystem are flowing water that drains the landscapes, and include the biotic interactions amongst plants, animals and micro-organisms, as well as abiotic physical and chemical interactions of its many parts. River ecosystem are part of larger watershed networks or catchments, where smaller headwater streams drain into mid-size streams, which drains into larger river networks. The major zone in river ecosystems are determined by the river bed's gradient or by the velocity of current. faster moving turbulent water typically contains greater concentration concentration of dissolved oxygen, which supports greater biodiversity, than the slow-moving water of pools. The distinction from the basis for the division of rivers into upland and lowland rivers.

The following unifying characteristics make the ecology of runway water unique among aquatic habitat. The flow is undirectional, there is a stage of continuous physical change, and there is a high degree of spatial and temporal hetrogeneity at all scales, the variability between lotic system is quite high and the biota is specialized to live with flow conditions.

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HUMAN IMPACT:

Of the thirty-two cities in the world in the early 1990s twenty-two were located on estuaries.
As ecosystems, estuaries are under threat from human activities such as pollution and over fishing. They are also threatened by sewage, coastal settlements, land clearance and much more. Estuaries are affected by events far upstream, and concentrate materials such as pollutants and sediments.
Land run-off and industrial, agricultural, and domestic waste enter rivers and are discharged into estuaries. Contaminants can be introduced which do not disintegrate rapidly in the marine environment, such as plastics, pesticides, furans, dioxins, phenols and heavy metals.

Such toxins can accumulate in the tissues of many species of aquatic life in a process called bio accumulation. Eustaries tend to be naturally eutrophic because of land run-off discharges nutrients into it. With human activities, land run-off now includes many chemicals used as fertilizers as well as waste from livestock and humans. Excess oxygen-depleting chemicals in the water can lead to hypoxia and the creation of 'dead zones.

artificial for the social, ecological and nutritional well being of rural communities and ultimately, global population.

COMPONENTS OF AGRO ECOSYSTEM :

There are two main components of ecosystem
1. Living (Biotic components).
2. Non-Living (Abiotic Components).

1. BIOTIC COMPONENTS —

Autotropes and heterotropes are biotic components of the ecosystems. Green plants take simple inorganic materials and produce their own food. These organisms are called atotropes. All other forms of life which do not possess chlorophyll can't produce their own food and depend upon others for their food are called heterotrophs.
Eg- Fungi, most bacteria animals etc.

2. ABIOTIC COMPONENTS —

Abiotic components are non-living environment and are usually of two types —
Materials like water, mineral salts, atmospheric gases etc.
Energy like light, heat, stored energy in Chemical bonds etc.

CONCLUSION

Everyone in the world depends completely on earth's systems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfillment and aethetic enjoyment. The transformation of the planet has contributed to substantial netgains in human well being and economic development. An ecosystem is balanced when the natural animals and plants and nonliving components are in harmony. With increasing pollution change in migratory patterns and rise of human population, many ecosystems are in danger of loosing that harmony. Human beings are an integral part of ecological systems and depend on nature for survival and quality of life. Thus, saving nature will save the ecosystems and ourselves.

ACKNOWLEDGEMENT

I would like to thank our teacher Dr. Mahua Dutta for assigning us with the project which helped us to explore a topic otherwise ignored by the present population and also helped us learn a lot in the process.

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She has been supportive of our efforts of my fellow classmates and friends has made this project an easy and fun activity and a welcome project apart from our regular studies.

This project would not also have been possible without the help, encouragement, guidance and support of my family who have extended all possible help to me any time I needed.

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2016

ENVS AECC PROJECT

ECOSYSTEM

THE NATURE'S MECHANISM

CONTEXT

ECOSYSTEM :—

An ecosystem is a geographic area where plants, animals and other organisms, as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living parts as well as abiotic factors, or non-living parts. Biotic factors, include plants, animals and other organisms. Abiotic factors include rocks, temperature and humidity.

Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in the temperature of an ecosystem will often affect what plants will grow there, for instance. Animals that depends on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish.

