Gokhale Memorial Girls' College

Date: 13/04/2023

To whom it may concern

Subject: Completion of ENVS Project by CEMA, CMEV and ASPV students of Semester II in 2022

The undersigned hereby certifies that the students mentioned in the table given below successfully 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 as ENVS-CEMA_CMEV_ASPV (for DVV compliance) with pdf link of their projects stated alongside.

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PROJECT ON ENVIRONMENTAL STUDIES (AECC-2)

TOPIC: Study of Ecosystem-Aquatic ecosystem (pond, river, wetland and estuary)

Done by,

Adrija Saha

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Semester - 2

Department - Chemistry

ACKNOWLEDGEMENT

Firstly, I would like to express my special thanks and gratitude to our Principal Ma'am Dr Atashi Karpha as well as to my professor Rajkumar Barman Sir who gave me this opportunity to do this assignment on the topic "STUDY OF ECOSYSTEM " which has helped me a lot in developing my knowledge. I am very much thankful to them.

Secondly, I would also like to thank my parents and friends who helped me a lot in finalising the project within the span of time.

CONTENTS

Definition Of Ecosystem

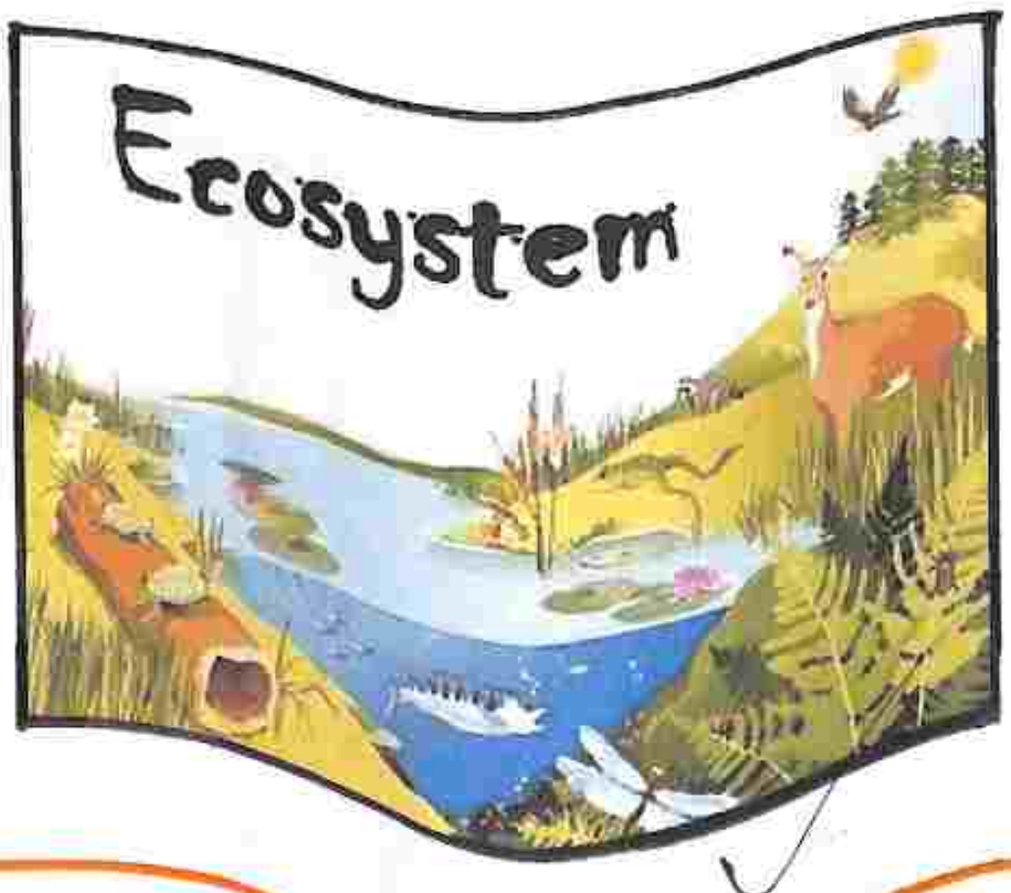
An ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living, parts, as well as abiotic factors, or nonliving parts. Biotic factors include plants, animals, and other organisms. 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 depend on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish.

Eugene Odum, an American biologist, pioneered the concept of ecosystem-the holistic understanding of the environment as a system of interlocking biotic communities.

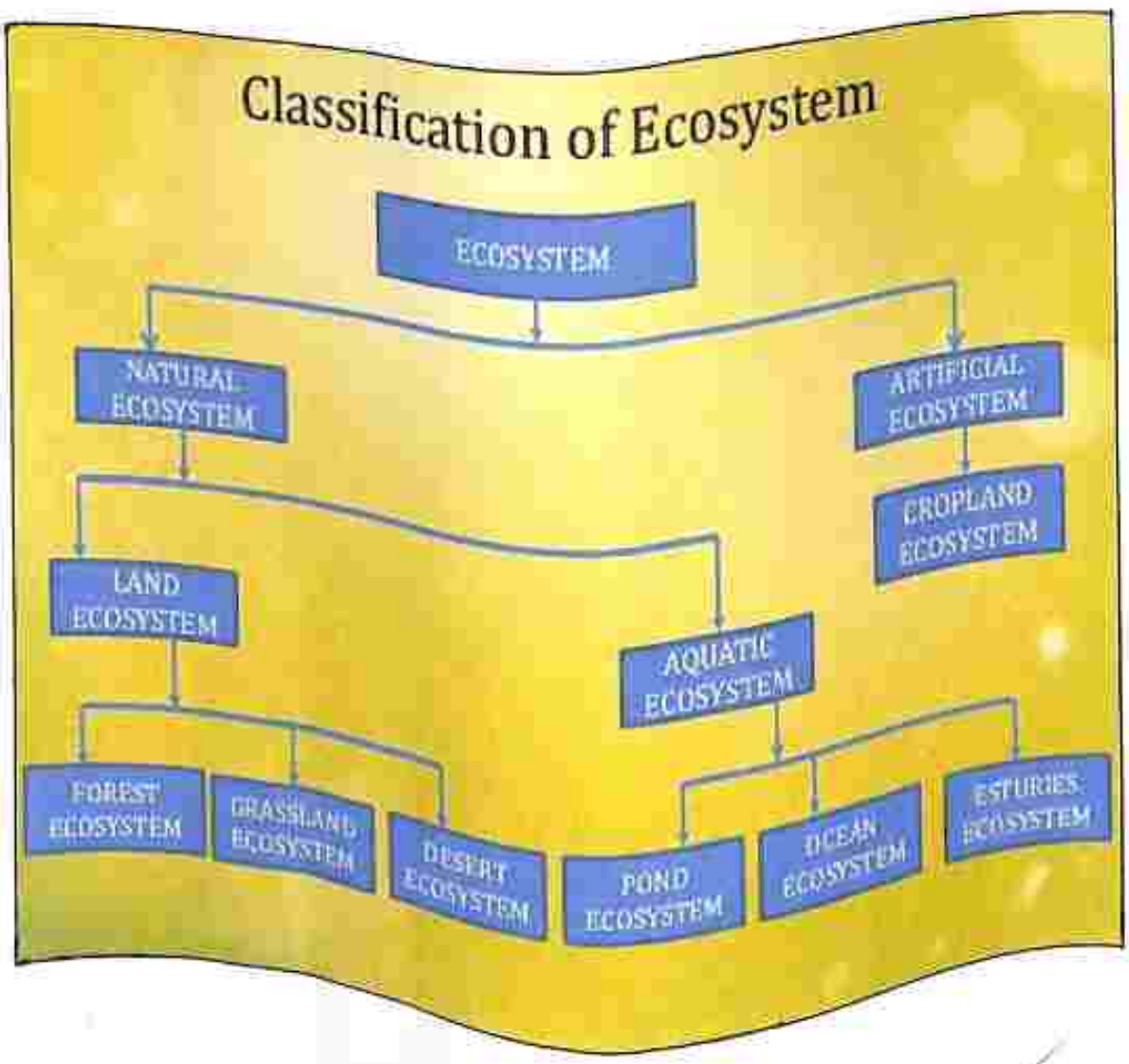
A Prussian botanist, geographer and naturalist **Alexander Von Humbolt** is considered the father of ecology. He was the first to study and present the relationship between organisms and their environment.

Tansley coined the term "ecosystem" to recognise the intercommunity and its physical environment ration of the biotic community and it's physical environment.



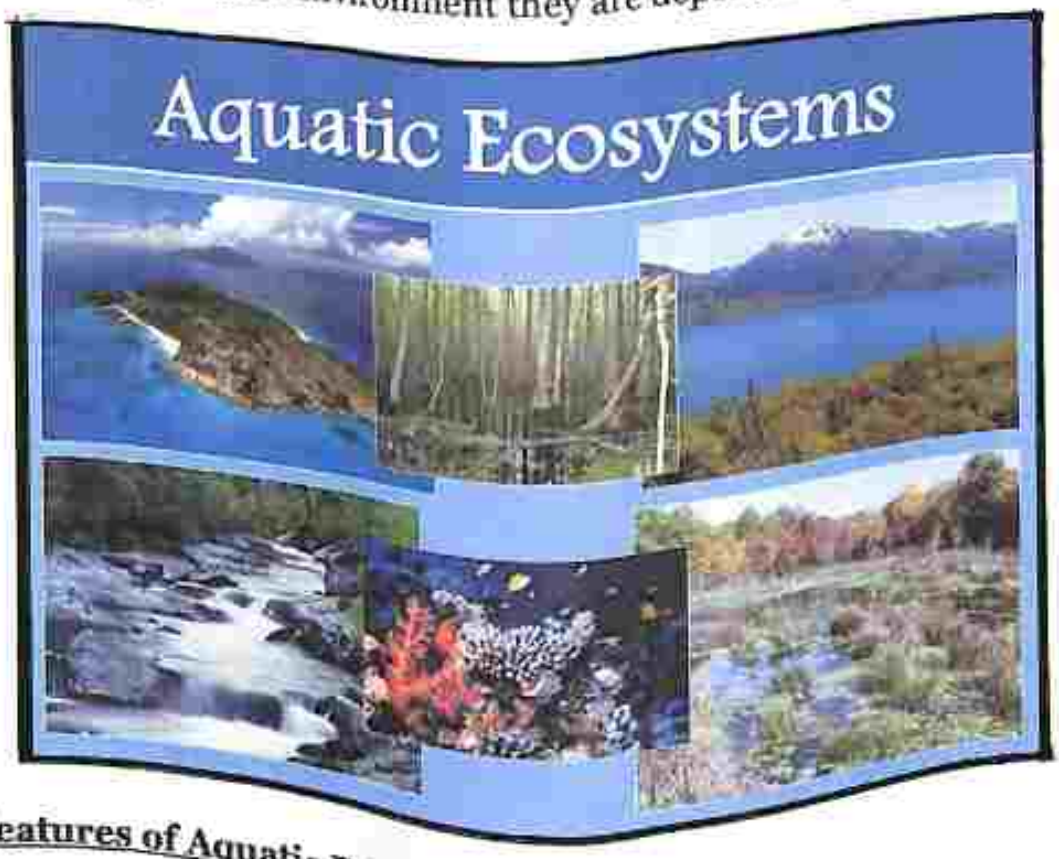
Classification of Ecosystem

Ecosystems can generally be classified into two classes such as natural and artificial. **Artificial ecosystems** are natural regions affected by man's interferences. They are artificial lakes, reservoirs, townships, and cities. **Natural ecosystems** are basically classified into two major types. They are aquatic ecosystem and terrestrial ecosystem.



Aquatic Ecosystem

An ecosystem which is located in a body of water is known as an aquatic ecosystem. The nature and characteristics of the communities of living or biotic organisms and non-living or abiotic factors which interact with and interrelate to one another are determined by the aquatic surroundings of their environment they are dependent upon.



Features of Aquatic Ecosystem:

- They can be made of either freshwater or saltwater.
- Provide habitat for a variety of aquatic features.
- Algae and corals make the majority of the florals.
- Have a high level of biological diversity making them the world's richest and productive ecosystem.

Importance of Aquatic Ecosystem:

Aquatic ecosystems perform numerous valuable environmental functions such as:

- Recycling nutrients.
- Purifying water.
- Maintaining stream flow.
- Recharging ground water.
- Providing habitat for wildlife.

Classification of Aquatic Ecosystem

Aquatic ecosystem can be broadly classified into two types. They are:

- Marine Ecosystem
- Freshwater Ecosystem

Marine Ecosystem:-

Marine ecosystems are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which has different physical and biological characteristics. This particular ecosystem is the largest aquatic ecosystem and covers over 70% of the earth's total surface. The following categories comprise the marine ecosystem

- **Ocean Ecosystem: Pacific Ocean, Atlantic Ocean, Indian Ocean, Arctic Ocean, and the Southern Ocean** are the five major oceans on earth. Notably, the Pacific Ocean is the largest and deepest of these five, while the Atlantic is the second largest in terms of size. Also, the Southern Ocean harbours the largest population of Krill among them. Other than that, the oceans serve as home to aquatic organisms like – turtles, crustaceans, plankton, corals, shellfish, blue whale, sharks, tube worms, reptiles, etc.

- **Estuaries:** Typically, it is the meeting point of a sea and rivers, which makes the water slightly more saline when compared to freshwater and more diluted when compared to the marine ecosystem. Biologically, estuaries are considered to be productive as they stimulate primary production and trap plant nutrients. **Some examples of estuaries include – tidal marshes, river mouth, and coastal bays.**

Freshwater Ecosystem:–

An ecosystem characterized by low-salt content, making a suitable environment for various plants and animals is known as a freshwater ecosystem. This aquatic ecosystem covers less than 1% of the earth's surface. There are three basic types of freshwater ecosystems: **Lentic** (slow moving water, including **pools**, **ponds**, and **lakes**), **Lotic** (faster moving water, for example **streams** and **rivers**) and **Wetlands** (areas where the soil is saturated or inundated for at least part of the time).

- **Lentic Ecosystem:** It includes standing water bodies like **ponds** and **lakes**. All standing water habitats, such as lakes and ponds, are included in lentic ecosystems. Algae, rooted and floating-leaved plants, and crustaceans like crabs and shrimp live in these habitats. Salamanders, frogs, water snakes, and alligators are commonly found in lentic ecosystems.

- **Lotic Ecosystem:** These aquatic ecosystems are characterized by rapid flowing water moving in one direction which includes **rivers**. They are a hub of a wide variety of insects like beetles, mayflies, and stoneflies, among others. Also, it harbours species like river dolphins, beavers, otters, eel, minnow, and trout.

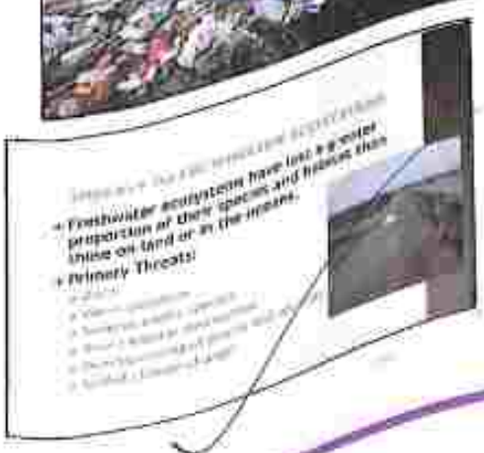
- **Wetlands:** These are marshy areas that are often covered in water and harbour a variety of flora and fauna. Wetlands are known to be a home of water lilies, marshes, swamps, Northern Pikes, dragonflies, Green Heron, etc.

Threats to Aquatic Ecosystem

The five threats to the aquatic system leading to the destruction of habitats include:

- **Habitat modification:** The change in habitat is a leading global cause of habitat loss, and the change in abundance of persisting species is a significant threat.
- **Habitat destruction:** It can destroy coastal habitats, reduce water and affect human health. Hurricanes and Tsunamis can cause habitat destruction disrupting many aquatic plants and species. The loss of habitat can decrease the protection of shorelines affecting human life.
- **Overfishing:** Overfishing leads to an imbalance that can erode the food web resulting in the destruction of aquatic life and vulnerable species such as corals or turtles.
- **Water Pollution:** It can lead to an algal bloom in an aquatic environment. The nutrient enrichment stimulates plant and algae growth, reducing fresh dissolved oxygen levels in the water because of toxicity in water bodies leading to the death of aquatic organisms.
- **Invasive species:** Invasive species can increase the rate of evaporation and dilution capacity. It can decline streamflow and destruct the extinction of flora and fauna.

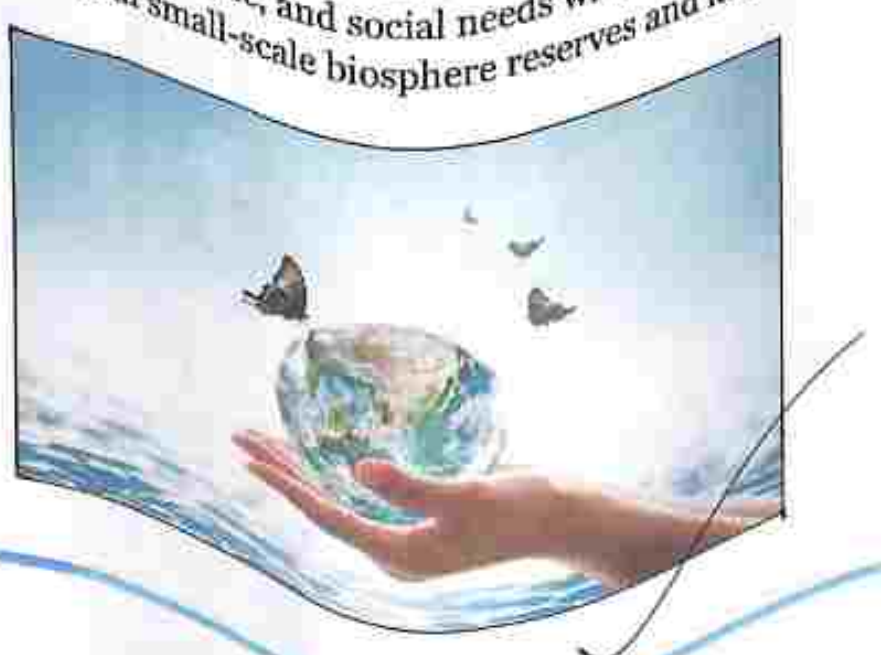
Examples are the overuse of pesticides, fertilizers that change the aquatic environment. The sewage from industries and domestic disrupts the aquatic life, the proliferation of nutrients causes algal bloom that can create ecosystem off-balance.



Conservation of Aquatic Ecosystem

Aquatic conservation strategies support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems. In order for biodiversity conservation to be effective, management measures must be broad based.

- Aquatic areas that have been damaged or suffered habitat loss or degradation can be restored. Even species populations that have suffered a decline can be targeted for restoration (e.g., Pacific Northwest salmon populations).
- An aquatic bio- reserve is a defined space within a water body in which fishing is banned or other restrictions are placed in an effort to protect plants, animals, and habitats, ultimately conserving biodiversity.
- Regulatory measures must be taken on wastewater discharge in the water body to conserve biological diversity.
- Increasing public awareness is one of the most important ways to conserve aquatic biodiversity. This can be accomplished through educational programs, incentive programs, and volunteer monitoring programs.
- Various organizations and conferences that research biodiversity and associated conservation strategies help to identify areas of future research, analyze current trends in aquatic biodiversity.
- Bioregional management is a total ecosystem strategy, which regulates factors affecting aquatic biodiversity by balancing conservation, economic, and social needs within an area. This consists of both small-scale biosphere reserves and larger reserves.



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. Over the past 50 years, humans have changed these ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This transformation of the planet has contributed to substantial net gains in human well-being and economic development. But not all regions and groups of people have benefited from this process in fact, many have been harmed. Moreover, the full costs associated with these gains are only now becoming apparent. So it is better that care for ecosystem should be taken as one of the major responsibility of every individual for sustainable living of future generations as well.

9/5/6/22

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TOPIC

Study of Environmental Science (AIR POLLUTION)

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CU Registration Number: 013-1211-0199-21

Department : Chemistry

Topic: Pollution (Air pollution)

Semester: 2

Paper Code: AECC-2

CONTENT

:INTRODUCTION :

:Air pollution :

According to Environmental Pollution Centres

"Air pollution can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose health risk. In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming)."