The whole surface of the Earth is a series of connected ecosystems. Ecosystems are often connected in a larger biome. Biomes are large sections of land, sea, or atmosphere. Forests, ponds, reefs and tundra are also the types of biomes, for example. They're organised very generally, based on the types of plants and animals that live in them. Within each forest, each pond, each reef, or each section of tundra, you'll find many different ecosystems.

Mallee

Mallee, also spelled mellee, Soubland plant community found in Southern Australia, composed primarily of woody shrubs and small trees of the genus Eucalyptus. Mallee ecosystems are in areas with a Mediterranean climate, largely found in Western Australia, the Eyre and York peninsulas of South Australia, and the Southwestern corners of Victoria and New South Wales. Mallee is considered part of the Mediterranean vegetation biome, which includes American chaparral, Chilean Matorral, Mediterranean maquis and the fynbos of South Africa.

South African Mallee

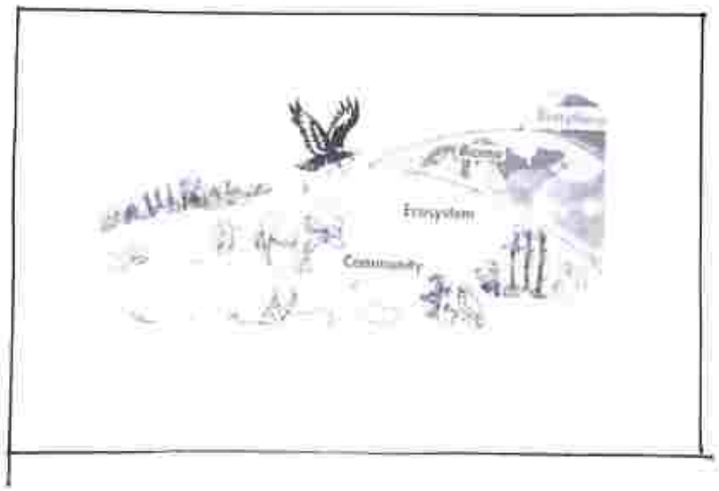
The term mallee is also used in Australia to describe multistemmed woody plants that arise from an underground woody structure known as lignotuber or mallee root. This adaption, common in many eucalypts of mallee ecosystems, allows the plants to resprout quickly following a wildlife.

Keystone Species

Keystone Species, in ecology, a species that has a disproportionately large effect on the communities in which it occurs. Such species help to maintain local biodiversity within a community either by controlling populations of other species that would otherwise dominate the community or by providing critical resources for a wide range of species. The named keystone species, coined by American Zoologist Robert T. Paine in 1969, was derived from the practice of using a wedge-shaped stone to support the top of an arch in a bridge or other construction.
The starfish Pisaster ochraceus is a keystone specie. This predatory starfish feeds on the mussel Mytilus californianus and is responsible for maintaining much of the local diversity of species within certain communities.

Structure of Ecosystem

- Ecosystem
  - Abiotic Factors
  - Biotic Factors
    - Producers
    - Consumers
      - Primary — Herbivores
      - Secondary — Primary Carnivores
      - Tertiary — Secondary Carnivores
    - Decomposers



Types of Ecosystem

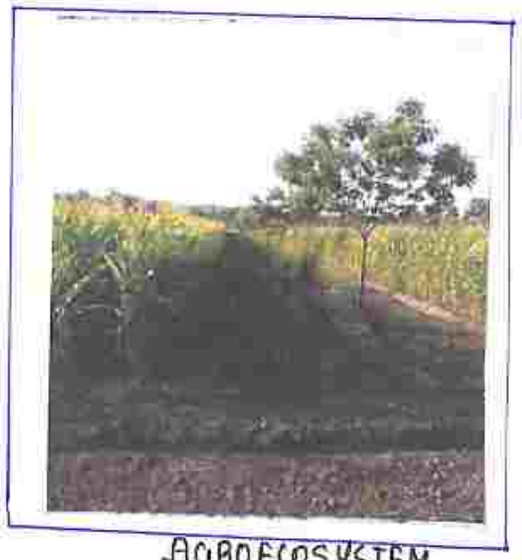
- Ecosystem
  - Natural ecosystem
    - Terrestrial ecosystem
      - Grassland Ecosystem
      - Forest Ecosystem
      - Desert Ecosystem
    - Aquatic Ecosystem
      - Fresh water
      - * Brackish water.
      - Marine water
  - Artificial ecosystem

Estuary Biodiversity

Estuaries provide a calm refuge from the open sea for millions of plants and animals.
The diversity of habitats enclosed in estuaries support enormous abundance and diversity of species e.g.: fish, shelfish, lobsters, marine worms, mud seagrasses, mangroves, algae and phytoplankton.

Visiting species include birds which roost and feed pelagic fish to spawn and use a nursery.

Agro Ecosysteme



AGROECOSYSTEM

An agroecosystem is the basic unit of study in agroe-cology and is somewhat arbitarily defined as a spatially and functionally coherent unit of agricultural activity and includes the living and non-living components involved in that unit as well as their interactions.

Forest gardens are probably the worlds oldest and most resilient agroecosystem. Forest gardens originated in pre historic times along with jungle dad river banks and in the wet foothills of monsoon regions.

Some major organizations are hailing from farming within agroecosystems as the way forward for mainstream agriculture.

Why is conserving crop and animal diversity important for our health?

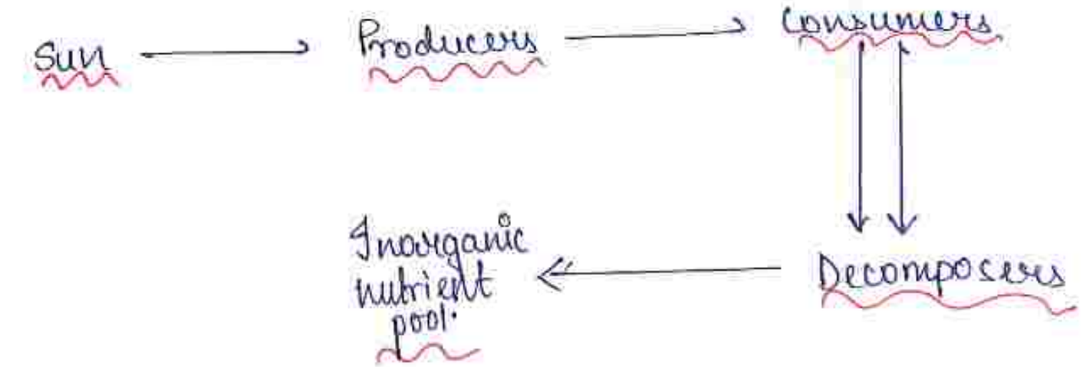
→ We need more variety of food to nourish people and sustain the planet but over the last 100 years, more than 90 per cent of crop varieties have disappeared. Half of the breeds of any domestic animals have been lost.

According to Food and Agricultural Organisation (FAO), only nine plant species account for 66 percent of total crop production despite the fact that there are atleast 30,000 edible plant.

Conclusion

Ecosystems are created by the interrelationship between living organisms and the physical environmental inhibits, that inhabit (land, water and air). Ecosystems require a source of energy to make them work and for most, although not all, this is light from the sun.

To study ecosystems, we have to start to identify the components involved and the interrelationships between them. We can list the living organisms by identifying the species involved.



Acknowledgement

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~ Anushka Jana
CNDV Dept.