:Pollution in India:

Air pollution in India is serious issue with the major sources being fuelwood and biomass burning, fuel adulteration, vehicle emission and traffic congestion. In autumn and winter months, large scale crop residue burning in agriculture fields a low cost alternative to mechanical tilling is major source of smoke, smog and particulate pollution. India has a low per capita emissions of greenhouse gases but the country as whole is the third largest after China and the United States. A 2013 study on non-smokers has found that Indians have 30% lower lung function compared to Europeans. India was the third largest emitter of carbon dioxide in 2009 at 1.65 Gt per year, after China (6.9 Gt per year) and the United States (5.2 Gt per year). With 17 percent of world population, India contributed some 5 percent of human-sourced carbon dioxide emission; compared to China's 24 percent share. On per capita basis, India emitted about 1.4 tons of carbon dioxide per person, in comparison to the United States' 17 tons per person, and world average of 5.3 tons per person. The India Central Pollution Control Board found that of the four major Indian cities, air pollution was consistently worse in Kolkata, every year over 5-year period (2012 -2017). Delhi was close second, followed by Mumbai. Chennai air pollution was least of the four. West Bengal has been worsely affected by air pollution. Main causes of air pollution in West Bengal were due to fuel mass burning, traffic congestion, greenhouse gas emissions, etc.

:Pollution in Kolkata:

The city of Kolkata has been dubbed as one of the most unplanned and polluted cities in the world. A study in comparison of air quality data among four metropolitan areas in India indicates a higher pollution level in Kolkata in comparison to Mumbai and Chennai, and is close to Delhi. It has also been termed as the dusty city. Air pollution in

Kolkata becomes acute during winter, when pollution ranges higher than at other times. On the other hand, the worst-polluted traffic intersections double the city's average pollutants during busy hours. Studies have demonstrated that children inhaling polluted air in Kolkata suffer from adverse lung reactions and genetic abnormalities in exposed lung tissues. Approximately 47% of Kolkata's population suffers from lower respiratory tract symptoms with the lungs of city residents being approximately seven times more burdened compared to their rural counterparts due to air pollution. Other air pollution-related health problems, including haematological abnormalities, impaired liver function, genetic changes, and neurobehavioral problems, are found to be more prevalent amongst those categories of workers exposed to high levels of vehicular emission. They include roadside hawkers, traffic policemen, and taxi and auto drivers.

:Purpose of this study:

With this little background, the purpose of this project is to understand the current scenario of air pollution in Kolkata and status of the urban environment in terms of air quality, health outcomes of air pollution, and addressing some suitable measures with view to mitigate the menace of air pollution to pave the way for bringing sustainable urban development to Kolkata.

:Source of Air Pollution and Pollutants:

NO.OF SOURCES:- :

A) Non-anthropogenic source(natural source)
B) Anthropogenic source(man-made source)

Non-anthropogenic source:

VOLCANIC ERUPTION:

Volcanic eruptions emit series of toxic gases (including sulphur and chlorine) as well as particulate matter (ash particles) but are usually restricted to localized areas. Volcanic activity is huge source of air pollution which leads to acid rain and another phenomenon. Volcanic eruptions release large quantities of greenhouse gases and other aerosols into the atmosphere, these gases form massive clouds which accumulate in the atmosphere; this process is referred to as outgassing or off gassing In addition magma particulates, known as ash or pyroclastic flow.

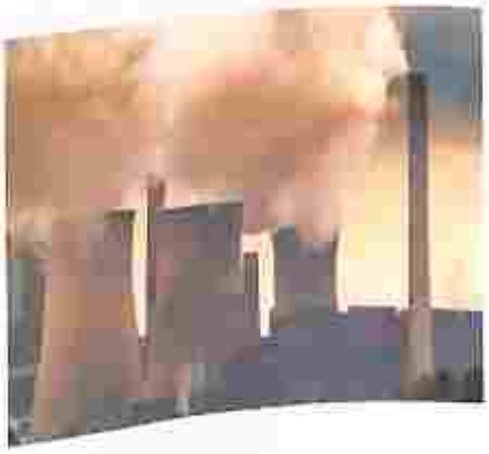
:DUST STORMS:

Dust particles, often referred to as particulate matter (PM), in the atmosphere arise from wide variety of sources. Particulate matter may be generated mechanically, for example by the wind, may be emitted directly to the atmosphere or may be formed by reactions in the atmosphere from precursor gases. Dust leads to the formation of sulphur di oxide, carbon di oxide and many other harmful gases through chemical, mechanical and combustion process.

:Anthropogenic Source:

:THERMAL POWER STATION:

Thermal Power Plants are major source of air pollution. Power plants are the largest emitters of SO_2. In the presence of other gases SO_2 forms Sulphuric acid and can precipitate down as acid rain leading to destruction of eco systems. Ash is the residue after the combustion. Ash contains toxic elements that can percolate into the atmosphere. The wind, breach of dykes or ash spills can carry away the ash particles to surrounding areas causing harm to humans and vegetation.



:AUTOMOBILES:

Passenger vehicles are a major pollution contributor, producing significant amounts of nitrogen oxides, carbon monoxide, and other pollution. Transportation emits series of air pollutants (gases including carbon monoxide, sulphur oxides, and nitrogen oxides and particulate matter) through the tailpipe gases due to internal combustion of various fuels (usually gasses such as oxides of carbons, of sulphur, of nitrogen, as well as organic chemicals as PAHs)

:AIR POLLUTANTS:

Primary Air Pollutant:

Soot(Unburned fuel):

Soot mass of impure carbon particles resulting from is incomplete combustion of hydrocarbons. It is more properly restricted to the product of the gas-phase combustion processlation. but is commonly extended to include the residual pyrolysed fuel particles such as coal. cenospheres. charred wood, and petroleum the coke that may become airborne during pyrolysis and that are more properly identified as cokes or char. Soot catises various types of cancer and disease.

SO2(Sulphur Dioxide):

SO2 is produced by volcanoes and various industrial processes. Coal and petroleum often contain sulphur compounds, and their combustion generates sulphur dioxide. Further oxidation of SO2, usually in the presence ofa catalyst such as NO2, forms H2SO4, and thus acid rain. This is one of the causes for concern over the environmental impact of the use of these fuels as power sources.

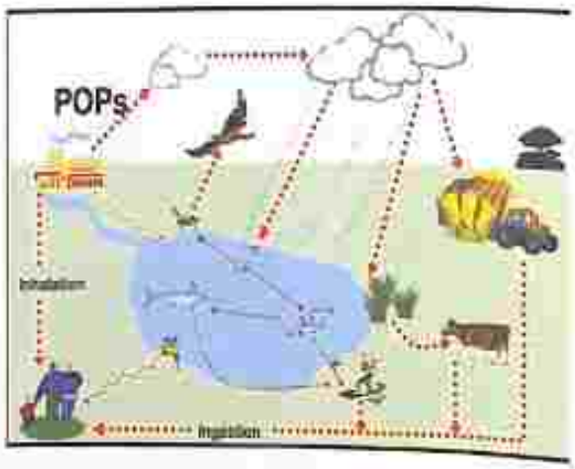
Secondary Air Pollutant:

Smog:

Particulates created from gaseous primary pollutants and compounds in photochemical smog. Smog is a kind of air pollution. Classic smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulphur dioxide. Modern smog does not usually come from coal but from vehicular and industrial emissions that are acted on in the atmosphere by ultraviolet light from the sun to form secondary pollutants that also combine with the primary emissions to form photochemical smog.

Persistent organic pollutants (POPs)

Persistent organic pollutants (POPs) are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes. Because of this, they have been observed to persist in the environment, to be capable of long-range transport, bio accumulate in human and animal tissue, bio magnify in food chains, and to have potentially significant impacts on human health and the environment.



:EFFECTS OF AIR POLLUTION ON ENVIRONMENT AND MAN:

Effects on Flora (vegetation):

Air pollution comes from many sources such as the smoke stack in a factory, car exhaust, or gassing from paint or producing plastic. The effects of air pollution on plants are widely seen and damage all plants including our food crops and trees. The chemicals responsible for the pollution include carbon, sulphur, and nitrogen oxides. Plants usually show damage in variety of ways, including visible signs of damage like necrotic lesions, stunted plant growth, or changing in colour including chlorosis (aka yellowing leaves), reddening, bronzing, mottling. Ozone holes in the atmosphere also harm plants. Holes in the upper atmosphere allow excess ultraviolet light to pass through the atmosphere

Effects on Fauna

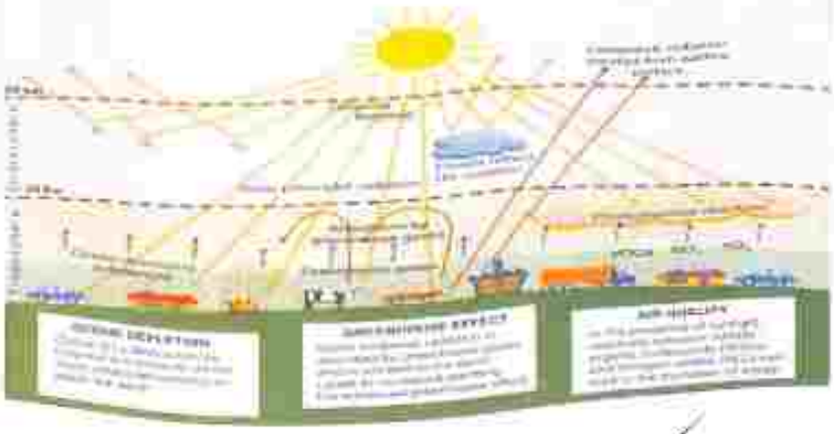
Acid Rain When water droplets in clouds combine with acidic air pollutants, the water turns acidic. Once the droplets hit the ground, acid rain causes damage to the environment. Not only does acid rain harm animals and fish, but it also kills trees. Once the acid rain soaks into the ground, the soil becomes unfit for habitat and living creatures.

Effects on man

NAUSEA:- Dizziness and nausea - Pollutants, such as carbon monoxide, can interfere with the delivery of oxygen throughout the body, which may cause fatigue, headaches, dizziness, nausea, confusion and disorientation when inhaled at high levels.
COUGHING:- Breathing polluted air can cause a dry or tickly cough. This can occur even in otherwise healthy people, who haven't previously been diagnosed with any sort of lung condition.
HEADACHE:- Air pollution can trigger headaches: Chemical exposure and specific environmental irritants are well known headache triggers.

EFFECTS ON ECOLOGY

CHLOROSIS:- Chlorosis is a condition in which leaves produce insufficient chlorophyll. As chlorophyll is responsible for the green colour of leaves, chlorotic leaves are pale, yellow, or yellow-white. The affected plant has little or no ability to manufacture carbohydrates through photosynthesis and may die Sulphur dioxide enters plants along with normal air components moving into the leaves and reacting with cells inside the leaf which ultimately leads to chlorosis. Ozone injury also leads to the same. NECROSIS:- Necrosis is form of cell injury which results in the premature death of cells in living tissue by autolysis. Necrosis is caused by factors external to the cell or tissues, such as infection, toxins, or trauma which result in the unregulated digestion of cell components. In general ,SO2 pollution results in abscission of older leaves and tip necrosis in flower and sepals. GREEN HOUSE EFFECTS:- Air pollution includes greenhouse gases. One of these is carbon di oxide, common part of the exhaust from cars and trucks. Green house gases cause global warming by trapping heat from the sun, in the earth atmosphere .Greenhouse gases are natural part of earth atmosphere, but in the last 150 years or so ,the amount in our atmosphere has increased. The increase comes from car exhaust and pollutants released from smokestacks at factories.

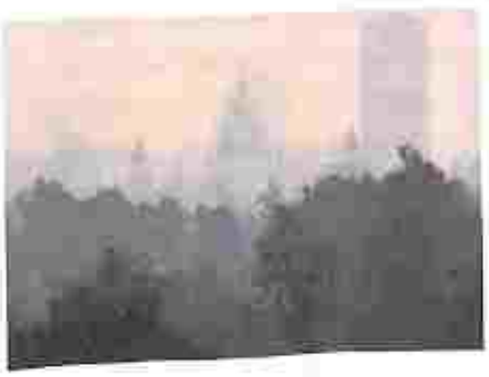


AIR QUALITY ASSESSMENT IN KOLKATA

PRESENT COMPOSITION OF AIR IN KOLKATA

According to the Censtis of India (2011), Kolkata had 4.5 million population, with the urban agglomeration. which comprises the city and its suburbs, home to approximately 14.1 million people, which makes it the third most densely populated metropolitan area in the country The first count is for Kolkata City (4.5 million), which is under the Kolkata Municipal Corporation (KMC), while the second count (14.1 million) is for the Kolkata Metropolitan Authority (KMA), which comprises the city (KMC) and its suburbs. The city of Kolkata has been dubbed as one of the most unplanned and polluted cities in the world. A study in comparison of air quality data among four metropolitan areas in India indicates a higher pollution level in Kolkata in comparison to Mumbai and Chennai, and is close to Delhi has also been termed as the dusty city Air pollution in Kolkata becomes acute during winter, when pollution ranges higher than at other times. On the other hand, the worst-polluted traffic intersections double the city's average pollutants during busy hours.

Approximately 47% of Kolkata's population suffers from lower respiratory tract symptoms with the lungs of city residents being approximately seven times more burdened compared to their rural counterparts due to air pollution Other air pollution- related health problems, including haematological abnormalities, impaired liver function, genetic changes, and neurobehavioral problems. are found to be more prevalent amongst those categories of workers exposed to high levels of vehicular emission. They include roadside hawkers, traffic policemen, and taxi and auto drivers.



PREVENTIVE MEASURES AND CONTROL OF AIR POLLUTION

CORRECTION AT SOURCE:-

To effectively tackle the problem of air pollution, it is essential to prevent or minimize the formation ofpollutants at the source. In case of industrial pollution, this can be achieved by analysing the process design amid selecting those methods that do not contribute to air pollution or have minimum impact due to air pollution.

This technique is known as source correction methods'. The application of these methods is difficult, however some of these methods can be applied without having a major impact on economy of operation. Below described are few methods for control of pollution at source. Raw material change When raw material causes air pollution, purer grade of raw material may reduce generation ofundesirable substances.

An example in this regard is the use oflow sulphur diesel in place ofregular diesel which contains a higher sulphur content leading to effluents with a high concentration of sulphur particulates. Another example would be usage ofnatural gas in place of coal to reduce the generation of particulates (both suspended and respirable). Operational change- By causing all dust creating activities that are generated in a process to effectively controlled and separated by effecting an operational change in the manufacturing industry. Moistening the dust thereby binding the dust is a time old method to prevent dust from spreading.

:TREATMENTS:

The biological treatment of air pollution depends on aerobic microorganisms- mostly mesophilic bacteria--that feed on both organic and inorganic compounds in the waste gas. The microbes convert the pollutants into carbon dioxide, water, and salts. The technology primarily has been implemented in Europe. Facilities there have been treating gas streams comprising hydrocarbons (as well as some chlorinated organics) at concentrations below 1000 mg/m3 and at gas temperatures of 10 to 43 °C, with low dust loads

1. Bio filter :- This is the simplest and least expensive biological treatment method. Its main component is a bed of compost, tree bark, peat, heather, or soil, about 1m deep, through which the contaminant gas is blown The material in the bio filter bed provides diverse culture of microorganisms that degrade the gaseous pollutants passing through.

2. Bio scrubber :- A bio scrubber couples traditional air pollution control and wastewater treatment technologies and consists of two units: scrubber and a biological treatment basin. The soluble waste gases and oxygen are continuously absorbed into water in the scrubber. Biological oxidation occurs in the basin unit, which often is the activated sludge basin of a wastewater treatment plant. Bio scrubbers are used where the biological degradation products (such as the acids produced during H2S and NH3 removal) would harm bio filter bed.

COLLECTION OF POLLUTANTS:-

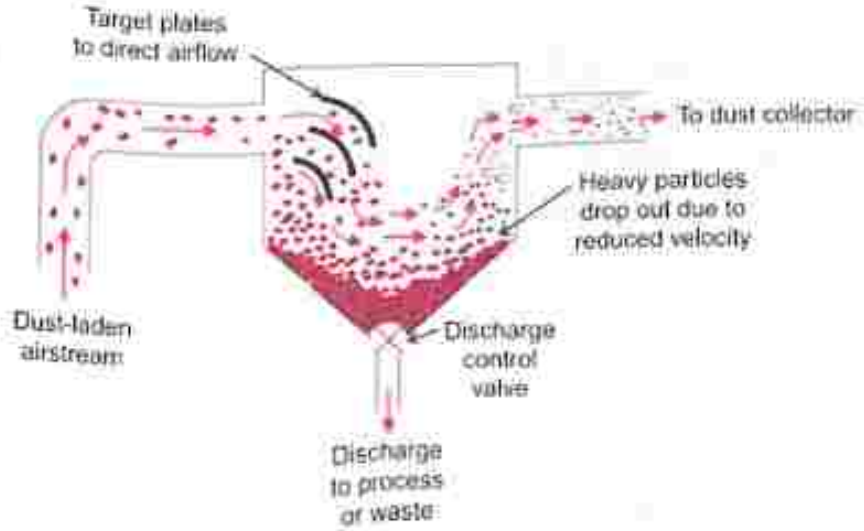
The various devices used to collect pollutants are :-

Gravitational Settling Chamber:-

For removal of particles exceeding 50 in size from polluted gas streams, gravitational settling chambers are put to use. This device consists of huge rectangular chambers. The gas stream polluted with particulates is allowed to enter from one end. The horizontal velocity of the gas stream is kept low (less than 0.3 m/s) in order to give sufficient time for the particles to settle by gravity.

Wet Collectors(Scrubbers):-

In wet collectors or scrubbers, the particulate contaminants are removed from the polluted gas stream by incorporating the particulates into liquid droplets. Electrostatic Precipitators:- The electrostatic precipitator works on the principle of electrostatic precipitation i. e. electrically charged particulates present in the polluted gas are separated from the gas stream under the influence of the electrical field.



GOVT RULES AND REGULATIONS:

Kolkata is making serious efforts to improve air quality. Some of the challenges that faces on the road towards successful policy-making are human migration. coal burning industries, diesel driven vehicles, legislation harmonization and harmonization of databases, standards, researches and methodologies.

The management is done on two levels, central (the Ministry of Environment, the WBPCB, the Ministry of Transport and Highways, etc.) and local (Department of Environment and local bodies and authorities).

In recent years number of legal interventions have taken place regarding vehicle emissions, fuel quality, introduction of cleaner fuels and reducing old vehicles which has greatly influenced the overall efforts to improve the air quality in Kolkata.

There were various awareness campaigns raised, among which was the one when the West Bengal Pollution Control Board (WBPCB) gave publicity to the Supreme Court's decision regarding the use of fireworks only between 6 a.m. and 10 p.m. through request made to mobile phone network companies to send messages to their users with specific text on raising awareness.

Also, in 2004 the WBPCB carried out a large number of inspections at firework manufacturing facilities during October and November (just before the festival season) and seized large number of prohibited ones. The same happened during the actual festival season. The WBPCB also established monitoring network for ambient quality measures of air pollutants such as SPM, SO2 (Chakraborty and Bhattacharya 2004)

CONCLUSION

- Air pollution is a major environmental issue. It can affect the health and life support systems as well. Since clear air is an essential factor of life for respiration, it is necessary to prevent the sources of air pollution.

- Due to air pollution dust reactive phenomena like acid rain, global warming etc. Using appropriate controlling devices and processes, the pollutants in their can be removed. There are five processes for the removal of particulate matters. Settling chambers, Cyclone, Electrostatic precipitators,

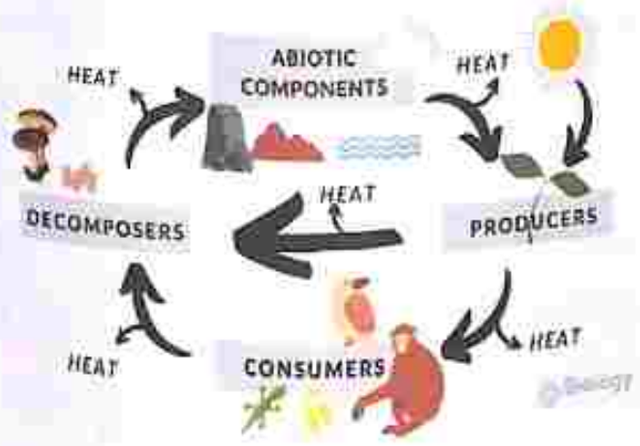
- Bag houses and filters and Scrubbers. For gaseous matters, Absorption, adsorption and combustion processes are used.

2.6

15/5/22

AECC-2

PROJECT ON ENVIRONMENTAL STUDIES



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Topic: Study of Ecosystem (Forest Ecosystem)

Submitted by : Hasina Parveen

Semester : 2

CU Registration No: 013-1211-0202-21

CU Roll No: 213013-11-0059

College Roll No: 21/BSCH/0186

GOKHALE MEMORIAL GIRLS' COLLEGE

ACKNOWLEDGEMENT :

Firstly, I would like to express my special thanks and gratitude to our Principal Ma'am Dr. Atashi Karpha as well as to my professor Mr. Rajkumar Barman Sir who gave me this opportunity to do this assignment on the topic "STUDY OF ECOSYSTEM" which also helped me in doing a lot of research and I come to know about so many new things.