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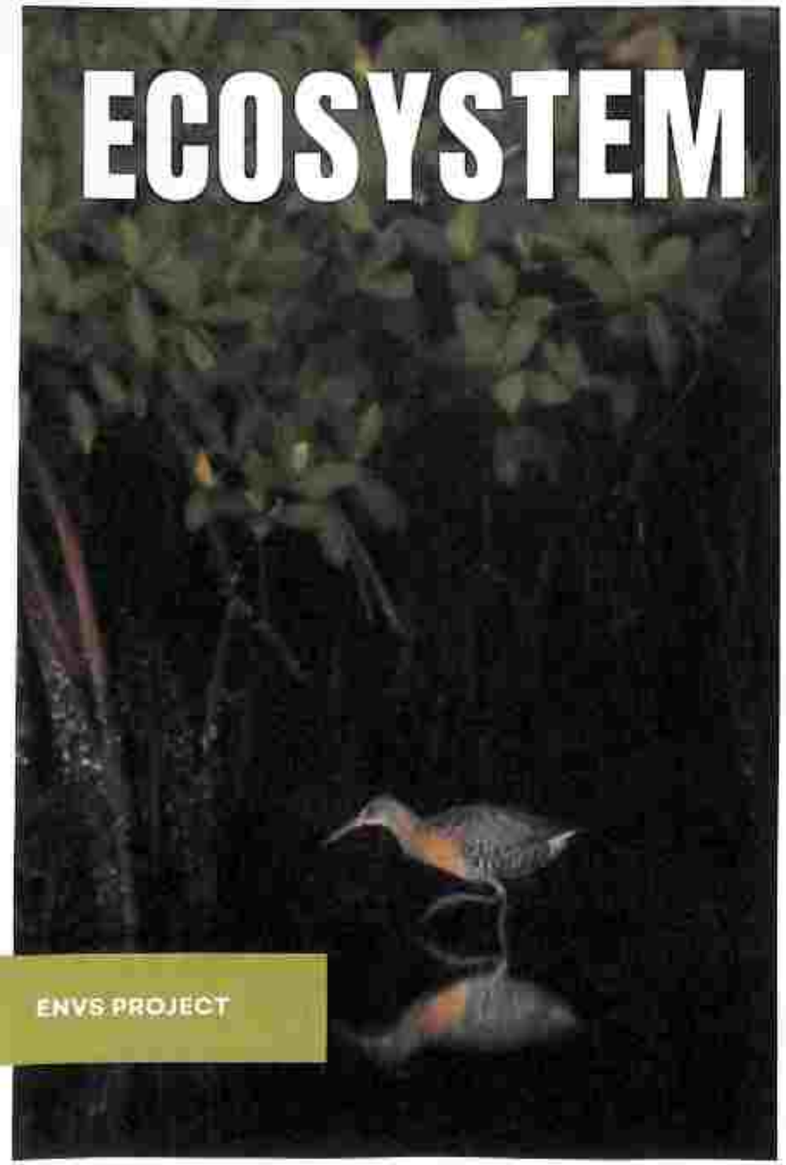

ENVS PROJECT

SEMESTER 02

CU ROLL NO.:- 213013-13-0015

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CONTENT

ECOSYSTEM

An ecosystem refers to a practical unit of nature where living organisms act together among themselves and with the surrounding physical environment. Environmentalists look at the whole biosphere as a global ecosystem. Moreover, the forest ecosystem is a part of the terrestrial ecosystem.

However, it can differ generally in size; for example, it can be a small pond or a sea, or a huge forest. Typically, these are self-sustaining. We can split the ecosystems into two comprehensives classifications, specifically, terrestrial ecosystem and aquatic ecosystem.

The terrestrial ecosystem includes grassland, desert, and forest ecosystem, but the lake, pond, river, and wetland ecosystems fall under the aquatic ecosystem umbrella.

Ecosystems are controlled by external and internal factors. External factors such as climate, parent material that forms the soil, and topography control the overall structure of an ecosystem but are not themselves influenced by the ecosystem. Internal factors are controlled by decomposition, root competition, shading, disturbance, succession, and the types of species present.

POND ECOSYSTEM

Introduction: A pond is either a natural or an artificial body of water that is enclosed. Ponds can occur naturally in the world or they can be human-made (such as a garden pond).

An ecosystem is a technical term for a community of organisms. For such a community to form an ecosystem, it needs to be a distinct system where the organisms live and interact.

The pond Ecosys differ from other water ecosystems. Unlike the river ecosystem, which is categorized under the Lotic systems, a point he d ecosystem falls under the Lentic

ecosystem for the reason that the water remains stagnant in ponds for a relatively long period.

Meaning of Pond Ecosystem:

A pond ecosystem is a system of organisms that live together in a pond. A pond ecosystem can be defined in three ways:

1. A closed community of organisms in a body of water
2. An enclosed body of water that houses numerous different creatures.
3. A biological system that includes water and plant and animal life interacting with each other.

So, to summarize, a pond ecosystem is:

- A community of organisms living together
- Within a body of water that can be either artificially enclosed or naturally enclosed.
- A distinct community with its ecology.

Types of pond ecosystem:

Ponds can come in many different forms, and they all have their differentiating characteristics. Below, you will find a discussion of some of the key types of pond ecosystem.

appear and at other times of the year will be relatively deserted - one example for instance is a seasonal oasis in the desert. These types of pond ecosystems are sometimes referred to as ephemeral pools as well, to reflect the fact that they only exist at certain times of the year.

5. Underground ponds.

Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, lichens, and so on.

Characteristics of pond ecosystems.

Several things mark pond ecosystems out from other types of ecosystems. Below, you will find a list of some of the main features of these ecosystems.

1. Still waters: pond ecosystems are lentic ecosystems i.e.; they involve stagnant or standing water.
2. Surrounded banks: by definition, pond ecosystems are surrounded by either artificial or natural banks.
3. Wet: these ecosystems are wet and humid.
4. Different levels: distinct communities of creatures will live at different levels of a pond. Crustaceans and deep-water fish may live at the lower level, for example, whilst birds and blooming plants may live towards the surface.
5. Variable in size: some pond ecosystems can be very small (such as a rockpool) whilst others can be almost as large as a lake.

almost everywhere, but they can also be found plentifully. That, again, makes them a key habitat for many different species.

4. Source of hydration.

Even if they do not live in the pond ecosystem, many species of animals will come to pond ecosystems whenever they need a drink. A key example is a watering hole in a prairie or desert. Humans can also use these ecosystems as a source of water.

Food Chain in the Pond Ecosystem:

1. The food chain is a sequence of organisms in which each organism eats the lower member and is eaten up by the next higher member.
2. Phytoplankton and algae serve as producers that convert solar energy into chemical energy.
3. Phytoplankton is consumed by zooplankton (primary consumers).
4. The food chain further proceeds with the small pond species that feed on zooplankton.
5. Small Pond species are eaten by large pond species.
6. Several bacteria and fungi feed on dead and decaying parts of the animal species and are therefore called decomposers. Decomposers convert the organic matter (dead plants and animals) into their inorganic components that are again util-utilized producers, and hence a continuous flow of energy is maintained.

Conclusion:

Though they can be found all over the globe, pond ecosystems are often neglected by conservationists. All of our wetland ecosystems ought to be safeguarded because they are vital habitats for an abundance of different species. This includes pond ecosystems which, as we have seen, can come in many different shapes and forms and can perform many different functions.

RIVER AS AN ECOSYSTEM:

Water is an essential component of life.
Surface water resources are the most preferred locations for life settlements. Most of the human civilizations originated near water courwatercoursesly along the major rivers.
A River is a large natural course of flowing water obtained from precipitation. The surface water moves down along the slopes due to the action of gravity. Streams, tributaries, brooks, creeks, and springs are the different types of watercourses classified based on their dimension and distribution.

- A river is also termed major, medium, and minor, based on its number and length of tributaries, stage of development, area of catchment,t and geomorphological conditions.
- Every major river must have a place of origin on the upstream side, which is called the headwaters, and a point of

rivers. They are the veins of the earth through which life flows. Rivers not only make our planet habitable; they also make it exceedingly beautiful. Rivers are invaluably useful for man, animals, and plants. They are the source of potable water, irrigation for agriculture, power generation, transport, food, recreation, and leisure, etc.

Rivers are the most precious gift that nature has given to the ind. No life can be imagined there would be no water(river). It is the sole duty of overtry person the to prevent this indispensable resource from getting polluted. If we don't take this seriously, the existence of Human Beings will become a History on this Earth.

What is a Wetland?