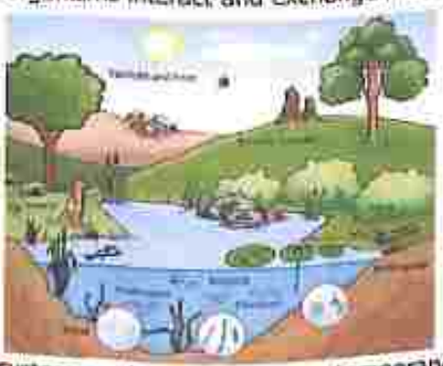
Secondly, I would also like to thank my parents and friends who helped me a lot in finalising the project within the span of time.

Content :

INTRODUCTION

WHAT IS ECOSYSTEM?

Ecosystem (Gk. oikos-household, systema- composite whole)is a self sustained and self regulated segment of nature where living organisms interact and exchange material among themselves and with



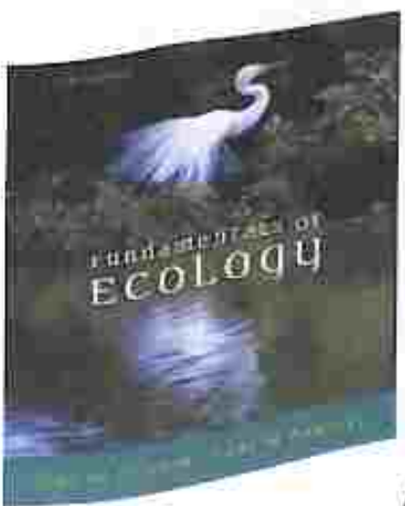
their physical environment .Ecosystem can be small or large ,temporary or permanent, natural or anthropogenic, terrestrial or aquatic, complete or incomplete. Many ecologists regard the entire biosphere as a global ecosystem, as a composite of all local ecosystems on Earth .

WHO COINED THE TERM "ECOSYSTEM "?

Arthur George Tansley coined the term ecosystem' in 1935 to describe the interactions between organisms and with their environment.

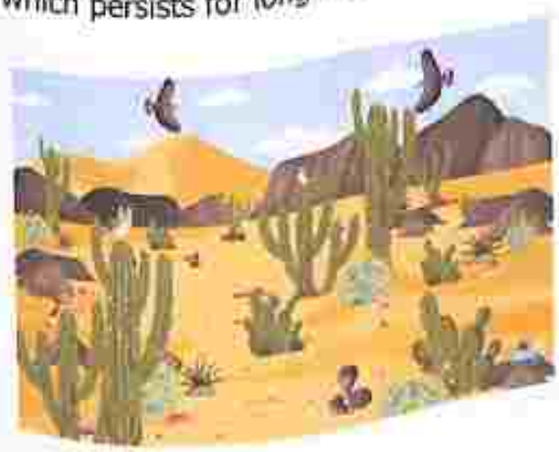
Odum was an American biologist who worked on ecosystem ecology and wrote the book 'Fundamentals of ecology'.

Eugenius warming was the first to write a textbook on plant ecology. He gave the concept and content on ecology.



TYPES OF ECOSYSTEM:

1. **Natural and Artificial : Natural** ecosystem is one which develops under natural conditions without any human support ,e.g.,**forest,desert, grassland,lake, sea.** **Artificial** or man-made or anthropogenic ecosystem is one which has been created and is being maintained by human beings, e.g., **garden, village, city,poultry,apiary,dams,spacecraft ,aquarium** ,etc.**Agro- ecosystem** is the largest anthropogenic ecosystem.
2. **Terrestrial and Aquatic :Terrestrial** ecosystems occur over land.They are of three major types- **desert, grasslands** and **forests. Aquatic** ecosystems occur in water bodies. They are of two types ,**fresh water**(ponds,lakes,streams)and **salt water**(estuaries, marine).
3. **Large and Small :** The whole biosphere functions as a global ecosystem. It has innumerable small and large ecosystems.A very **large** ecosystem is known as **megaecosystem**,,e.g. **sea**.A large ecosystem like **forest** is called **macroecosystem**. An ecosystem restricted to a **small** area like valley and a pond is called micro ecosystem .The term **nanoecosystem** is used where the area is very small , like a **wooden log,aquarium.**
4. **Permanent and Temporary :** A **temporary** ecosystem is the one which persists for a short period, e.g.,**rain water pond** or **ditch**.A **permanent** ecosystem is the one which persists for long duration , e.g.,**forest, lake.**



DESERT ECOSYSTEM

(Natural, Terrestrial)

5. **Complete and Incomplete :** An ecosystem which has all the components is known as **complete** ecosystem, e.g, **forest**. Ecosystem which is deficient in one or more components is known as **incomplete** ecosystem,e.g.,**rain water pond** (without consumers).

POND ECOSYSTEM

(Natural, Aquatic, Small)

FOREST ECOSYSTEM

(Natural, Terrestrial, Large, Permanent, Complete)

IMPORTANCE OF ECOSYSTEM:

Energy : Study of ecosystems provides information about amount of energy flowing into them ,it's harvesting and availability at various levels.

Food Chains and Food Webs : Each ecosystem has a number of food chains and food webs. Their knowledge is helpful to restore a degraded ecosystem and prevent unscientific exploitation of different ecosystems.

Inter-relationships : Study of ecosystems gives information about inter-relationships amongst various types of organisms as well as between organisms and their abiotic environment.

Protection : Each ecosystem whether natural or man-made requires protection from pollutants and pests.

One of the terrestrial ecosystem is **FOREST ECOSYSTEM** which

Contain greater range of biodiversity .

WHAT IS FOREST ECOSYSTEM ?

A **forest ecosystem** is a unique ecology, including a very nice community of flora and fauna. When we heard "forest," the primary thing that comes to our mind is trees. An area covered with trees making various canopy layers is commonly known as a forest ecosystem. This ecosystem consists of various plants, animals, and other micro-organisms, making it a natural habitat for them.

Also, it is much more stable and resistant to the detrimental changes as compared to the small ecosystems such as wetlands and grasslands.

STRUCTURAL FEATURES OF FOREST ECOSYSTEM :

The two main structural features of a forest ecosystem are:

- **Species composition:** It refers to the identification and enumeration of the plant and animal species of a forest ecosystem.
- **Stratification:** It refers to the vertical distribution of different species which occupy different levels in the forest ecosystem. Every organism occupies a place in an ecosystem on the basis of source of nutrition. For example, in a forest ecosystem, trees occupy the top level, shrubs occupy the second and the herbs and grasses occupy the bottom level.

COMPONENTS OF FOREST ECOSYSTEMS :

The components of a forest ecosystem, responsible for most of ecosystem function, are as follows:

1. Productivity

The basic condition for any ecosystem to operate and sustain itself is the continuous supply of solar energy. Plants are too the producers in a forest ecosystem.

There are two sorts of productivity in a forest ecosystem: primary and secondary. Primary productivity refers to the amount of solar energy captured or biomass production per unit area over some time by the plants through photosynthesis.

A further classification is made into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). GPP of an ecosystem is the rate of capture of solar energy or the complete production of biomass. And NPP is the amount of leftover biomass after being used by plants or producers.

1. Decomposition

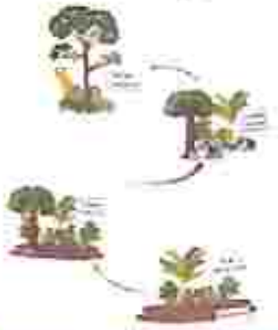
Decomposition is an exceptionally oxygen-requiring practice. In the course of decomposition, decomposers transform the complex organic compounds of debris into inorganic substances like, nutrients, water and carbon dioxide.

The debris or 'detritus' is the leftover residues of the dead plant such as flowers, bark, leaves and moreover, the remains of the animals, plus their fecal matter. The stages of decomposition are fragmentation, leaching, catabolism, humification and mineralization.

2. Energy flows

Energy flows in a single direction. Firstly, plants capture solar energy ,so they are called 'producers'. This energy is then passed on to the animals through the plants they eat, these animals are called 'primary consumers'. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain.

Energy Pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process, some energy is always lost as heat at each step.

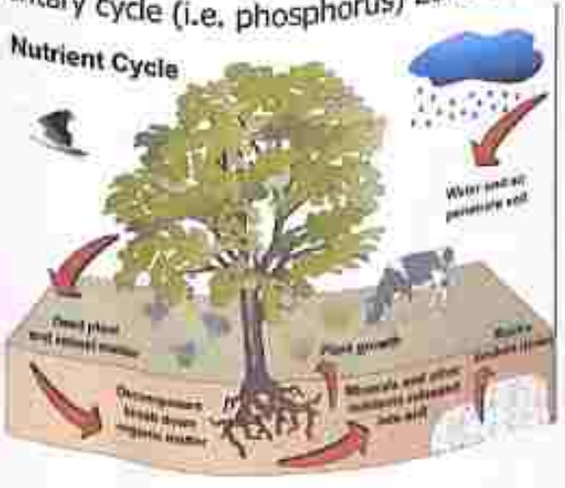


Energy flow of forest ecosystem

3. Nutrient Cycling

Nutrient cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of Nutrient cycling, gaseous and sedimentary.

For Gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reservoir whereas for the sedimentary cycle (i.e. phosphorus) Earth's crust is the reservoir.



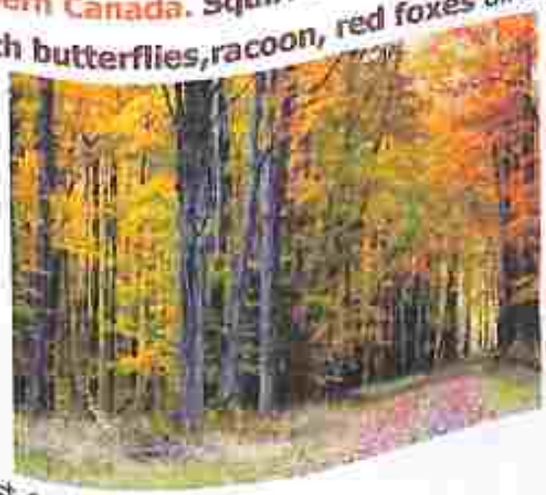
TYPES OF FOREST ECOSYSTEM:

- Temperate Forest Ecosystem
- Tropical Rainforest Ecosystem
- Boreal or Taiga Forest Ecosystem

Temperate Forest Ecosystem

The Temperate forest ecosystem is the most common of the world's forests. Temperate forests are in areas where the climate alters a lot from summer to winter. Temperate forests are virtually always consistent of two kinds of trees: **deciduous** and **evergreen**. Both are however considered "woody plants". Deciduous forest trees shed their leaves in the winter. Evergreens are trees that keep their leaves all year, such as **pine** trees.

- **Species of Temperate forest:** Trees that drop their leaves in autumn are called deciduous trees. Oaks, elms, ash, and beeches are a few of the deciduous trees that can grow in temperate forests. **The trees which** stay green all year long, are called evergreens. **Pines, firs,** and **spruce trees** are evergreen —and they are **Christmas trees!** Temperate forests are found in **eastern North America, northeastern Asia, and central and western Europe as well as parts of Southern Canada. Squirrels, chipmunks ,bobcats,grizly bears, monarch butterflies,racoon, red foxes** all are the species of



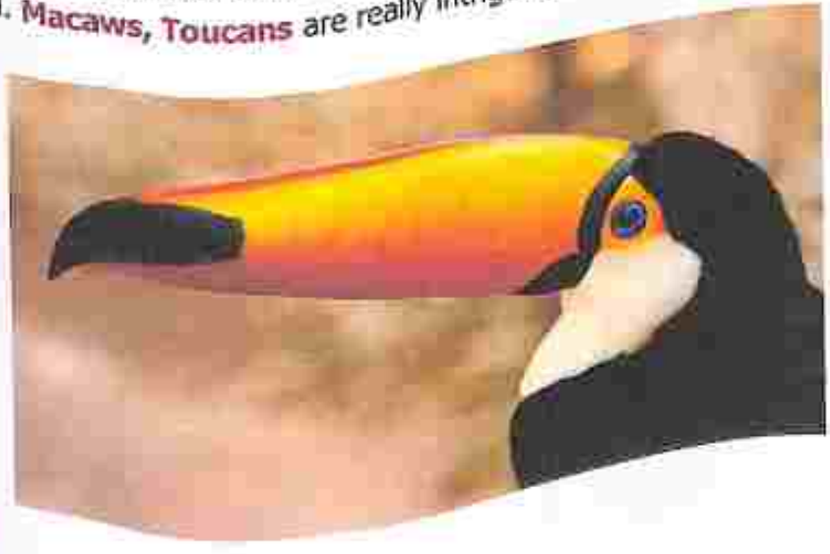
temperate forest ecosystem.

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 some parts where sunlight makes it to the surface, they are filled with fascinating plants. These plants are considered the "understory" or the shrub layer of a forest. Rainforests get its name for the fact that they get a lot of rain – an average of 80 inches annually.

- **Species of Tropical Rainforest:** The most dreaded and famous **spider** in the world lives in the jungle. **Tarantulas** are one of the spookiest creatures you will ever come across. Stunning butterflies fill the forest. On the other hand Rainforest birds are some of the most stunning in the world. **Macaws, Toucans** are really intriguing birds .



Birds aren't the only animals that soar through the rainforests. Many species of **winged mammals** live in the jungle. From the innocent fruit bat to the exceptional **flying squirrel**, the tropical rainforests are packed with amazement. **Anacondas , chameleons** are the cold blooded reptiles lived in the Tropical Rainforest.

The well-known **Amazon** jungle is found in **Brazil, South America.** This specific tropical forest is termed as "Neotropics". Further large blocks of such forests are found in **Central and West Africa.**

Taiga Forest Ecosystem

Boreal forest ecosystem is the collective green stretch of deciduous and coniferous forest that surround a big share of the Northern Hemisphere. 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 land mass and is the single biggest land based ecosystem in North America.

- **Species of Taiga Forest :** The Boreal has more than 5,000 species of visible including **foxes, lynxes, bears, minks, squirrels, while larger ones include grey wolves and their preys: caribou, reindeers and moose.** In winter, wolves hunt these herbivores in packs, often dividing themselves into two groups to encircle their preys before attacking them. **Spruce, fir, pine** and **tamarack** are the main species found in the Canadian boreal forest.

In **North America,** boreal forest lands expands across majority of **northern Canada** and into **Alaska.**

IMPORTANCE OF FOREST ECOSYSTEM :

The world's forests hold importance for all of their inhabitants as well as for the overall health of the planet. The benefits of forests to society and to the diversity of life make it vital that they be protected from deforestation and other potential negative impacts of civilization.

Climate: Forests are major contributors to the Earth's ability to maintain its climate, by the global impact of their photosynthesis. They are a natural defense against climate change, removing the greenhouse gas carbon dioxide and generating oxygen. This assists in purifying the atmosphere and controlling rising temperatures. Deforestation negates these benefits.

Biodiversity: Forests contain a greater range of **biodiversity** than any other ecosystems on earth. Only a fraction of the species found in forests have been examined and studied. A single massive tree in the Amazon rainforest can be home for thousands of species. The wide variety of trees and plants found in tropical forests comprises particularly intensive biodiversity. This biodiversity is be important on its own terms in ways we may not currently understand, as interdependent species have evolved over millions of years to interact and flourish.

Commercial Importance: Humankind derives many benefits from forest ecosystems. Many medicines and pharmaceuticals have been discovered in plants native to forests. Local communities survive on plants and animals culled from the forests. Products that modern society depends on such as wood, paper and bamboo all originate from forest ecosystems. Many other desirable products such as spices, gums and dyes are also found in forests around the globe.

THREATS OF FOREST ECOSYSTEMS:

Deforestation

Deforestation can result in serious negative impacts for forest biodiversity. While it would take 1000 years for some tropical forests to recreate their biodiversity, others have been irreversibly damaged, as species become extinct after the destruction of their habitat

Natural disasters and disturbances

Natural disturbances are interacting with climate change to further increase forest degradation. Climate change is enabling invasive plant and insect species to gain advantage over native species. Until now, winter freezes have limited most forest pests, but rising temperatures will increase their negative impacts on forests.

Fire is a natural part of forest ecosystems and several species of trees have found ways to protect their seeds from it. However, with increasing temperatures favouring more intense wildfires, many forests will not be able to recover. Besides fire, flooding and hurricane-force winds have intensified and have been responsible for forest degradation.

Construction of multipurpose buildings:

Forests are being cleared by the 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 .

CONCLUSION

In conclusion, forest ecosystems are vital for the health of our planet and the health of the millions organisms collaboratively living in them.

A slight tip in the balance (like deforestation or climate change) can offset detrimental effects that impact these ecosystems devastatingly. This is why care for our forests and trees is crucial.

It is only possible with more than adequate forest management by ecologists and conservationists alike. Forestry departments (usually government and NGO funded) are

responsible for care and upkeep of existing forests and protection from threats like deforestation.

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15/6/22

ENVIRONMENTAL SCIENCE (ENVS)

SUBJECT: ENVS PROJECT

TOPIC: STUDY OF COMMON PLANTS AND BASIC PRINCIPLES OF IDENTIFICATION

NAME: SREYA BHOWMICK

DEPARTMENT: COMMUNICATIVE ENGLISH MAJOR

SEMESTER: 2

PAPER: AECC2

COLLEGE ROLL NO.: 21/BAV/0030

CU ROLL NO.: 212013-13-0001

CU REGISTRATION NO.: 013-1211-0220-21

DATE: 25.05.2022

STUDY OF COMMON PLANTS AND BASIC PRINCIPLES OF IDENTIFICATION

Plants are predominantly photosynthetic eukaryotes of the kingdom '*Plantae*'. Historically, the plant kingdom encompassed all living things that were not animals, and included algae and fungi; however, all current definitions of Plantae exclude the fungi and some algae, as well as the prokaryotes (the archaea and bacteria). By one definition, plants form the clade Viridiplantae (Latin name for "green plants") which is sister of the Glaucophyta, and consists of the green algae. The latter includes the Embryophyta (land plants) which include the flowering plants, conifers and other gymnosperms, ferns and their allies, hornworts, liverworts, and mosses.

Most plants are multicellular organisms. Green plants obtain most of their energy from sunlight via photosynthesis by primary chloroplasts that are derived from endosymbiosis with cyanobacteria. Their chloroplasts contain chlorophylls a and b,which gives them their green color. Some plants are parasitic or mycotrophic and have lost the ability to produce normal amounts of chlorophyll or to photosynthesize, but still have flowers, fruits, and seeds. Plants are characterized by sexual reproduction and alternation of generations, although asexual reproduction is also common.

There are about 320,000 species of plants, of which the great majority, some 260–290 thousand, produce seeds. Green plants provide a substantial proportion of the world's molecular oxygen, and are the basis of most of Earth's ecosystems. Plants that produce grain, fruit, and vegetables also form basic human foods and have been domesticated for millennia. Plants have many cultural and other uses, as ornaments, building materials, writing material and, in great variety, they have been the source of medicines and psychoactive drugs. The scientific study of plants is known as botany, a branch of biology.

C) Trees- Trees are big and tall plants. They have very thick, woody and hard stems that are called the trunk. This single main stem or the trunk give rise to many branches that bear leaves, flowers and fruits all by itself. The lifespan of the trees are very large i.e., for several years. For example- Banyan Tree.

In addition to these three main categories, there are two more types of plants which needs support to grow. They are specifically called creepers and climbers.

I) Creepers- Creepers are plants with weak stem that grow along the ground, around another plant, or up a wall by means of extending stems or branches. They have very fragile stems that can neither stand erect nor support all of its weight. For example- Watermelom Plant.

II) Climbers- Climbers are much more advanced than creepers. Creepers have a very thin, long and weak stem which cannot stand upright, but they can use external support to grow vertically and support their weight. For example- Grapevine.

Some individual examples of different types of plants:~

1. Herb: *Bacopa monnieri*

It is a perennial, creeping herb native to the wetlands of Southern & Eastern India, Australia, Europe, Africa, Asia and North & South America. It is known by the common names water hyssop, brahmi, thyme-leaved gratiola, herb of grace and Indian pennywort. *Bacopa* sp. is used in ayurveda.

Family: Plantaginaceae

Order: Lamiales

Characteristics:-

- Leaves are succulent and relatively thick. Leaves are only ⅛ inch wide and ¾ inch long.
- Leaves are oblanceolate, arranged oppositely on the stem and 1-veined.
- Flowers are small and white with 5-6 petals.

Importance:-

- It promotes liver health.
- Contains powerful antioxidants.
- May reduce inflammation.

2. Shrub: *Adhatoda vasica*

*Adhatodavasica*is a well-known plant in Ayurvedic and Unani medicine. It has been used for the treatment of various diseases and disorders, particularly for the respiratory ailments.

Family: Acanthaceae

Order: Lamiales

Genus: Justicia

Characteristics:-

- It has broad, lanceolate leaves measuring 10-16 cms in length and 5 cm in wide.
- They become greenish brown when dried and have a bitter taste.
- They have a small similar to strong tea.

Importance:-

- It helps to cure bronchitis, tuberculosis and other lung and bronchiole disorders.
- It has been used to speed delivery during birthchild.
- The leaves can be used over wounds and inflammatory swellings.

3. Tree: *Melia azedarach*

Meliaazedarach is commonly known as the chinaberry tree, pride of India, bead tree, Cape lilac, syringa berrytree, Persian lilac, Indian lilac or white cedar is a species of deciduous tree in the mahony family, Meliaceae, that is native to Indomalaya and Australia.

Family: Meliaceae

Order: Sapindales

Genus: Melia

Characteristics:-

- It is a small or medium sized tree in the mahogany family.
- Braches are stout with buff coloured lentiols.
- Leaves are twice or thrice times compound, alternate or puberulant to glabrous.

Importance:-

- It is antioxidative analgesic.
- It is anti-inflammatory.
- It has antihypertensive properties

Climber: *Paederia foetida*

Paederiafoetida is a species of plant, with common names that are variations of skunkvine, stinkvine or Chinese fever vine. It is native to temperate and tropical Asia; and has become naturalized in the Mascarenes, Melanesia, Polinesia and Hawaiian Islands, also found in North America. Paederia sp. is known for the strong, sulphurous odour exuded when it's leaves or stems are crushed or bruised. This is because the oil responsible for the smell, and found primarily within the leaves, contain sulphur compounds including large dimethyle disulphide.

Family: Rusiaceae

Order: Gentianales

Genus: Paederia

Characteristics:-

- It is 7m long and has young parta are without hair to densely covered with hair.
- The leaves smell unpleasant when crushed.
- The opposite, stalked leaves have blades that are usually egg or lance shapedshaped with a pointed tip.

Importance:-

- Used to treat aches, jaundice.
- Used in the treatment of inflammation, piles and diarrhea.
- Used to treat dysentery.

Conclusion:

Plants are very important because they are the backbone of all life on Earth and an essential resource for human beings. They provide food, air, habitat, medicine and help to distribute and purify water.

Each plant is characterized by one of the three life histories: haploid (1n), diploid (2n), or the most common haploid-diploid. Within each of these three types, there are also variations. Of the plants with haploid life cycles, most algae lack a dikaryotic phase, while most fungi have a dikaryotic phase. There are also other algae and fungi that are characterized by diploid life cycles. Lastly, plants with a haploid-diploid life history undergo an alternation of generations, either similar or dissimilar. In all of these life cycles, asexual reproduction may occur, but it is sexual reproduction that is responsible for genetic diversity. Due to variations arising separately and at different rates, the evolution of land plants did not follow a linear sequence. Before land plants, alga with mostly haploid life cycles existed, but land plants later originated from a haploid-diploid ancestor.

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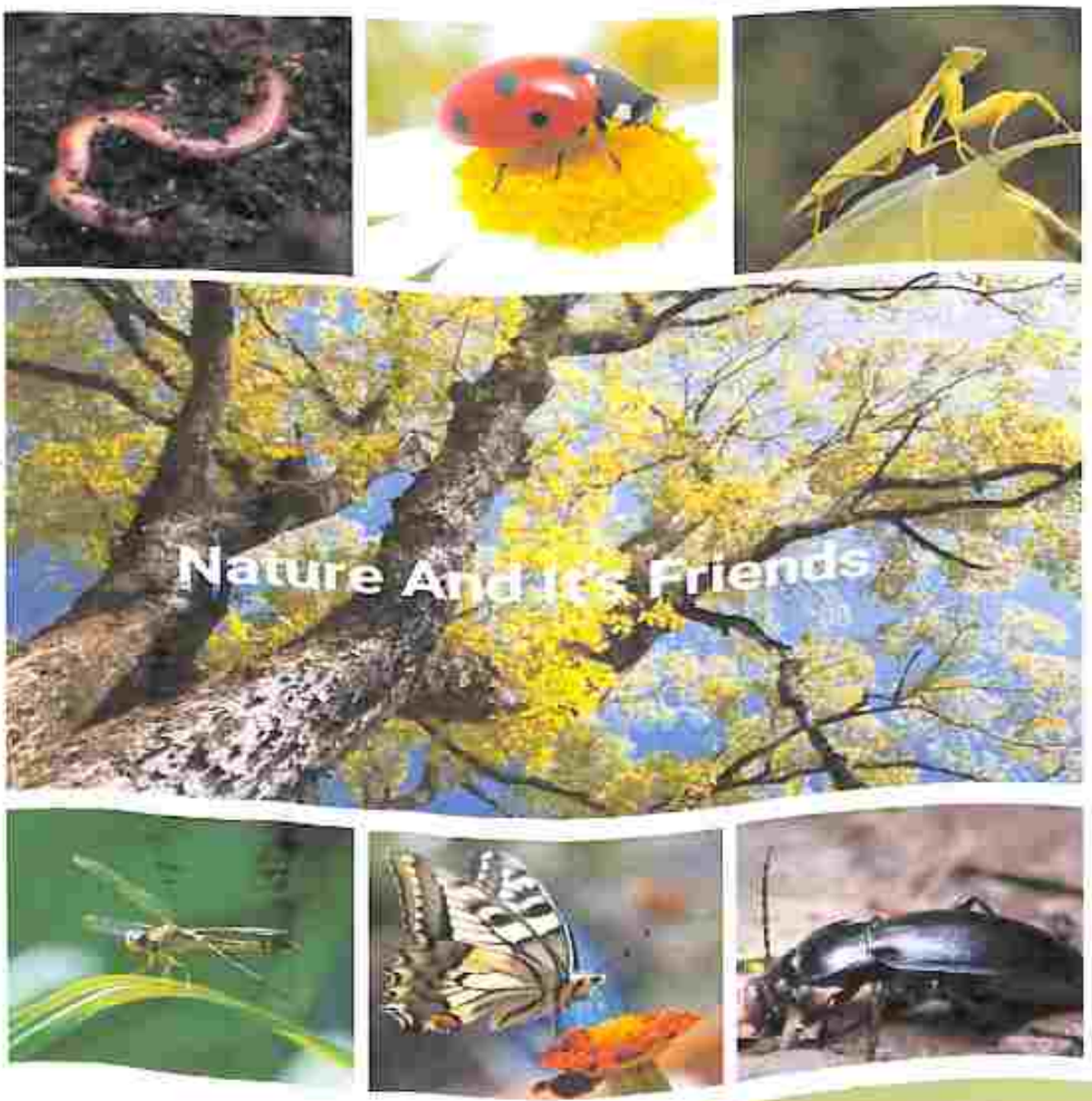
2022

Environmental Science Project



Adrikarnee Khanra

5/28/2022

SUBJECT :- ENVS PROJECT

TOPIC : STUDY OF BENEFICIAL INSECTS AND THEIR CONTRIBUTION IN NATURE

COLLEGE NAME : GOKHALE MEMORIAL GIRLS' COLLEGE

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PAPER: AECC2

COLLEGE ROLL NO. : 21/BAV/0033

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CU REGISTRATION NO. : 013-1211-0221-21

DATE : 28.05.2022

15/6/22

Professor's Signature

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In successfully completing this project, many people have helped me. I would like to thank all those who are related to this project.

Primarily, I would like to express my sincere thanks and gratitude to my Environmental Science Professor for letting me work on this tutorial. I am very grateful to him and for his support and guidance in completing this tutorial.

Finally, I would like to thank my parents who have helped me with their valuable suggestions and guidance and have been very helpful in various stages of project completion .Without them I would not have been able to complete this tutorial.

Adrikarnee Khawa

Signature

CONTEXT

Page No.

STUDY OF BENEFICIAL INSECTS AND THEIR CONTRIBUTION IN NATURE

Introduction

Insects are generally considered the most successful group of living organisms on Earth. Success may be attributed to mobility, high reproduction rates, short life cycles, the ability to change body form during their life (metamorphosis), and their adaptive nature. We can find lots of insects who contribute themselves in Nature. These special insects are called BENEFICIAL INSECTS.

Beneficial Insects :

Beneficial Insects (sometimes called *Beneficial Bugs*) are the number of species of insects that perform values services like pollinating plants, producing useful substances, controlling pest insects, acting as scavengers, and serving as food for other animals. These insects seem like a nuisance to us, they play a vital role in balancing the equilibrium of the eco-system. The concept of *beneficial* is subjective and only arises in light of desired outcomes from human perspective. In agriculture, where the goal is to raise selected crops, insects that hinder the production process are classified as pests, while insects that assist production are considered beneficial. In horticulture and gardening, beneficial insects are often considered those that contribute to pest control and native habitat integration.

In this project we will see how can some specific insects contribute themselves in nature.

Explanations are given below :

1. Helpful Honey Bees

A honey bee is a eusocial flying insect within the genus Apis of the bee clad. They are essential in everybody's life.

- Honeybees are important because they are responsible for a great deal of pollination. That pollination is what allows our food crops to propagate. This not only allows us to continue to eat fruit and vegetables, but it also provides the feed necessary for the animals that we consume as well. After all, one-third of the food we eat depends upon pollination, including almonds, apples, berries, cucumbers and melons.

- An example of how bee pollination helped increase yield and productivity is Bharatbhai from Valsad, Gujarat, who increased his crop yield by up to 80 percent, earning him an additional income of Rs 7,700 in just one year.

- Besides this they make honey, which is used as food, medicine, and even in beauty products around the world.

2. Proud Praying Mantises

Mantises are an order of insects that contains over 2,400 species in about 460 genera in 33 families.

- The Praying Mantis is often referred to as an efficient exterminator

- A young praying mantis eats soft-bodied creatures such as aphids, mosquitoes and caterpillars.

- When mature, it can eat beetles, grasshoppers, crickets and just about any garden pest.

- The praying mantis even feeds on moths at night.

3.Lovely Little Ladybugs

Belonging to the Coccinellidae family, Ladybirds are polka-dotted little beauties that are either round or oval in a size-range of 1 to 10mm. They are also known as ladybirds or lady beetles.

- Aphids are small sap-sucking insects that are destructive pests. Ladybugs can consume up to 50 to 60 aphids per day. a ladybug can eat up to 5,000 aphids in its lifetime.

- In addition to this, ladybugs also feed on soft-bodied, plant-eating insects like mites, scales, thrips, and whiteflies.

- Encouraging ladybugs in someone's garden can mean less use of insecticides.

4. Daring Dragonflies

A dragonfly is a flying insect belonging to the order Odonata, infraorder Anisoptera. many insect haters still appreciate their beauty.

- They are also easy to love because they prey on pesky flying insects including mosquitoes, flies, moths, whiteflies and fruit flies.

- a single dragonfly can eat 30 mosquitoes in a single day.

- They also eat the larvae of these creatures, stopping them before they can cause damage to nature.

5. Beautifully Butterflies

Butterflies are insects in the macrolepidopteran clade Rhopalocera from the order Lepidoptera, which also includes moths.

- They pollinate plants in garden. Butterflies are great for a garden as they are attracted to bright flowers and need to feed on nectar.When they do this their bodies collect pollen and carry it to other plants. This helps fruits, vegetables and flowers to produce new seeds.The majority of plants need pollinators like bees and butterflies to reproduce.

- They are an indicator of a healthy environment. They are all really good for the environment and play a role in increasong biodiversity - the variety of plants, animals and micro-organisms and their ecosystems.
- Naturalist and veteran broadcaster Sir David Attenborough says spending time in nature – even just watching butterflies in a home garden – is good for our mental health.

6. Great Ground Beetles

Beetles are insects that form the order Coleoptera, in the superorder Endopterygota. These nocturnal creatures are typically found under debris.

• Ground beetles prey on slugs, caterpillars, and ants.
• They are known to consume their body weight in food each day.

• These beetles also consume fallen weed seeds that can reduce weed population in some cases.

• In addition to keeping insect pests under control, ground beetles and their larvae also help facilitate natural composting. Beetles are also scavengers, feeding on dead animals and fallen leaves, thereby recycling the nutrients back to the soil.

FEW MORE BENEFICIAL INSECTS:

BRACONID WASP

- Prey: Aphids, Caterpillars/Hornworms
- Attracted By: Common yarrow, Fern-Leaf Yarrow, Lemon Balm, Parseley

DAMSEL BUG

- Prey: Aphids, Cabbage Worms, Caterpillars, Mites
- Attracted By: Caraway, Fennel, Goldenrod, Spearmint

MINUTE PIRATE BUG

- Prey: Aphids, Spider Mites, Caterpillars, Thrips
- Atrracted By: Alfalfa, Caraway, Fennel, Goldenrod, Spearmint

TACHINID FLY

- Prey: Gypsy Moths, Japanese Beetles, Cutworms, Squash Bugs
- Attracted By: Buckwheat, Carrot, Cilantro, Dill

SOLDIER BEETLE

- Prey: Aphids, Grasshopper Eggs, Soft-Bodied Insects
- Attracted By : Goldenrod, Linden, Marigold, Zinnia

Conservation :

Conserving beneficial insects is everyone's business, from landscapers, to consumers, to state and federal land managers. Biodiversity and conservation practices are key to a healthy environment and reducing beneficial insect and pollinator decline. Natural predators are a long-lasting, natural, non-toxic solution that will further the ecological diversity of your green space. Natural predators can be divided into two groups – predators and parasitoids. Many are attracted to flowering plants for pollen and nectar and contribute to pollination services.

Beneficial Insect Conservation Resources :

- 2017 ***Save the Bees Plant Flowers and Trees poster***, Dr. Vera Krischik, Entomology Extension Specialist, University of Minnesota
- 2020 ***Guide to Integrated Pest Management (IPM)***, Dr. Vera Krischik Entomology Extension Specialist, University of Minnesota and Laurie Schneider.

Conclusion :

Without insects, our lives would be vastly different. Insects pollinate many of our fruits, flowers, and vegetables. We would not have much of the produce that we enjoy and rely on without the pollinating services of insects, not to mention honey, beeswax, silk, and other useful products that insects provide. Insects feed on a seemingly endless array of foods. Many insects are omnivorous, meaning that they can eat a variety of foods including plants, fungi, dead animals, decaying organic matter, and nearly anything they encounter in their environment. So we should take care of the Beneficial Insects. They help to keep balance in our environmen. They are one of the most essential living creatures in our nature.

Bibliography:

Help from internet, following websites links and books have been used in the completion of this Tutorial:

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- ✓ www.organiclesson.com
- ✓ https://en.wikipedia.org/wiki/Beneficial_insect
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- Books:

- ✓ Beneficial Insects: Predators, Parasitoids and Pollinators (Article)
- ✓ Beneficial Insects (Book by D. V Alford)

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15/6/22

ENVIRONMENTAL SCIENCE RESEARCH PAPER

NAME: AARSHI GHOSH

REGISTRATION NUMBER: 013-1211-0222-21

UNIVERSITY ROLL NO: 212013-13-0003

DEPARTMENT: COMMUNICATIVE ENGLISH

SEMESTER: 2ND

SUBJECT: ENVIRONMENTAL STUDIES (AECC)

TOPIC: STUDY OF COMMON PLANTS, INSECTS AND BIRDS.

ACKNOWLEDGEMENT

I am thankful to our respected professor, Sir RKB for advising and computing with his guidance and supervision, I've been able to complete this research paper. It helped me get in-depth knowledge about the different kinds of birds, insects, and plants present around us, and their major roles in our ecosystem, and also how we can preserve them. My regards to our principal ma'am for giving us this opportunity.

OBJECTIVES

>to know about a few birds, insects, and plants present in Kolkata.

>to know their distributions and other important characteristics

>to know about the preventions

>to know about their basic principles of distinction.

INDEX

INTRODUCTION

▪ PLANTS

The modern definition of plants includes organisms that live primarily on land, and sometimes in water (excluding algae that live mainly in water).

Plants play a vital role in the maintenance of life on Earth. All energy used by living organisms depends on the complex process of photosynthesis. (a chemical process used by green plants containing chlorophyll, along with water, CO2, and sunlight) hence are also known as autotrophs. Plants are critical to other life on this planet because they form the basis of all food webs. Plants, or the plant-like ancestors of plants, have lived on this planet longer than most other groups of organisms. Any multicellular eukaryotic life form is characterized by:

- photosynthetic nutrition in which chemical energy is produced from water, minerals, and carbon dioxide with the help of chlorophyll, a pigment that absorbs energy from the sun.
- cells that contain cellulose in their walls and are therefore to some extent show rigidness.
- the absence of organs for locomotion, resulting in a more or less stationary existence. Sometimes, we see vague movements due to external stimuli.
- the absence of nervous systems, and
- an alteration of haploid and diploid generations, with the dominance of one over the other being significant, taxonomically.

▪ BIRDS

Any of the warm-blooded, beaked vertebrates of the class Aves, including more than 9,600 living species. A covering of feathers distinguishes birds from all other animals. Birds have a four-chambered heart (like mammals), forelimbs modified into wings, and keen vision, and their eggs have calcium-rich eggshells. Their sense of smell is not highly developed. Birds are found almost worldwide in diverse habitats on both land and water. Dietary preferences and nest structure vary widely. Almost all species incubate their eggs. Flying birds have evolved skeletons in which part of the bone is replaced by air spaces, an adaptation for reducing weight. The crop, an enlarged part of the esophagus used for temporary food storage, enables birds to feed while in flight. Humans use wild and domesticated birds and their eggs for food, hunt wild birds for sport and use feathers for decoration and insulation.

- **INSECTS**

Insects (class Insecta or Hexapods), is any member of the largest class of the phylum Arthropoda, which is itself the largest of the animal phyla. Insects have segmented bodies, jointed legs, and external skeletons (exoskeletons). Insects are distinguished from other arthropods by their body, which is divided into three major regions:

- the head, which bears the mouthparts, eyes, and a pair of antennae
- the three-segmented thorax, which usually has three pairs of legs (hence "hexapod") in adults and usually one or two pairs of wings, and
- The many-segmented abdomen contains the digestive, excretory, and reproductive organs.

In numbers of species and individuals and in adaptability and wide distribution, insects are perhaps the most eminently successful group of all animals., Any member of the class Insecta, the largest arthropod class, includes nearly 1 million known species (about three-fourths of all animals) and an estimated 5–10 million undescribed species. Many species undergo complete metamorphosis. There are two subclasses: **Apterygote** (primitive, wingless forms, including silverfish and bristletails) and **Pterygote** (more advanced, winged, or secondarily wingless forms).

RESEARCH DETAILS

AREA OF STUDY: NORTH 24 PGS, KOLKATA, WEST BENGAL.

DATE: MAY 2022

DURATION: 3 DAYS OF FIELDWORK AND 2 DAYS FOR PREPARING THE HARDCOPY.

MATERIALS USED: MAC, PHONE CAMERA, INTERNET

OBSERVATION PART 1

PLANTS

- **MARGOSA TREE**

Scientific name: Azadirachta indica.

Vernacular Name: Neem

Source: The leaves, bark, Bowers, fruits, and seeds are used as a drug

Family: Meliaceae

Species: A. Indica

Distribution: Is native to the Indian subcontinent and dry areas throughout south Asia, but grown all over India; found on a large scale in rural and urban places.

Chemical composition: The main active constituent is azadirachtin and others are Nimbin, salannin, nimbidin, etc.

Uses:

1. The leaves are carminative, expectorant, anthelmintic, and insecticidal properties. Fresh leaf ice with salt is given for intestinal worms, jaundice, skin disease, and malarial fever. The leaves are applied for boils, chronic ulcers, swelling, and wounds.
2. The bark is used for liver complaints, and to remove roundworms.
3. Gum is a stimulant, demulcent tonic, and used in debility.

- **ALOE VERA**

Scientific Name: Aloe barbadensis miller.

Vernacular Name: Gritakumari

Source: Thick fleshy leaves (Pulp, dried, juice) are used as a drug

Family: Liliaceae

Distribution: Is native to West Indies or Mediterranean region. It grows wild in hot dry valleys of the Western Himalayas and the southern, Northern parts of India. It is mainly distributed in every place in rural areas some of the important places like Waki, Mahud, Chindepir, Rajouri, Sangola, Jawala, and Gherardi. It is a Kerophytic plant.

Chemical composition: Contain approximately 98.5% water, while the mucilage or gel consists of about 99.5% water [10]. The remaining 0.5 – 1% solid material consists of a range of compounds including water-soluble and fat-soluble vitamins, minerals, enzymes, polysaccharides, phenolic compounds, and organic acids

Uses: Aloe is chiefly used as a purgative, abortifacient, anthelmintic, blood purifier, cathartic cooling, digestive and diuretic, inflammation, and to cure painful parts of the body. It is useful in the burn, cold cough, jaundice, worms, and piles, Aloe is used in the preparation of vegetables. pickles, cosmetics, and skin blemishes help to grow new healthy tissue. It is used as a hair tonic as it stimulates the growth of hair.

- **PERIWINKLE**

Scientific Name: Catharanthus roseus

Vernacular Name: Sadaphuli, sadabahar

Source: The dried leaves and roots of this plant are used as a drug

Family: Apocynaceae

Distribution: Is probably indigenous to Madagascar. It is cultivated in South Africa, West Indies, Srilanka, India, USA, Europe, and Australia as an ornamental plant. It is also cultivated for its medicinal properties. In India, it is grown in Nilgiri, Kanyakumari, etc. The plant is observed in rural areas like Wanichinchale, Medsingi, Walegaon, Kadlas, Sangola, and Ardhalgaon.