A wetland is an area where water covers the soil or is present either at or near the surface of the soil all year or for varying periods during the year, including during the growing season. Water largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and land species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland soils. Wetlands vary widely because of regional and local differences in soils, topography, climate, water, vegetation,and other factors, including human disturbance. Indeed, wetlands are found from the tundra to the tropics and on every continent except Antarctica. Two general categories of wetlands are recognized: coastal wetlands and inland wetlands. Often called "nurseries of life," wetlands provide habitat for thousands of species of aquatic and terrestrial plants and animals. Although wetlands are best known for being home to water lilies, turtles, frogs, snakes, alligators, and crocodiles, they also provide important habitats for waterfowl, fish, and mammals. Migrating birds use wetlands to rest and feed during their cross-continental journeys and as nesting sites when they are at home. As a result, wetland loss has a serious impact on these species.

Types of Wetlands:

MARSHES are wetlands dominated by soft-stemmed vegetation. They are sometimes saturated, flooded, or ponded with water and characterized by grasses adapted to wet soil conditions. Marshes are further characterized as tidal marshes and non-tidal marshes. SWAMPS are wetlands dominated by trees and other woody plants. Swamps occur in either freshwater or saltwater floodplains. They are characterized by very wet soils during the growing season and standing water during certain times of the year. Well-known swamps include Georgia's Okefenokee Swamp and Virginia's Great Dismal Swamp.

BOGS are freshwater wetlands characterized by spongy peat deposits, evergreen trees and shrubs, and a floor covered by a thick carpet of sphagnum moss. These systems, whose only

world, comparable to tropical rain forests and coral reefs in their productivity and the diversity of species they support. Aquatic plant life flourishes in the nutrient-rich environment, and energy converted by the plants is passed up the food chain to fish, waterfowl, and other wildlife and us as well. In addition to the biological productivity of wetlands, an acre of wetland can store 1-1.5 million gallons of floodwater. Although wetlands keep only about 5% of the land surface in the conterminous United States, they are home to 31% of our plant species and support one-third of all endangered species. Wetlands are found on all continents except Antarctica and their diversity is as broad as their geographic occurrences. Read on for more specific functions and values of wetland ecosystems.

Functions of a Wetland:

1) Absorption and storage of floodwaters and groundwater recharge in dry periods Protection of coastlines from high energy open ocean waves
2)Slowing of water velocity so sediments may settle out thereby improving water quality.
3)Filtering and removal of excess nutrients and toxins by wetland soils and plants Providing nurseries for juveniles of many aquatic species including most commercially harvested fish.
4)Providing habitat for many upland species such as raccoons and deer as well as habitat for sensitive wetland-dependent species like salamanders.

Value of Wetlands to Humans:

Alternately, the value of a wetland is an estimate of the importance or worth of one or more of its functions to society. For example, a value can be determined by the revenue generated from the sale of fish that depend on the wetland, by the tourist dollars associated with the wetland, or by public support for protecting fish and wildlife. Although large-scale benefits of functions can be valued, determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well.

What is Wetland Restoration?

Wetlands are one of the most valuable and fragile components of a watershed, but for many years they were filled and drained for agriculture and development. Now we are learning that wetlands are crucial to the health of our waters and wildlife. Wetland restoration, the renewal of natural and historical wetlands that have been lost, is a growing activity. It can improve water quality and wildlife habitat across the nation.

Conclusion of wetlands:

of precipitation in the region governs the forest's development. If there is adequate rain for the growth of trees, then a forest will typically develop. Otherwise, the region will turn into grasslands.

Tropical rainforest ecosystem:

Tropical rainforests are one of the most vital forest ecosystems on Earth. These outstanding ecologies are homes to countless species of animals and plants. Rainforests not only have high biodiversity of plants but are also fully packed with tall trees that create a ceiling (canopy) from the sun above. This ceiling stops smaller plants on the forest floor from growing, but in some parts where sunlight makes it to the surface, are filled with fascinating plants. These plants are considered the "understory" or the shrub layer of a forest.