Chemical composition: mainly consists of glycosides and alkaloids. The alkaloids are present in the entire plant but they are found in more proportion in leaves and roots. Some important alkaloids are vinblastine, and vincristine, other alkaloids present in the plant are ajmaline, serpentine, vindoline, etc.

Uses: It is used in hypotensive, antidiabetic action, and other dimer indole-indoline used for curing the anticancer activity. The alkaloids vincristine is highly active in the

treatment of childhood leukemia. Vincristine proves effective in breast cancer and the leaves are used in diabetes.

- **PURGING CASSIA**

Scientific Name:Casia fistula Linn

Vernacular Name: Bahwa, Amaltas.

Source: Pod and bark of this plant are used as a drug.

Family: Caesalpiniodeae

Distribution: It is an ornamental tree with yellow flowers found throughout India Grow o valleys up to 1200 m in the Himalayas. It can be found in urban and rural regions of India as well.

Chemical composition: 1-8 dihydroxyanthraquinone, Tryptamines, Fistucacidin13.4,7,8.4. pentahydroxy LaVan Ox anthraquinone, Epincatechin, Procyanidin 2, flavonoids, Rhein, Kaempferol, Corytophanid, Fistulin, Fistulic acid.

USES: 1. The sweet blackish pulp of the seedpod is used as a mild laxative. The wood is hard and heavy and is used for cabinet and inlay work. Roots are astringent, cooling, purgative, febrifuge and tonic. It is useful in skin diseases, burning sensations, and syphilis.

2.The bark is laxative, anthelmintic, emetic, febrifuge, diuretic, and depurative. It is useful in bolls, ringworms affection, colic dyspepsia, constipation, diabetes, strangury, and cardiac problems.

3.Leaves are laxative, antiperiodic, and depurative, used for dry cough and bronchitis. Fruits are sweet, cooling purgative, carminative, anti-inflammatory, diuretic, and ophthalmic. It is used in flatulence, colic, dysentery, inflammations, and intermittent fever. It is also used in cardiac disorders, strangury, ophthalmopathy, and general debility. Pulp from fruits called 'Cassia pulp' is a well-known laxative. The bark of the tree is rich in tannins.

4. Flowers are bitter, acrid, cooling, emollient, and purgative and are useful in vitiated conditions of pitta, burning sensation, leprosy, and skin diseases. It is also useful in cardiac disorders, intermittent fever, and general debility.

OBSERVATION PART 2

BIRDS

- **BAYA WEAVER**

Common English Name: Baya weaver

Bengali Name: Babui

Scientific Name: Ploceus philippinus

Distribution: in the plain with low altitude; found India to Indo-China via Malaya,

Characters: Chirping and roosting more time, movement very swit

Species: P. philippinus

Vegetation Spectrum: Strychnosnux-vomica, Melaazadirachta, Mikaniascandens, Tremaorientalis, Bambusa sp. Mangifera Indica, Tinosporacordfalia, etc.

- **COMMON BULBUL**

Common English Name: Common Bulbul

Bengali Name: Bulbuli

Scientific Name: Pycnonotus barbatus

Family: Pycnonotidae

Distribution: In all parts of the plain and even in low altitudes of the hilly area.

Character: Clever and very intelligent.

Vegetation Spectrum: Meliaazadirachta, Morindaangustilia, Holuptelaintegrifolia, Stephaniahemandifolia, Mkaniascandens, Tremaorientalis, Mangiferaindica, etc.

- **INDIAN RING-NECKED PARROT**

Common English Name: Indian ring-necked parrot

Bengali Name: Tiya

Scientific Name: Psittacula krameri

Family: Psittaculidae

Genus: Psittacula

Distribution: Indian Sub-continent. All parts of the plain.

Characters: Very punctual about them.

Vegetation Spectrum: Micheliachamaca Seracaasoka Terminaliaarjuna, Ficusbengalensis, P Religiosa, Disoxylum sp. Borassustabelifer, etc.

- **ROCK DOVE**

English Name: Rock dove (Female and Male)

Bengali Name:payra

Scientific Name: Columba livia

Distribution: Indian Sub-continent. All parts of the plain.

Speed: 150 km/h

Family: Columbidae

Characters: Can be used as pets.

Vegetation Spectrum: in rice fields and in fallow land Plants with seeds of Chrorophomplicato Crotonbonplandinum, Brassica nigra, Lathyrus Sativa, etc.

OBSERVATION PART 3

INSECTS

- **INDIAN MEAL MOTH**

The Indian meal moth was given its name after an insect scientist found it feeding on corn meal, also known as Indian meal. They typically live from two to six months.

Size: 5/8"

Shape: Elongated, oval

Color: Copper reddish

Legs: 6

Wings: Yes

Antenna: Yes

Common Name: Indian meal moth

Kingdom: Animalia

Phylum: Arthropoda

Order: Lepidotera

Family: Pyralidae

Species: Plodiainterpuctella

Diet: Indian meal moths feed on dried fruits, grains, seeds, nuts, chocolate, candies, birdseed, dog food, powdered milk, dried red peppers, and candy.

Habitat: Attracted to the light, these bugs are found in bright places where food is stored like restaurants and grocery stores.

Impact: Moths infest foods and can contaminate food products by leaving skin and waste behind.

Prevention: Store food in sealed containers. Discard infested foods in outdoor trash bins. Clean infested cupboards thoroughly with a vacuum and soap and water.

- **MOSQUITO**

There are about 170 different kinds of mosquitoes in North America alone. These pests are part of the same family as houseflies and fruit flies because they all have two clear, veined wings. Best known as a summer pest, Mosquitoes can develop from egg to adult in 10 to 14 days.

Size: 1/4" to 3/8"

Shape: Narrow, oval

Color: Pale brown with whitish stripes across the abdomen.

Legs: 6

Wings: Yes

Antenna: Yes

Common Name: Mosquito

Phylum: Arthropoda

Order: Diptera

Family: Culicidae

Species: Varies

We usually say, "I have been bitten by a mosquito", but this is not completely true. Mosquitoes do not bite. Female mosquitoes feed on plant nectar and blood. They need the protein to reproduce. To get to the blood, they pierce our skin with their "proboscis" and suck our blood. Male mosquitoes feed exclusively on plant nectars. Mosquitoes are busiest at night and will fly up to 14 miles for a blood meal. They hunt for food by detecting body heat and Carbon Dioxide, the gas we breathe out.

Habitat: Mosquitoes breed in soft, moist soil or stagnant water sources such as storm drains, old tires, children's wading pools, and birdbaths.

Impact: Mosquitoes spread diseases such as West Nile Virus, malaria, and dengue fever.

Prevention: Replace all stagnant water at least once a week. Remove trash from around any standing water. When sleeping outdoors or in areas where mosquito populations are heavy, surround your bed with "mosquito" netting.

- **DUST MITE**

The dust mite is nearly impossible to see without magnification. A typical mattress can contain tens of thousands of dust mites. Nearly 100,000 mites can live in a single square. yard of carpet.

Size: 1/75"

Shape: Flat, broad, oval

Color: Off white to tan

Legs: 8

Wings: No Antenna: No

Common Name: Dust mite

Kingdom: Animalia

Phylum: Arthropoda

Class: Arachnida

Order: Acariformes

Family: Pyroglyphidae

Species: Dermatophagoidesfarina

Diet: Dust mites primarily feed on dead skin shed by humans and other animals. They can also absorb moisture from the air.

Habitat: Dust mites are most often found in beds. They may also be found living in carpets, furniture, and clothing.**Impact**: Dust mites are harmless to most people. They carry small foreign proteins, often referred to as "allergens". They don't carry diseases, but these proteins can cause allergic reactions in people by triggering the immune system to overreact.

Prevention:

1. Change your sheets often. Vacuum frequently.
2. Use a vacuum cleaner with a HEPA filter.
3. If dust mites are a real problem in your home, call a pest management professional.

- **PILLBUG**

The pill bug is the only crustacean that can spend its entire life on land. Their shells look like armor and they are known for their ability to roll into a ball. Sometimes children call them rollie-pollies. Most pill bugs live for up to two years. They are most active at night.

Size: 3/4" **Shape**: Oval **Color**: Dark brown to black **Wings**: No **Antenna**: Yes **Common Name**: Pillbug **Kingdom**: Animalia **Phylum**: Arthropoda **Class**: Malacostraca **Order**: Isopoda **Family**: Armadillidiidae

Species: Armadilliliumvulgare)

Diet: Pillbugs mostly eat rotting vegetation like vegetables.

Habitat: Pillbugs live in wet locations. They are found under damp objects or in organic garbage. If pillbugs enter a building, they will often dry out and die.

Impact: Pillbugs do not spread diseases or contaminate food.

Prevention:

1. Keep your homes and the areas around your home clean and dry.
2. Eliminate food sources such as vegetable or plant debris.

CONCLUSION

- **PLANTS:**

Each plant is characterized by one of the three life histories: haploid (In), diploid (2n), or the most common haploid-diploid. Within each of these three types, there are also variations. Of the plants with haploid life cycles, most algae lack a dikaryotic phase, while most fungi have a dikaryotic phase. There are also other algae and fungi that are characterized by diploid life. cycles. Lastly, plants with a haploid-diploid life history undergo an alternation of generations, either similar or dissimilar. In all of these life cycles, asexual reproduction may occur, but it is sexual reproduction that is responsible for genetic diversity. Due to variations arising separately and at different rates, the evolution of land plants did not follow a linear sequence. Before land plants, alga with mostly haploid life cycles existed, but land plants later originated from a haploid-diploid ancestor.

- **BIRDS**:

We conclude that species spatial distributions are directly affected by global warming and subsequently climate change. In general terms, it has been stated by the scientific community that the distribution of species has been moving in a poleward trend. Within the realm of our study, we found no conclusive evidence to prove or disprove this statement. The evidence that we did find and cited leads us to the conclusion that the distribution of species is in fact being altered by climatic change, but we were unable to determine exactly what that change was. This project focused on bird species (as we found they were ideal indicators of species shifts due to the fact that their patterns of movement are already larger and more immediate than other organisms. This and the fact that bird movements and migrations are well documented are the reason we chose to focus our study on birds). Evidence found specifically from birds shows that there is a correlation between bird populations. characteristics and alterations in climatic factors such as temperature and precipitation, the change in population characteristics show that some sort of shift or generally trended movement is occurring.

- **INSECT:**

Insects play many important roles in nature. They aid bacteria, fungi, and other organisms in the decomposition of organic matter and in soil formation. The decay of carrion, for example, brought about mainly by bacteria, is accelerated by the maggots of flesh flies and blowflies. The activities of these larvae, which distribute and consume bacteria, are followed by those of moths and beetles, which break down hair and feathers. Insects and flowers have evolved together. Many plants depend on insects for pollination. Some insects are predators of others.

BIBLIOGRAPHY

To complete this project, I did fieldwork with the help of my friends. And the following internet sites helped me get a thorough report:

1. wikipidia.com
2. google.com
3. Google images
4. Other educational sites.

15/6/22

Date: 28/05/2022
Page No :

SUBJECT: ENVS PROJECT

27

TOPIC: Study Of Pond Ecosystem

NAME: Indrani Halder

DEPARTMENT: COMMUNICATIVE ENGLISH

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CU ROLL NO: 212013-13-0004

CU REGISTRATION NO: 013-1211-0223-21

Date:28/05/2022
Page no:

Content

Pond Ecosystem

Introduction:

The ecosystem is a basic unit in ecology, formed by the interaction of plants, animals and microorganisms forming biotic factors with their physical environment or the abiotic factors.

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. 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 z_ones 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 usually occupied by rooted plants.

II. **Limnetic Zone:** ranges from the shallow to the depth of effective light penetration and associated 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 mussels, crab, worms etc.

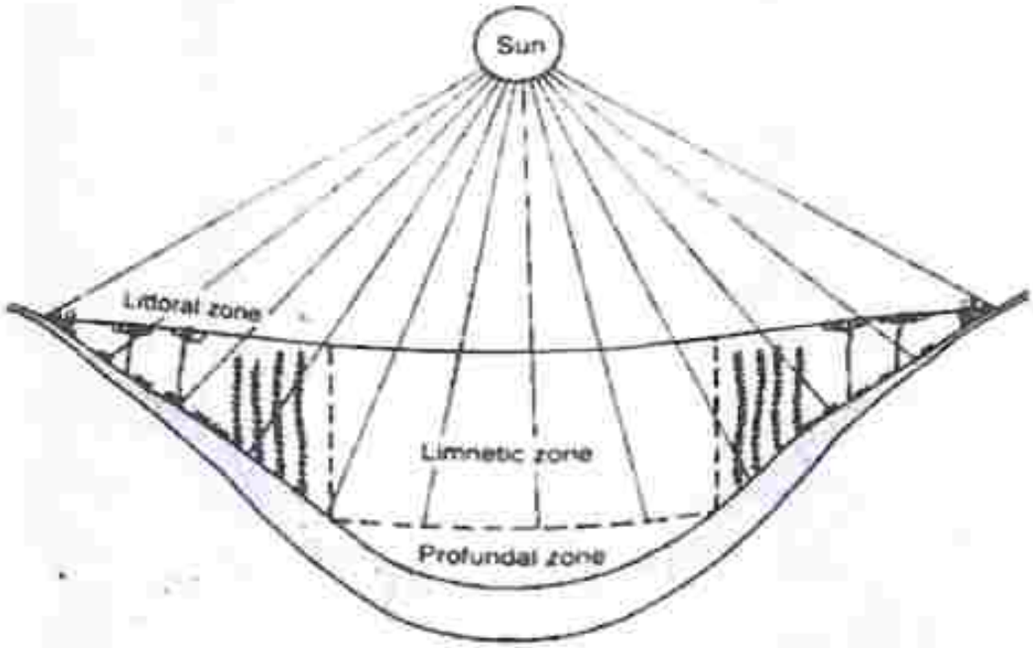


Fig. 3.3 Different zones of a fresh water pond

The organisms inhabiting this freshwater ecosystem include algae, fungi, microorganisms, plants and fish. These organisms can be further classified as producers, consumers and decomposers, based on their mode of obtaining nutrition. The energy in an ecosystem flows from the producers to the consumers. Decomposers, on the other hand, get nutrients from the dead organisms by decomposing them.

Two main components of pond ecosystems are as follows-

1. Biotic component
2. Abiotic component

Producers:

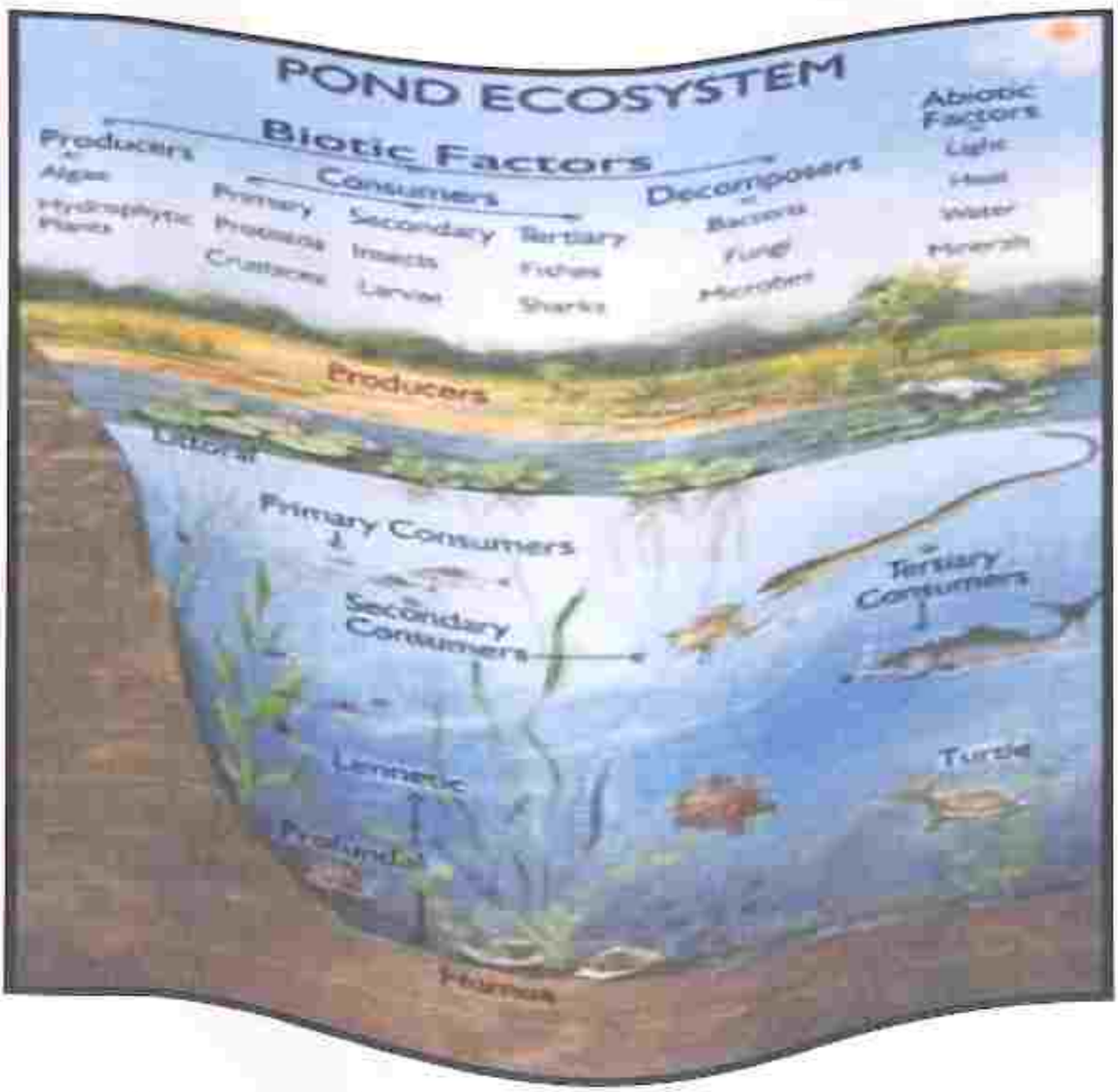
The main producers in pond or lake ecosystem are algae and other aquatic plants, such as Azolla, Hydrilla, Potamogeton, Pistia, Wolffia, Lemna, Eichhornia, Nymphaea, Jussiaea, etc. These are either floating or suspended or rooted at the bottom. The green plants convert the radiant energy into chemical energy through photosynthesis. The chemical energy stored in the form of food is utilized by all the organisms. Oxygen evolved producers in photosynthesis is utilized by all the living organisms in respiration.

Consumers:

In a pond ecosystem, the primary consumers are tadpole larvae of frogs, fishes and other aquatic animals which consume green plants and algae as their food. These herbivorous aquatic animals are the food of secondary consumers. Frogs, big fishes, water snakes, crabs are secondary consumers. In the pond, besides the secondary consumers, there are consumers of highest order, such as water-birds, turtles, etc.

Decomposers and Transformers:

When aquatic plants and animals die, a large number of bacteria and fungi attack their dead bodies and convert the complex organic substances into simpler inorganic compounds and elements. These micro-organisms are called decomposers chemical elements liberated by decomposers are again utilized by green plants in their nutrition.



Abiotic component: Abiotic factors are non-living factors that can have an impact on the ecosystem the main factors of ponds include water quality, temperature, light, soil, and seasonal change. Water is an important abiotic factor. The quality of water is crucial for living organisms in the pond. The temperature could impact the ecosystem if they are at the extremes. 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 diseases. Too low of a water temperature also puts the aquatic ecosystem under stress and the fish can die off in large amounts. pH is also taken into consideration because too low or too high of acidity in the water can clog a fish's gills and reproduction will be more challenging. The lay of the land and the soil is of importance as well. The soil needs to contain enough moisture to keep the surrounding plants alive. If the soil or ground is dry, it is less likely to sustain a live or growing plant in comparison to moist, fertile soil that will help the plant stay alive. Light is also an abiotic factor in this ecosystem. The plants need light for photosynthesis so they can produce oxygen not only above the water but below as well to sustain healthy oxygen levels for aquatic organisms. Fish also need light in the form of heat from the sun to keep the water at a regular temperature. The change of seasons has an impact on the pond. Spring and Fall are

the seasons that keep the ecosystem healthy and the risk of negative effects on the organisms that inhabit the environment very low. This is because the temperature and climate are not extreme enough have a great impact on the oxygen and nutrient level can be evenly distributed between the different water levels. In the winter time, because of the low temperatures, ice can form over top of the pond and block oxygen and sunlight from going into the water which puts the fish under stress; oxygen from the water can even disappear from in the water if it is too cold. Also, plants above the water will freeze and die. In the Summer, the temperature of the water can become too warm and again hold less oxygen for the aquatic organisms. Too much sunlight can impact the pond because the algae is growing too fast therefore crowding space for the fish.

Conclusion

An ecosystem is a functional unit of the biosphere. The biotic and abiotic components of any unit of the biosphere interact with each other, influence each other, and together constitute a dynamic system called an ecosystem. It can be recognised as a self-regulating and self-sustaining unit of the landscape. The pond ecosystem is an aquatic ecosystem that comprises several submerged, emerged, free-floating plants and algae living together with different types of animal species.

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For making this project I have taken help from the following :-

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15/6/22

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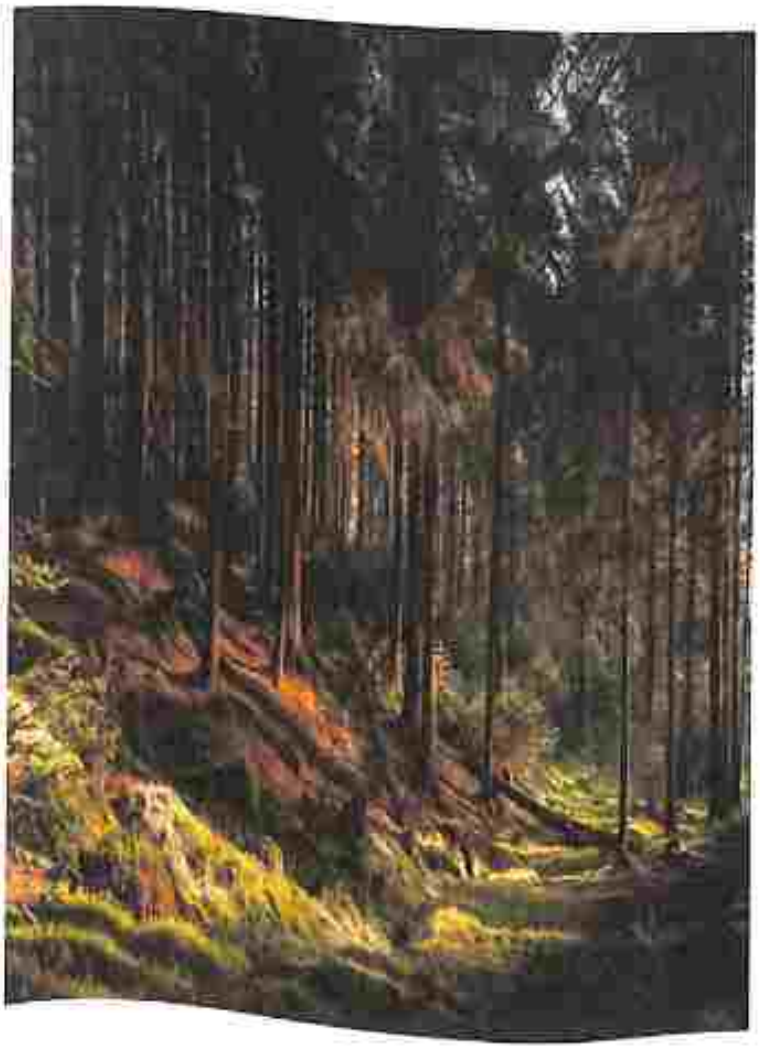
A survey on Forest Ecosystem



STUDY OF ECOSYSTEMS

FOREST ECOSYSTEM

ABSTRACT

Study and survey of ecosystems as a wide concept that may include different types of forest cultivation and etc.

ARPITA ADHIKARY

ENVS PROJECT

NAME: ARPITA ADHIKARY

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CONTENTS

ACKNOWLEDGEMENT

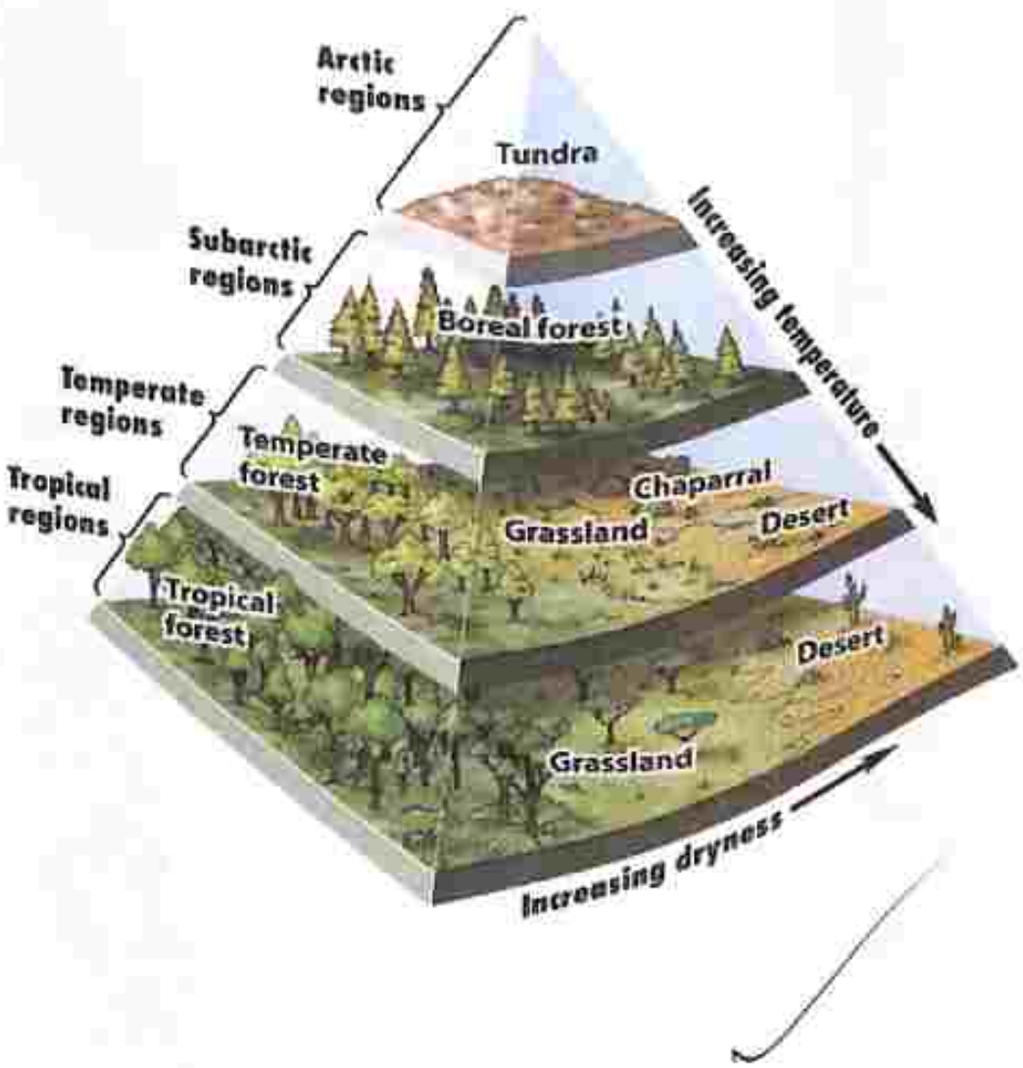
I would like to give my heartful thanks to my ENVS Professor Rajkumar Barman for giving me such a wonderful opportunity for doing research over forest ecosystem. I have learnt so many things from this project. Our college Gokhale Memorial Girl's College, and all my teachers, friends, and parents, were also helpful and encouraging with the project, without them doing this project would have been impossible.

INTRODUCTION

ECOSYSTEM

An ecosystem is a community of living organisms in conjunction with the non-living components of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flow. Ecosystems is controlled by external and internal factors.

External Factors such as Climate, Parent Material, Topography etc. Internal Factors such as Types of species, Floral, Fauna, Decomposition etc. There are a lot of types of Ecosystems but in this study paper we will look into the Forest Ecosystem.



FOREST ECOSYSTEMS

A Forest Ecosystem is a place that provides natural habitat to millions of plants and animal species. The forest ecosystems have been divided into different types based on the Climate Conditions of that particular region- Tropical Rainforest, Temperate Rainforest etc.

A natural woodland area making it a suitable place for the survival of biotic and abiotic components, is usually termed as a forest ecosystem. A

forest ecosystem consists of various plants, animals, and other micro-organisms, making it a natural habitat for them.

The Forest ecosystems plays an essential role in the environment. It helps to balance the climate of the planet. One of the major roles that forest play is that provides us **oxygen to breathe**. Trees help to maintain the balance of carbon-di-oxide in the atmosphere. Besides, this forest also helps to prevent **soil erosion**, **rainfall**, **purifying the air** etc.

Forest Ecosystem

• The Non- living factors (Abiotic)	• The Living factors (Biotic)
• Eg- Rocks and Mountains	• Eg- Plants and Animals

Types of Ecosystems

Natural

Terrestrial

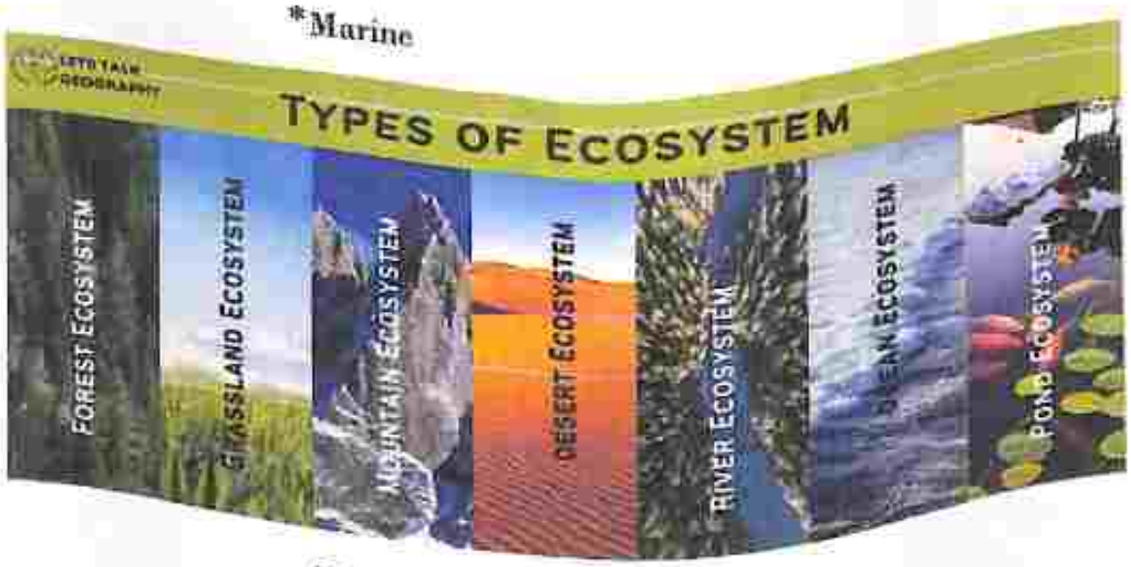
- *Forests
- *Grasslands
- *Desserts

Aquatic

- * Ponds
- *Lakes
- *Rivers
- *Wetlands
- *Marine

Artificial

- *Cropland
- *Wetland



Types of Forests

*Coniferous Forests

*Broad Leaved Forest

A. Evergreen Forest
B. Deciduous Forest
C. Thorn Forest
D. Mangrove Forest

Coniferous Forest

- Grow in the Himalayan region.
- Temperature is low.
- Have tall trees with needle-like leaves and downward sloping branches so that the snow can slip off the branches.
- Have cones instead of seeds are called gymnosperms.

BroadLeaved Forest

- Broad leaved Forests have large leaves of various and have several types.

Evergreen Forest

- It grows in the high rainfall areas of the Western Ghats, North Eastern and the Andaman and Nicobar Islands, and monsoon lasts for several months.
- It sheds a few of their leaves throughout the year.
- No leafless phase.
- Only shade loving trees can grow in the ground layers as canopy overlap.
- Forest is rich in orchids and ferns abounds in animal life and is most rich in insect life.

Deciduous Forest

- They are found in regions with a balanced amount of seasonal rainfall.
- Lasts for only few months.
- Most of the forests in which Teak grow are of this type.

- Trees shed their leaves during the winter and hot summer months and regain their fresh leaves just before the monsoon.
- Light can penetrate easily onto the forests floor.

Thorn Forest

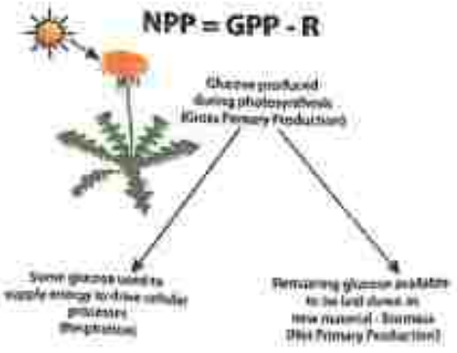
- They are found in the semi-arid regions.
- Trees are scattered and are surrounded by open grassy areas.
- They can conserve water.
- They have long and fibrous roots to reach water at great depths.
- They reduce loss of water – some species have small leaves and some have thick waxy leaves.
- They have thorns – protect plants from herbivores.

Mangrove Forest

- They grow along the coast especially in the river deltas.
- They are able to grow in a mix and saline and fresh water, in muddy areas.
- They have breathing roots.
- They prevent soil erosion.

COMPONENTS OF A FOREST ECOSYSTEM

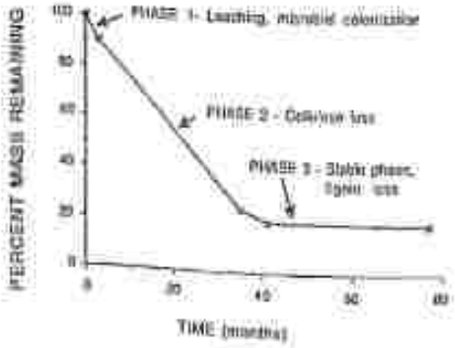
The components of a forest ecosystem are as follows:-



1.**Productivity**- The basic requirement for any ecosystem to function and sustained so

the constant input of solar energy. Plants are also the producers in a forest ecosystem.

There are two types of productivity in a forest ecosystem, primary and secondary. Primary productivity means the rate of capture of solar energy or biomass production per unit area over a period of time by the plants during photosynthesis. It is further divided into gross primary productivity (GPP) and net primary productivity (NPP). GPP of an ecosystem is the rate of capture of solar energy or the total production of biomass. However, plants also use a significant amount of GPP in respiration. Thus, NPP is the amount of biomass left after the utilization by plants or the producers. We can hence say that NPP is the amount which is available for the consumption to herbivores and decomposers. Secondary productivity means the rate of absorption of food energy by the consumers.

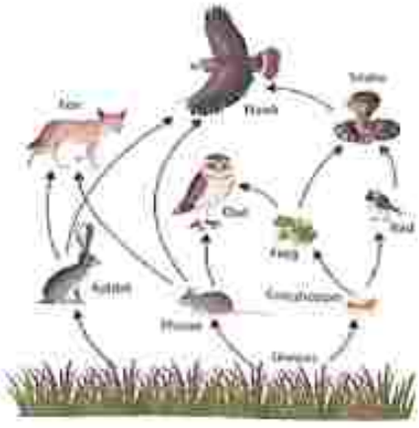


2.<u>Decomposition</u>- Decomposition is an extremely oxygen required process of decomposition, decomposers convert the

complex organic compounds of detritus into inorganic substances such as Carbon-di-oxide, water and nutrients.

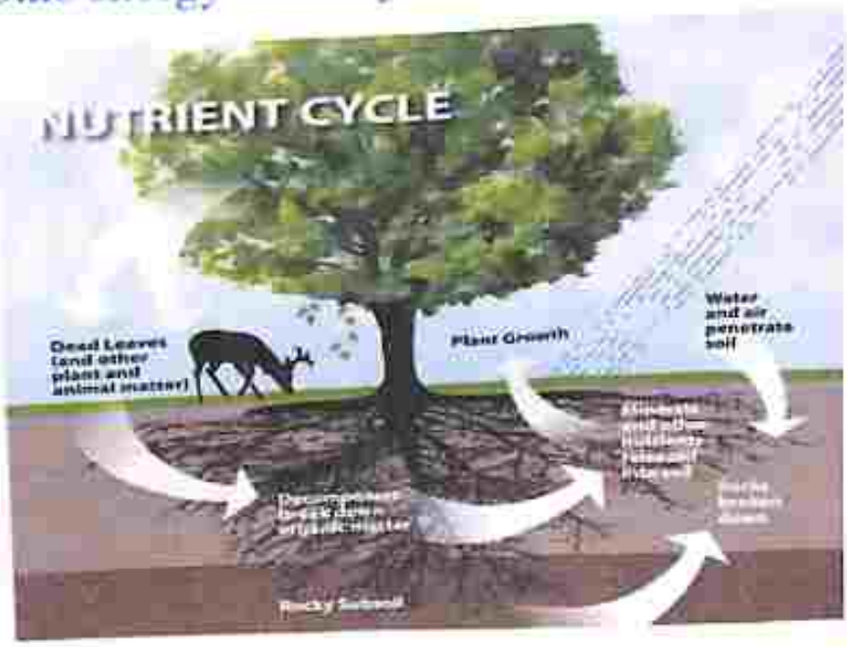
Detritus is the remains of the dead plant such as leaves, flowers, and also the dead remains of the animal including their faecal matter. Thus, steps involved in the process of decomposition are fragmentation, leaching catabolism, humification and mineralization.

The process of humification, leads to the accumulation of humans which undergoes the decomposition at a very slow rate. In the process of mineralization, the humans gets further degraded by microbes and inorganic nutrients are released.



3.**Energy Flow**- Energy flows in a single direction. Firstly, plants capture solar energy and then, transfer the food to decomposers. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain.

Energy pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process some energy is always lost as heat at each step.



4. **Nutrient Cycling-** Nutrient Cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of nutrient cycling, Gaseous and Sedimentary.

For gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reserver were as for the sedimentary cycle (i.e. phosphorus) earth's crust is the reserver.

Threats to Forest Ecosystem

- Deforestation
- Poaching
- Overexploitation of resources
- Development activities (mining, dams)
- Changing land use patterns

- Fragmentation
- Habitat degradation

Conservation of Forest Ecosystem

- ❖ Use resources Carefully
- ❖ Alternate source of energy for fuel wood
- ❖ Afforestation
- ❖ NP and Wildlife Sanctuaries
- ❖ Control pollution

CONCLUSION

Forest are the natural treasure of mother Earth given to us. Unfortunately, the forests around the world are getting destroyed mainly due to the pollution and deforestation to fulfill our needs. It is needed to recall the importance of forest ecosystems towards the environment. Also,we need to protect the forest ecosystem to save millions of plants and animal species.

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SUBJECT – ENVS PROJECT

TOPIC – STUDY OF COMMON BIRDS AND BASIC PRINCIPLES OF IDENTIFICATION

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CU REGISTRATION NUMBER – 013-1211-0225-21

DATE – 25.5.2022

ENVS PROJECT

Study Of Common of Birds And Basic Principles Of Identification

Birds make up the scientific class Aves. They are warm-blooded, egg-laying vertebrate animals that are covered with feathers and possess forelimbs that have modified to become wings. Birds also have scaly legs, and no teeth (except in a few early fossil forms). They maintain a constant body temperature of about 41 degrees C (106 degrees F). All birds today have descended from their flying ancestors, but a few such as ostriches, Mus, some grebes, and cormorants have lost their capacity for aerial flight. Others, such as penguins, have become adapted to flying in a much denser medium, water. Birds are found in all habitats, from the icy shores of Antarctica to the hottest parts of the tropics, and from mountains, deserts, plains, and forests to open oceans and densely urbanized areas. They inhabit ecosystems across the globe, from the Arctic to the Antarctic. Extant birds range in size from the 5 cm (2 in) Bee Hummingbird to the 2.75 m (9 ft) Ostrich. The fossil record indicates that birds evolved from theropod dinosaurs during the Jurassic period, around 150–200 Ma (million years ago), and the earliest known bird is the Late Jurassic Archaeopteryx, c 150–145 Ma. Modern birds are characterized by feathers, a beak with no teeth, the laying of hard-shelled eggs, a high metabolic rate, a four-chambered heart, and a lightweight but strong skeleton.

All living species of birds have wings - the now extinct flightless Moa of New Zealand were the only exceptions. Wings are evolved forelimbs, and most bird species can fly, with some exceptions including ratites, penguins, and a number of diverse endemic island species. Birds are social; they communicate using visual signals and through calls and songs, and participate in social behaviours including cooperative breeding and hunting, flocking, and mobbing of predators. The vast majority of bird species are socially monogamous, usually for one breeding season at a time, sometimes for years, but rarely for life. Other species have breeding systems that are polygamous (many females) or, rarely, polyandrous (many males). About 120–130 species have become extinct as a result of human activity since the 17th century, and hundreds more before then. Currently about 1,200 species of birds are threatened with extinction by human activities, though efforts are underway to protect them.