Boreal/Taiga Forest ecosystem:

• Boreal forest ecosystem is the collective green stretch of deciduous and coniferous forest that surrounds a big share of the Northern Hemisphere. In North America, boreal forest lands expand across the majority of northern Canada and into Alaska. It has been recognized as one of the Earth's great forest ecosystems for a long time.
• This forest ecosystem spreads over about 35% of Canada's landmass and is the single biggest land-based ecosystem in North America. It furthermore comprises a considerable amount of Canada's biodiversity and has long been documented as a central global carbon sink. Although we don't, being such a major carbon sink should, in itself, be considered an ecosystem service for the benefit of mankind! Although the boreal is comparatively unfamiliar, it is central as the "great lung" of North America. This forest ecosystem houses the biggest and tiniest mammal species (such as the wood bison and pygmy shrews respectively).
• Boreal forest has various natural resource components. Ripe with large lakes and northern rivers; huge swamps, bogs, and other organic marshes. The abundant biological diversity of the Boreal is a delight to see: lynx and caribous, cranes and bison, owls, woodpeckers with three toes instead of four, multicolour wood warblers, and beetles.
The Boreal has more than 5,000 species of visible and vibrant fungi, illustrious far more in Siberia and Scandinavia than in North America. Then there are the exquisite old-growth forests, the lushest and most biologically varied of the Boreal Forest groups that are vital for a lot of Boreal species.

Savanna forest ecosystem:

The Savanna ecosystem is generally found in South America, Australia, and Africa.
Savanna forests are quite vulnerable to forest fires; on the other hand, it has characterized by the ability to re-grow much faster.
The landscapes of the Savanna Forest ecosystem are covered with large areas of green lands, bushes & clusters of feeble trees.

Characteristics of a forest ecosystem:

2. Ecological Functions: Forests play an important role in maintaining ecological factors such as climate, carbon storage, nutrient cycling, and rainfall,
3. Culture and Social Benefits: The tribal people who live in the forests treat forests as nature goddesses. The traditional beliefs and spirituality save wild animals from hunting and cutting down of trees by urban people. Few modern people visit forests for recreation.

Threats to forest ecosystem:

• Deforestation

One of the major challenges faced by the forest ecosystem is deforestation. Deforestation is nothing but cutting the forests for some other purpose other than for forest use. Huge amounts of forests are cut down every year by the state governments for agriculture, settlements, constructing multipurpose projects, etc.
Some contractors even do illegal deforestation for monetary benefits. As a result of deforestation, the quality of soil also gets degraded because of soil erosion which in turn cannot sustain forests further.

Barren Quality:

Nearly half of the forests in India are there only for the namesake. Only the remaining half of the forests have a green cover. If we remove the barren forests from the list of forests, the ratio of forests to land in India will be around 11%, which is far short of the current estimate. So, it is important to grow forests to increase the ratio further. Construction of Multipurpose Projects

Forests are being cleared by the State Governments for constructing multipurpose projects and their associated canals. To support these projects, additional infrastructure is provided like constructing roads, buildings, etc. Similarly, roads are constructed for transportation facilities which in turn leads to the fragmentation of forests.

• Jhumming or Shifting Cultivation

The tribal people generally practice shifting cultivation where crops are grown for one or two years after clearing the forest areas and when the fertility of the soil gets exhausted, they move to newer forest areas. Similarly, to earn a livelihood, tribal people exploit forest wealth.

• Forest Fires

Though forest fires are not major threat to forests in India they are a common phenomenon the world over. Forest fires that happen either due to natural or man-made causes destroy the forests and hence cause deforestation.

Conservation of Forest:

Conservation of forests is the practice of planting more trees and maintaining the forested areas for sustainability for future generations. Forests are an important natural resource and are beneficial to humans in several ways. But due to

combinations. Estuaries have diverse flora and fauna and tremendous productivity:

- Salt marsh grasses, algae, and phytoplankton are the major producer.
- Many species of annelids, oysters, crabs, and fish are present.
- Many marine invertebrates and fish breed in estuaries or migrate through them to freshwater habitats upstream.
- A large number of waterfowl and other semi-aquatic vertebrates use estuaries as feeding areas.
- Human activities are having a large impact on estuaries. Estuaries receive the pollutants dumped into the streams and rivers that feed them.
- Residential and commercial development not only adds to pollution but eliminates some estuaries due to land filling.