Song Sparrow

Aptly named, the Song Sparrow will sing as many as 20 different melodies with as many as 1,000 improvised variations on his basic theme. In areas where the birds migrate, the male arrives on the breeding ground ahead of the female and starts to define a territory by singing his song from three or four prominent perches. The Song Sparrow is 5 to 6 inches in length, heavily streaked gray-brown upperparts. Dull white underparts have dark central breast spot, thick streaks. Head has brown crown, paler median stripe, pale gray eyebrow, white chin, dark brown moustache stripe. Rust-brown wings. Tail is long, usually tinged rust-brown. Birds in some areas will vary, with paler subspecies in the Southwest and darker subspecies along the West Coast. In early spring the male sings constantly and defends his territory. When the female first arrives, the male will dive at her as he does with any other intruder, but the female does not flee. In time the male will accept this behavior and the two will begin to move about the territory together. At this stage the male will reduce his singing to only about ten Songs per hour. Once the nest building has started, the male Song Sparrow will renew his singing. The nest is cup-shaped and made of grasses and occasionally leaves, placed on the ground early in the year, and up to 30 feet above the ground later in the season. Although the male may carry nesting materials, it's the female who builds the nest. The female lays one egg each day until the clutch of 3 to 5 greenish white with dark marks is complete.

Peacock

Peacocks are large, colorful pheasants (typically blue and green) known for their iridescent tails. These tail feathers, or coverts, spread out in a distinctive train that is more than 60percent of the bird's total body length and boast colorful "eye" markings of blue, gold, red, and other hues. The large train is used in mating rituals and courtship displays. It can be arched into a magnificent fan that reaches across the bird's back and touches the ground on either side. Females are believed to choose their mates according to the size, color, and quality of these outrageous feather trains. The term "peacock" is commonly used to refer to birds of both sexes. Technically, only males are peacocks. Females are peahens, and together, they are called peafowl. Suitable males may gather harems of several females, each of which will lay three to five eggs. In fact, wild peafowl often roost in forest trees and gather in groups called parties. Peacocks are ground-feeders that eat insects, plants, and small creatures. There are two familiar peacock species. The blue peacock lives in India and Sri Lanka, while the green peacock is found in Java and Myanmar (Burma). Peafowl such as the blue peacock have been admired by humans and kept as pets for thousands of years. Selective breeding has created some unusual color combinations, but wild birds are themselves bursting with vibrant hues. They can be testy and do not mix well with other domestic birds.

Mynah

Mynah birds are the best mimics on the planet, rivaling parrots in their speaking ability. These stocky birds are native to Asia, but have spread throughout the world as pets. The Mynah bird is native to India, Pakistan and Myanmar and many other Asian countries. Mynah birds were introduced to the Pacific Islands, Canada, South Africa and other nations to help combat agricultural pests. As a result of its adaptability and introduction throughout the world, Mynah birds have an expansive worldwide presence in the wild, and are even considered to be an invasive species. In 2013, Mynah birds were listed as one of the world's top 100 most invasive species by the Global Invasive Species Database. Mynah birds are small, stocky birds, usually weighing between 3 and 5 pounds. Mynah birds have black heads and brown bodies and wings, with bright yellow-orange bills, feet and skin around the eyes. The underside of the wings have white patches, which are generally only visible during flight. Mynah birds are omnivorous birds. They will eat a wide variety of fruits and vegetables, but also will eat many small agricultural pests. In the winter, when insects are in short supply, mynah birds can be seen rummaging through refuse and eating insects along the road. With proper veterinary care and nutrition, Mynah birds can live up to 25 years.

CONCLUSION

This project is meant to increase awareness about birds among all. From this project, we can conclude that birds are very important for our biodiversity and even for the survival of human beings. They play vital role in different ecosystems at different topic levels. We also got to know that birds can be protected if more awareness is spread among the people but due to lack of awareness birds are in danger. There are many National Parks, Sanctuary and Bio – Reserves for the protection of birds. Due to hunting, poaching and disruption of the ecological balance, many birds are getting extinct. As a result, birds living in water like swans, ducks and more are also falling drastically in number because of pollution. Thus, we all must take proper measures to help the birds live and save them from extinction. Birds are vital for our ecosystem and its balance, thus we must all keep them safe.

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15/6/22

(25)

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ECOSYSTEM

An ecosystem refers to a functional unit of nature in which living organisms interact among themselves as well as with the surrounding physical environment. Ecologists look at the entire biosphere as a global ecosystem. Besides, the forest ecosystem is a part of the terrestrial ecosystem.

It, however, may vary largely in size i.e. from a small pond to a sea or a large forest. Usually, these are self-sustaining. We can divide the ecosystems into two broad categories, namely, terrestrial ecosystem and aquatic ecosystem.

The terrestrial ecosystem includes desert, grassland and forest ecosystem, whereas pond, lake, wetland and river ecosystem are parts of the aquatic ecosystem.

A forest ecosystem is a functional unit or a system which comprises of soil, trees, insects, animals, birds, and man as its interacting units. A forest is a large and complex ecosystem and hence has greater species diversity.Also, it is much more stable and resistant to the detrimental changes as compared to the small ecosystems such as wetlands and grasslands.

A forest ecosystem, similar to any other ecosystem, also comprises of abiotic and biotic components. Abiotic components refer to inorganic materials like air, water, and soil. Biotic components include producers, consumers, and decomposers.

These components interact with each other in an ecosystem and thus, this interaction among them makes it self-sustainable.

Structural Features of the Forest Ecosystem

The two main structural features of a forest ecosystem are:

1. Species Composition: It refers to the identification and enumeration of the plant and animal species of a forest ecosystem.
2. Stratification: It refers to the vertical distribution of different species which occupy different levels in the forest ecosystem. Every organism occupies a place in an ecosystem on the basis of source of nutrition. For example, in a forest ecosystem, trees occupy the top level, shrubs occupy the second and the herbs and grasses occupy the bottom level.

Components of a Forest Ecosystem

The components of a forest ecosystem are as follows:

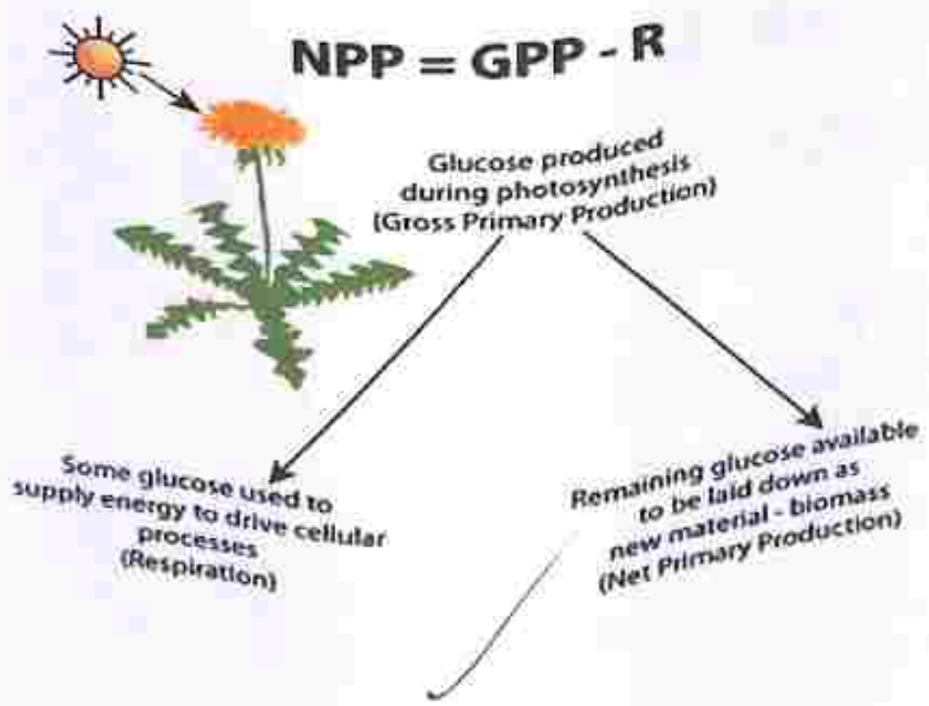
1.Productivity

The basic requirement for any ecosystem to function and sustain is the constant input of solar energy. Plants are also the producers in a forest ecosystem.

There are two types of productivity in a forest ecosystem, primary and secondary. Primary productivity means the rate of capture of solar energy or biomass production per unit area over a period of time by the plants during photosynthesis.

It is further divided into Gross Primary Productivity (GPP) and Net Primary Productivity (NPP). GPP of an ecosystem is the rate of capture of solar energy or the total production of biomass. However, plants also use a significant amount of GPP in respiration.

Thus, NPP is the amount of biomass left after the utilization by plants or the producers. We can hence say that NPP is the amount which is available for the consumption to herbivores and decomposers. Secondary productivity means the rate of absorption of food energy by the consumers.



2. Decomposition

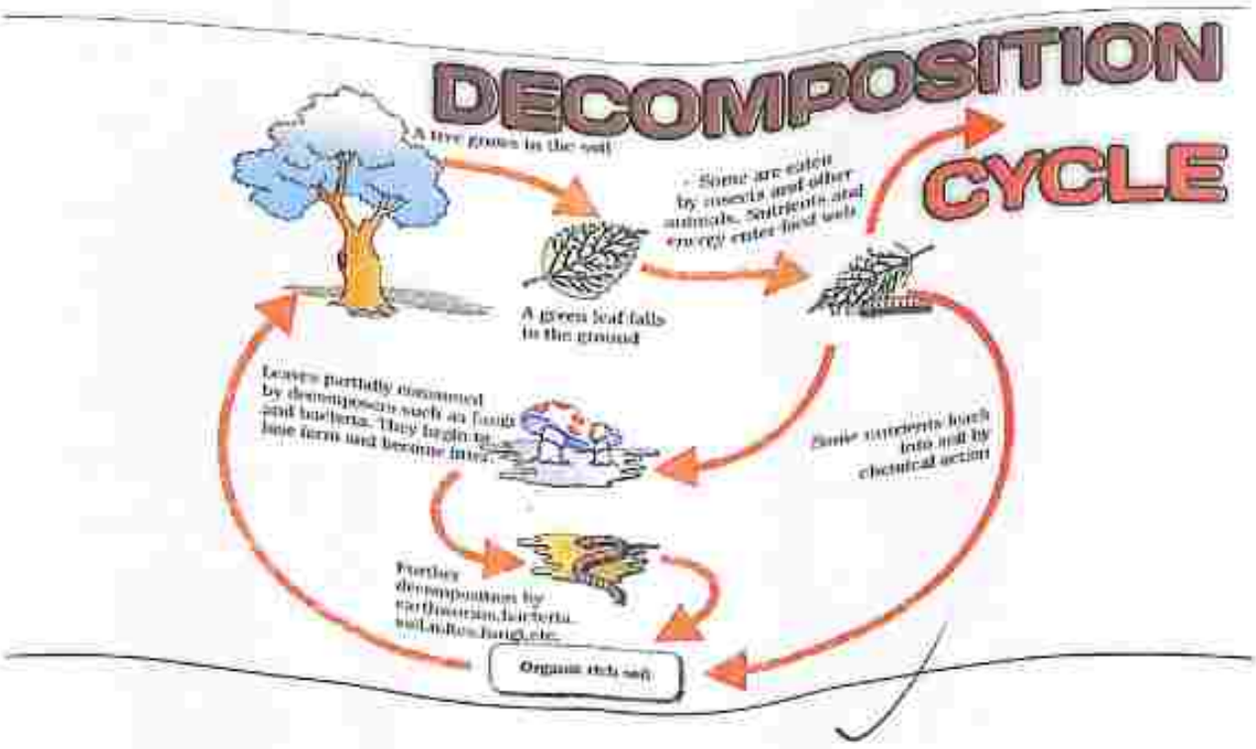
Decomposition is an extremely oxygen-requiring process. In the process of decomposition, decomposers convert the complex organic compounds of detritus into inorganic substances such as carbon dioxide, water and nutrients.

Detritus is the remains of the dead plant such as leaves, bark, flowers and also the dead remains of the animals including their faecal matter. The steps involved in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization.

In the process of fragmentation, detritivores break down the detritus into smaller particles. In the process of leaching, water-soluble inorganic nutrients descend down into the soil and settle as unavailable salts.

Under the process of catabolism, bacterial and fungal enzymes reduce detritus into simpler inorganic substances. Humification and mineralization processes take place during the decomposition of soil and not detritus.

The process of humification leads to the accumulation of humus which undergoes decomposition at a very slow rate. In the process of mineralization, the humus gets further degraded by microbes and inorganic nutrients are released.



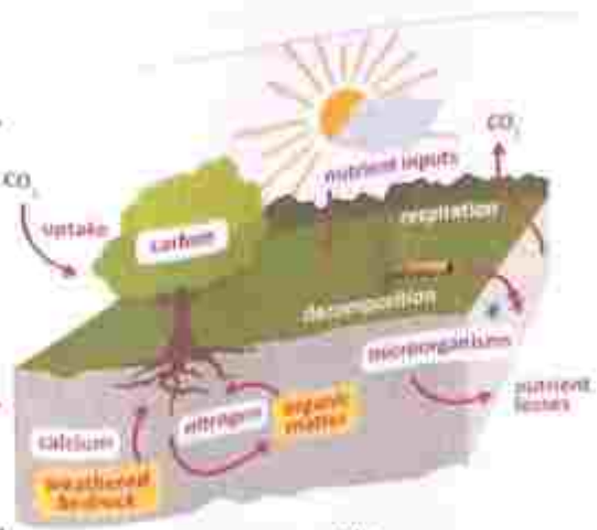
3. Energy flow

Energy flows in a single direction. Firstly, plants capture solar energy and then, transfer the food to decomposers. Organisms of different trophic levels are connected to each other for food or energy relationship and thus form a food chain. Energy Pyramid is always upright because energy flows from one trophic level to the next trophic level and in this process, some energy is always lost as heat at each step.

4. Nutrient Cycling

Nutrient cycling refers to the storage and movement of nutrient elements through the various components of the ecosystem. There are two types of Nutrient cycling, gaseous and sedimentary. For Gaseous cycle (i.e. nitrogen, carbon), atmosphere or hydrosphere is the reservoir whereas for the sedimentary cycle (i.e. phosphorus) Earth's crust is the reservoir.

(A graphic representation of energy transfer between trophic layers in an ecosystem.)



(A graphic representation of the nutrient cycling in an ecosystem.)

Conclusion

Forests and the products they provide are universally required for the continuation of human society as we know it. To change our society to one that does not depend on the forest (to the forest's detriment) and its associated benefits requires such an enormous paradigm shift that we generally do not even consider it worthy of further investigation. Given this situation therefore, it is imperative that we discover mechanisms to manage the forest for all the benefits it can provide, in a sustainable manner.

Few countries have all the answers to all the issues faced, thus there exists a real need for international cooperation. ***Loss of forest resources transcends national boundaries and affects the entire planet.*** Given this, the roles of various agencies become vitally important in order to minimise any potential downside and to maximise the upside. Governments, NGOs, intergovernmental panels and the like must work more closely in order to resolve the pressing issues facing the forests. In many cases a collaborative approach will provide a solution which is more acceptable to all parties, and more robust than a solution that is developed unilaterally.

Societies around the world are beginning to face up to the reality that as a species man requires forest resources - both the wood and non-wood products a sustainably managed forest can provide. As the guardians of those resources our performance has to date been abysmal. It is with a great deal of urgency that we must turn that record around and ensure that we have sustainably managed forests for the generations that are to follow. Only a long term global commitment to conservation and sustainable development can reverse the tide of uncontrolled deforestation. A sound policy framework is central to this commitment.

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15/6/22

VISIT TO A LOCAL URBAN POLLUTED SITE

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DATE OF SUBMISSION : 28-05-2022

25

Acknowledgement

I would like to express my special thanks of gratitude to my Teacher RAJ KUMAR BARMAN Sir who gave me the golden opportunity to do this wonderful project on the topic " visit to a local polluted site, which also help me in doing a lot of research and I came to know about so many new things I am really thankful to them.

Secondly I would also like to thank my parents and friends who helped me lot in finalizing this project within the limited time.

Introduction:

Pollution is the action of Polluting especially by environmental contamination with man made waste. Pollution is the introduction of Contaminants into the natural environment that cause adverse change. Pollutants, the components of pollution, I can be either foreign substance naturally occurring contaminates. Different types of pollution are air pollution, land pollution, water pollution, noise pollution, light folate -n, thermal pollution, radioactive contamination, plastic pollution and soon Some of the major forms of pollution are listed below along with the particular contaminant outlearnt to each of them:

Air Pollution: The release of chemical and reticulate into the atmosphere. Common gaseous pollutants include carbon monoxide, sulfuret dioxide. chlorofluorocarbons (CFCs) and nitrogen oxides produced by industry and motor vehicles. Photochemical ozone and smog are created as •nitrogen oxides and" hydrocarbon read to sunlight. Particulars matt err, axe fine dust is characterized by theirmicromere size PM,0 to PM2.5. Electromagnetic Pollution:

Electromagnetic pollution: The Over abundance of electromagnetic radiation in their non-ionizing form, like radio waves, etc. that people are constantly exposed at: especially in large cities. It's still unknown whether or not those types of radiation have any effects on human health, though.

Noise Pollution:Which encompassedstowaway noise. air. -craft noise, industrial noise as well as high-intensitysonar

Plastic Pollution : Involves the accumulation of plastic products and micro plastics in the environment that adversely affects wildlife, wildlife habitat, or humans. Soil contamination occurs chemicals are released by spill or underground leakage. The most
significant soil contaminants are hydrocarbons, heavy metals,MTBE,herbicides
and chlorinated hydrocarbons.

Thermal Pollution : Is a temperature change in natural water bodies caused by human influence, such as use of water as coolant in a power plant.

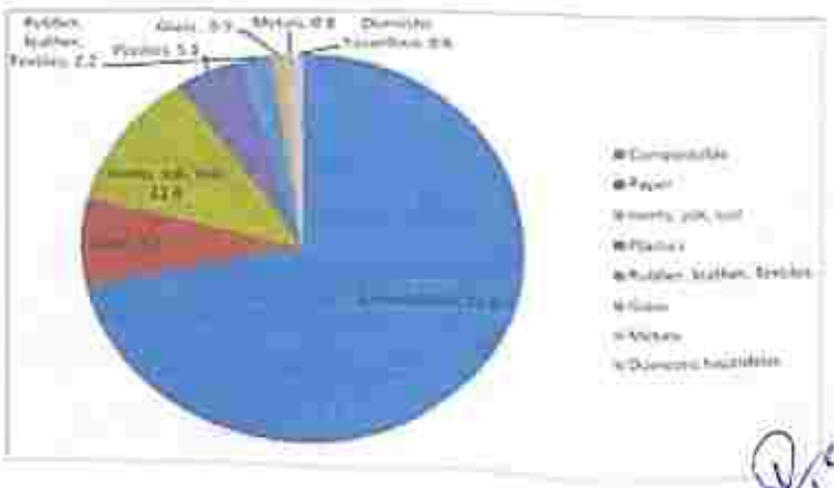
Water Pollution : By the discharge of wastewater from commercial and industrial waste into surface waters; discharges of unwanted domestic sewage and chemical contaminants into surface runoff flowing to surface waters; ground water pollution from waste disposal and leaching into the ground, including from pit latrines and sepic tanks; eutrophication and littering. Land pollution : Land pollution refers to the deterioration of the earth's land surfaces, at and below ground level. The cause is the accumulation of solid and liquid waste materials that contaminate groundwater and soil.

- Awareness program on categorization of waste into degradable and no degradable waste should be carried on
- Proper policy and loss like paying fine should be implemented
- Degradable waste should be incorporable for fertility improvement of soil

Summary, Conclusion and suggestion

This is the way I visited a local polluted area(land pollution) and found out its mitigation measure. Land is one of the integral parts of the environment, but increasing population, industrial development has cause it deterioration. Land pollution is one of the serious problems of our environment. Land pollution destroy the beauty of the place, invite many health problems like diarrhoea, cholera, dysentery to serious problems like skin cancer, respiratory problem. The toxic chemicals can reach our body throughfood and vegetables that grow in the polluted soil. Land pollution not only affect the human but it also affects the animals and plants.

In order to reduce the effects of land pollutiondifferent mitigation measures should be implemented. Proper management of garbage, reuse and recycle of recyclable waste. Laws and policy made by the government should be followed by people. People themselves are the causes of the land pollution so steps of land pollution mitigation should be started from each person.



15/6/22

STUDY OF COMMON PLANTS, INSECTS, FISH, BIRDS, MAMMALS AND BASIC PRINCIPLES OF IDENTIFICATION

B.Sc. Semester – II (under CBCS) Examination

UNIVERSITY OF CALCUTTA

AECC – 2

ENVIRONMENTAL STUDIES

REGISTRATION NUMBER:

013 -1211-0228-21

ROLL NUMBER:

213013-13-0001

INDEX

INTRODUCTION

Environmental Science is a scientific study of the natural world and how it is influenced by people. Major topics include: food, energy, human population, biodiversity and global change.