Freshwater from rivers sometimes moves with large freshwater bodies as the Great Lakes creating a "freshwater estuary" that functions like typical brackish estuaries.

Estuary Classification by Water Circulation freshwater-
The amount of circulation affects the salt distribution and salinity concentrations salt-wedge, fjord, slightly stratified, vertically mixed, Fresh Water.

Salt-Wedge Estuaries

- Salt wedge estuaries occur when the mouth of a river flows directly into salt water.
- The mouths of the Mississippi, Columbia and Hudson rivers are examples of salt wedge estuaries.
- The water circulation is controlled by the river that pushes back the seawater. This circulation creates a sharp boundary that separates an upper less salty layer from an intruding wedge-shaped salty bottom layer.

Fjord

- Fjord type estuaries are characterized by a deep elongated machine that is 'U' shaped and a ledge or barrier that separates the basin from the sea.
- Fjord type estuaries are found along glaciated coasts such as Alaska, Chile, New Zealand.
- They have moderately high river input and little tidal mixing.

Slightly Stratified or Partially Mixed Estuary

- Partially mixed estuaries have a tidal flow that provides a means of easing the salt wedge.
- Deeper estuaries such as Puget Sound and San Francisco Bay are examples of partially mixed estuaries.
- The salt water is mixed upward and fresh water is mixed downward.
- The lower layers of water typically remain saltier than the upper layers

Vertically Stratified or Well Mixed Estuaries

- Well-mixed estuaries have strong tidal mixing and low river flow that mix the sea water throughout the shallow estuary.

- Mudflat characteristics are defined by their specific combination of sand, silt, clay and organic matter content.
- Organisms best suited for the mud flat are burrowers.

Tidal Stream

- Tidal streams are highly productive transitional areas between the freshwater of rivers and the saltwaters of bays.
- Tidal streams serve as nurseries for many fish and shellfish, including several species important for commerce and recreation.
- Many macroinvertebrates are often present

Barrier Beaches

- Barrier Beaches are spits of sand that form parallel to the shore.
- Pounding waves, shifting sands, strong winds, and saline soils make living on the beach difficult.
- Microscopic and larger animals have adapted to life under the sand to escape the harsh conditions at the surface by burrowing into the sand.
- Low, sprawling root systems help hold the plants in place as winds blow and sands shift.
- Thick leathery or hairy leaves help reduce water loss.

Salt Marshes

- Salt marsh are wetland flooded regularly by tidal, brackish water.
- Sediment in the salt marsh often has a high salt content.

POINT AND NON-POINT SOURCE POLLUTION:

- Pollutants pose a large threat to estuarine organisms.
- Pollutants are introduced into estuaries from either point sources or non-point sources.
- Point sources are clearly defined, localized inputs such as pipes, industrial plants, sewer systems, oil spills from tankers, and the state governments regulate them.
- Non-point sources are indistinct inputs that do not have a clearly defined source, such as runoff of petroleum products from roadways or pesticides from farmland Estuary Preservation.
- Ensuring the health of our estuaries is vital to the survival of the plant and animal communities that call them home and the humans that depend on them for their way of life.
- A majority of pollutants find their wat into estuaries from non-point sources.
- Non-point sources are harder to detect and to control.
- Reduction of pollution requires substantial individuals and collective efforts.

ESTUARY PRESERVATION

Ensuring the health of our estuaries is vital to the survival of the plant and animal communities that all of home and the humans that depend on them for their way of life.

water, disease management, climate regulation, spiritual fulfilment and aesthetic enjoyment. The transformation of the planet has contributed substantial net gains in human wellbeing and economic development. An ecosystem is balanced when the natural animals and plants and non-living components are in harmony. With increasing pollution change in migratory patterns and rise of human population, many ecosystems are in danger of losing that harmony. Human beings are an integral part of ecological systems and depend on nature for survival and quality of life. Thus, saving nature will save the ecosystems and ourselves.

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