Importance of EVS :

It helps us to establish a standard for a safe, clean and healthy natural ecosystem. It also deals with important issues like safe and clean drinking water, hygienic living conditions and clean and fresh air, fertility of land, healthy food and development.

Main goal of EVS :

The three main goals of environmental science are:

i. to learn how the natural world works
ii. to understand how humans interact with the environment
iii. to find ways to deal with environmental problems and live more sustainably.

Types of Environment :

There are two different types of environment:

I. **Geographical Environment**- A geographical environment is also called a natural environment as it interacts with nature. The earth's surface, rivers, mountains, deserts, land, water, oceans, volcanoes, etc. come under the natural environment examples.

II. **Man-made Environment** - Man-made environment is the environment created by humans. It includes permanent human settlements like villages, towns, cities, and transport and communication facilities, besides various other communities.

STUDY OF COMMON 2 PLANTS

1. MARGOSA TREE

Common Bengali Name: Neem

Scientific Name: Azadirachta indica

Vegetation Spectrum: The exact origin is uncertain: some say neem is native to the whole Indian subcontinent; others attribute it to dry forest areas throughout all of South and Southeast Asia, including Pakistan, Sri Lanka, Thailand, Malaysia, and Indonesia. It is in India that the tree is most widely used.

Charateristics: Neem trees are fast-growing, medium-sized trees, usually attaining a height of 50 to 65 feet. Its trunk is short and straight with deeply fissured bark. The pinnate leaves are purple-red when young, developing to a medium green color when mature.

2. ALOE VERA

Scientific Name: Aloe barbadensis miller

Vegetation Spectrum: Aloe species are mostly inhabitants of arid climates, and are widely distributed in Africa, India, and other arid areas. The largest number of Aloe species is approximately 140, and most are found in South Africa. However, they could also be grown in subtropical summer rainfall and winter rainfall regions.

Characteristics:

- It contains healthful plant compounds.
- It has antioxidant and antibacterial properties.
- It accelerates wound healing.
- It reduces dental plaque.
- It helps treat canker sores.

STUDY OF COMMON 5 INSECTS

1. INDIAN MEAL MOTH

Common English Name: Indian Meal Moth

Scientific Name: Plodia interpunctella

Vegetation Spectrum: Indian Meal moth infestations begin with stored foods that contain the pest's eggs. When they hatch, larvae feed on materials like flour, cereals, and nuts. The pests may infest pantry goods during production, in the store, or at home.

Characteristics: Adult Indian meal moths are about 3/8 of an inch long and have a wingspan of about 5/8 of an inch. They have an elongated oval shaped body, their wings are gray in color except for the rear half which are a distinctive rusty bronze color.

2. MOSQUITO

Common English Name: Mosquito

Scientific Name: Culicidae

Vegetation Spectrum: Mosquitoes are distributed widely throughout the world. They are found at altitudes of over −4700 m, as well as in mines −1250 m below sea level. Species range in latitudes from the tropics northwards into the Arctic regions and southwards to the ends of the continents.

Characteristics: The slender, elongated body of the adult is covered with scales as are the veins of the wings. Mosquitoes are also characterized by long, fragile-looking legs and elongated, piercing mouthparts. The feathery antennae of the male are generally bushier than those of the female.

STUDY OF COMMON 2 FISHES

1. CATLA

Scientific Name: Catlacatla

Vegetation Spectrum: Catla fish is native to India, Bangladesh, Pakistan, Nepal and Myanmar. Catla fish is commonly found in rivers, canals and the breeding percentage is very good. This fish can also be grown commercially in fresh water ponds.

Characteristics: Catla is a fish with large and broad head, a large protruding lower jaw, and upturned mouth. It has large, greyish scales on its dorsal side and whitish on its belly. It reaches up to 182 cm (6.0 ft) in length and 38.6 kg (85 lb) in weight. Catla is a surface and midwater feeder.

2. ROHU

Scientific Name: Labeorohita

Vegetation Spectrum: The rohu occurs in rivers throughout much of northern and central and eastern India, Pakistan, Vietnam, Bangladesh, Nepal and Myanmar, and has been introduced into some of the rivers of Peninsular India and Sri Lanka.

Characteristics: The rohu is a large, silver-colored fish of typical cyprinid shape, with a conspicuously arched head. Adults can reach a maximum weight of 45 kg (99 lb) and maximum length of 2 m (6.6 ft), but average around 1/2 m (1.6 ft).

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STUDY OF COMMON PLANTS, FISHES, BIRDS AND BASIC PRINCIPLES OF IDENTIFICATION

UNIVERSITY OF CALCUTTA

B.Sc. Semester-II (under CBCS) Examination

ENVIRONMENTAL STUDIES

Paper Code- ENVS (Sem-2)

Name- Aindrila Das

Name of the subject- ASPV

Registration No.- 013-1211-0229-21

CU Roll No.- 213013-13-0002

Acknowledgement:

I am grateful to my EVS teacher Raj Kumar Barman for helping me out with the project and assisting me in my project in areas where I got stuck. I am obliged to the college and my university that they gave us the opportunity to work out on this project which also helped me increase my general knowledge.

INTRODUCTION

Environmental Science is a scientific study of the natural world and how it is influenced by people. Major topics include: food, energy, human population, biodiversity and global change.

Importance of EVS :

It helps us to establish a standard for a safe, clean and healthy natural ecosystem. It also deals with important issues like safe and clean drinking water, hygienic living conditions and clean and fresh air, fertility of land, healthy food and development.

Main goal of EVS :

The three main goals of environmental science are:

i. to learn how the natural world works
ii. to understand how humans interact with the environment
iii. to find ways to deal with environmental problems and live more sustainably.

Types of Environment :

There are two different types of environment:

I. **Geographical E** ... also called

STUDY OF COMMON 2 PLANTS

1.BANAYN TREE

Common Bengali Name- BOT

Scientific Name- Ficus benghalensis

Vegetation Spectrum- Banayn is a large, fast growing, evergreen tree that has been widely introduced across tropical and subtropical areas of the world. It has escaped from cultivation and become naturalized in natural and disturbed areas. Banayn produces large numbers of seeds which can be dispersed by both native and exotic birds.

Characteristics- The leaves of the banyan tree large, leathery, glossy, green, and elliptical. Like most figs, the leaf bud is covered by two large scales. As the leaf develops the scales. Young leaves have an attractive reddish tinge.

2. **False ashoka**

Common Bengali Name- DEBDARU

Scientific Name- Monoon longifolium

Vegetation Spectrum-also commonly known by its synonym Polyalthia longifolia, is an Asian small tree species in the family Annonaceae. It is native to southern India and Sri Lanka, but has been widely introduced elsewhere in tropical Asia. This evergreen tree is known to grow over 20 m. in height and is commonly planted due to its effectiveness in alleviating noise pollution. It exhibits symmetrical pyramidal growth with willowy weeping pendulous branches and long narrow lanceolate leaves with undulate margins.

Characteristics-This tree can grow upto 30 feet normally. It can appear to have no branches, But This tree will grow into a normal large tree giving plenty of shade. Emerging leaves have a coppery brown pigmentation, as the leaves grow older, the colour becomes a light green and finally a dark green.

STUDY OF COMMON 2 FISHES

1.ILISH

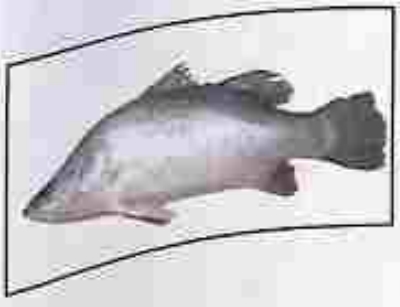
Scientific Name:Tenualosa ilisha

Vegetation Spectrum-It can grow up to 60 cm in length with weights of up to 3 kg. It is found in rivers and estuaries in Bangladesh, India, Pakistan, Myanmar (also known as Burma) and the Persian Gulf area where it can be found in the Tigris and Euphrates rivers in and around Iran and southern Iraq.

Characeristics- Hilsa Fish, popularly known as ilisha is rich in good quality fatty acids and Omega-3 that prevent coronary heart diseases in humans. Hilsa fish is one of the few fishes that is quite famous for its incredibly soft meat.

2.Barramundi

Scientific Name:Lates calcarifer
Common Bengali Name:Bhetki



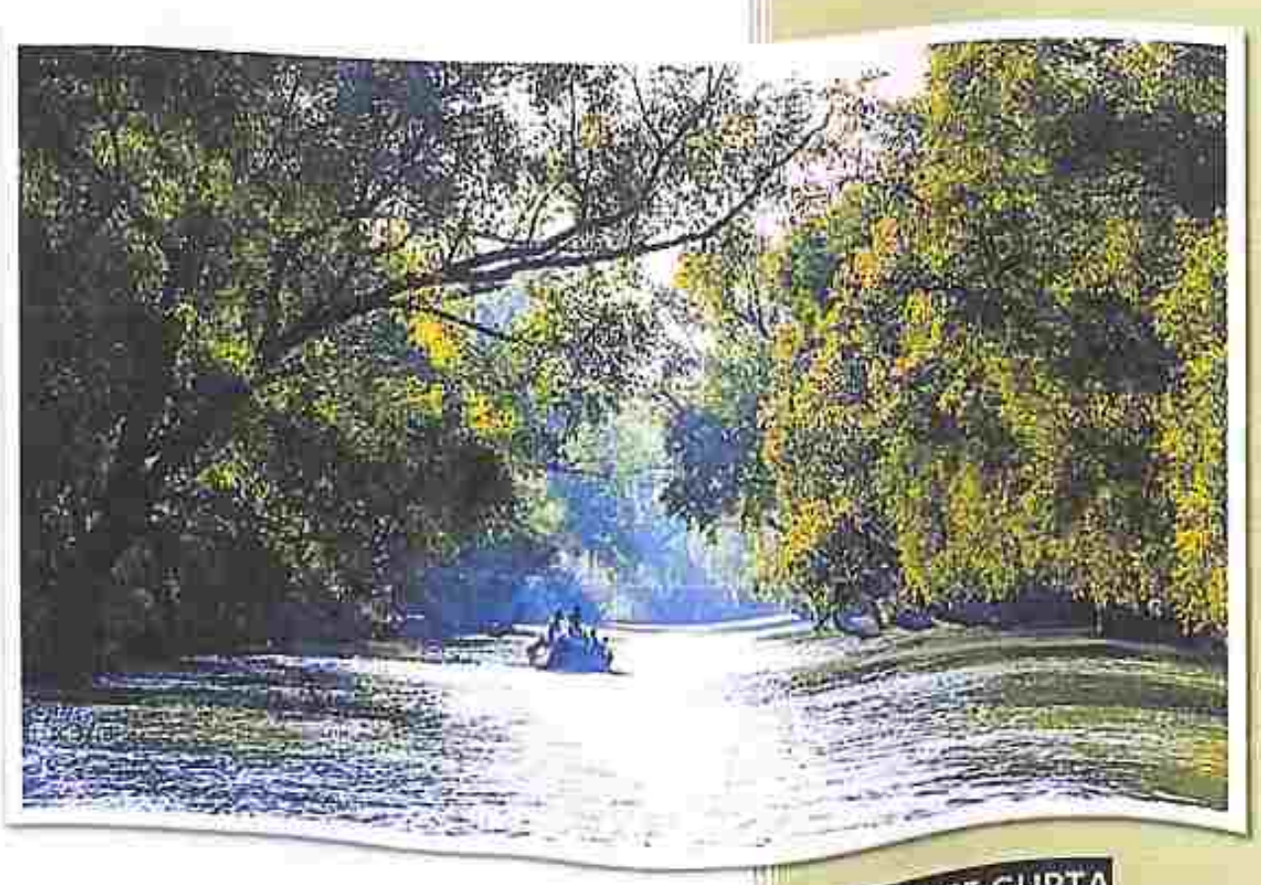
Vegetation Spectrum-The bhetki is a bony fish found in saline estuaries. It occa-sionally visits fresh water streams. The animal is one of the relished food fish and is abundantly available during the winter season.
Characeristics- Bhetki fish contain high level of omega-3 fatty acids that could lower the risk of cancer. It has nearly half the fat as compared to other fish such as salmon and it still gives an ample amount of nutrients like protein and minerals.

Characeristics- Bhetki fish contain high level of omega-3 fatty acids that could lower the risk of cancer. It has nearly half the fat as compared to other fish such as salmon and it still gives an ample amount of nutrients like protein and minerals.

15/6/21

ENVS PROJECT

STUDY ON SUNDARBAN WETLAND



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SEMESTER – II

DEPARTMENT - ASPV

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ACKNOWLEDGEMENT

I, Aksshee Gupta would like to thank RKB sir for giving the opportunity to work on this project and providing support and guidance.

THANK YOU

INTRODUCTION

Sundarbans is a marshy wetland with 60% of it in Bangladesh and the rest falling in India. Rivers like Ganga, Brahmaputra and Meghana drain and deposit all of its silt into this marsh. The ecosystem is unique in the sense that the freshwater rivers and saltwater from the Bay of Bengal confluence and have developed an endemic and enriching biosphere.

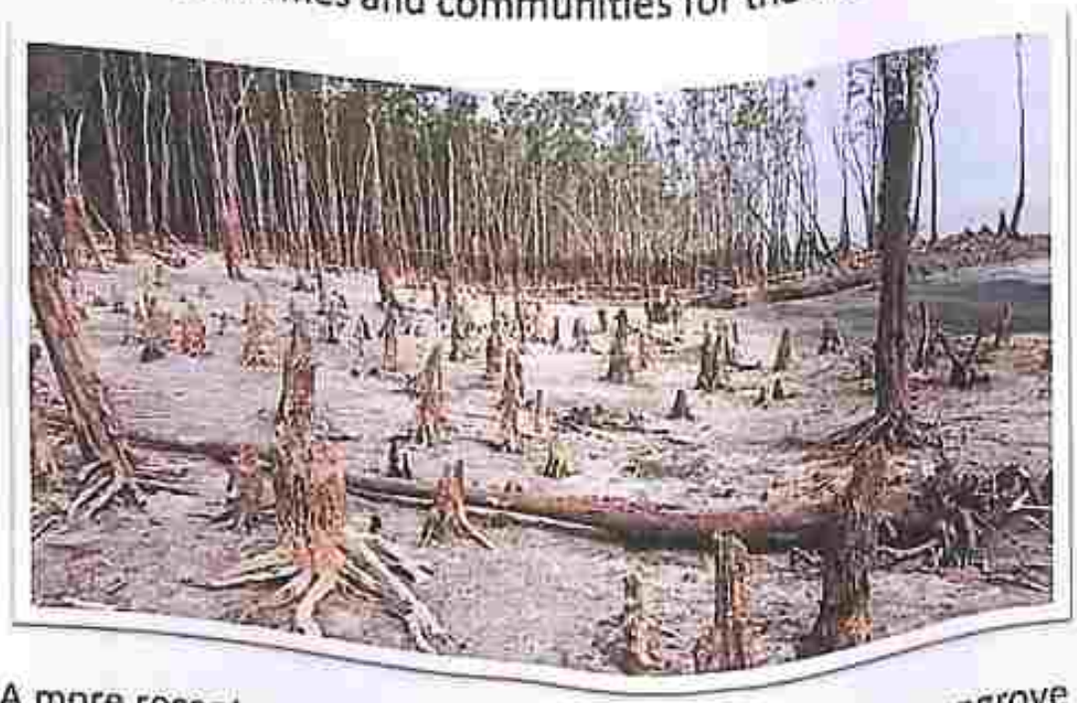
The world heritage site is struggling to survive

The Sundarbans – the largest contiguous mangrove forest in the world – is an area which has reached critical levels of exploitation and exhaustion through environmental degradation caused by human activity.

CAUSES & EFFECT

Deforestation

The main reasons for deforestation include, urban development, aquaculture, and the overexploitation of timber, fish, crustaceans, and shellfish. Urban development and population growth has increased the number of people living in mangrove forests, especially the Sundarbans. This has caused widespread deforestation in order to create new homes and communities for the increased population.



A more recent study found that the deforestation of mangrove forests from 2000 to 2012 released the amount of carbon dioxide nearly equivalent to the emission levels in the country of Myanmar during the same time period.

Shipping

Constant shipping has been a threat, the carelessness of which was represented by the oil spills in 2014 and in 2015. Around 500

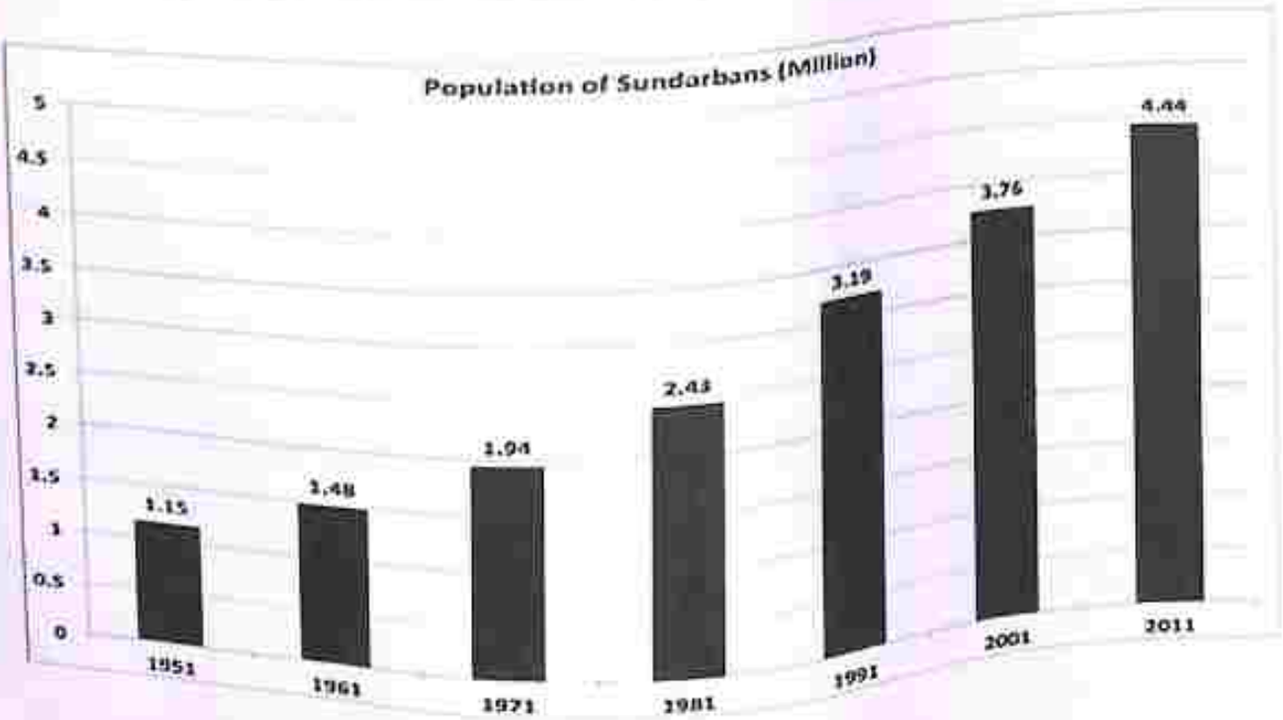
tonnes of heavy fuel leaked into the river waters. Shocking pictures of dead animals, oil-soaked plants and thick layers of oil floating over water rocked the newspapers and other media. No independent study of the damage caused to this sensitive mangrove forest was ever conducted.

Tiger Prawn Fishing

Indigenous shrimp farmers substituting traditional techniques for intensive machinery to curb capitalist need. Everyone won but nature. The consequence was rampant erosion of mud-dykes and weakening of the mangrove root system which ultimately affected the fish population and dependant food-chain.

Dead fishes and dolphins flood fields of Sundarban

IMPACT ON ECOLOGY



CAUSE	RESULT
Rampant Industrialization & Rapid Urbanization	Heavy Metal Pollution
Chemicals used by Agri & Aqua-culturist	Artificial Eutrophication
Tourism & Entertainment	Solid Waste/Plastic Pollution
Senseless Shipping	Oil Spills

All the above-mentioned results have made a huge impact on the ecology. These are nothing but adverse and unwanted by-products of the senseless push for indiscriminate economic development. This has made the place and its people very vulnerable numerable dimensions.

CONCLUSION

Human activities in the inhabited part of the Indian Sundarbans have a greater incremental impact on mangrove forests, salinity increase, relative mean sea level rise and land loss than previously assumed. Protection of wetlands is extremely complex and multiscalar because of the interaction of climatic threats, path-dependent development regimes and environmental governance. Enforcement of legal protection is intricately connected to power struggles and by no means a universal virtue.

The following references were used in the making of this project.

- indianexpress.com
- researchgate.net
- thethirdpole.net
- Wikipedia

15/6/22

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Project Report

On

Environmental Studies

Topic: A study on Agro-Ecosystem

GOKHALE MEMORIAL GIRLS' COLLEGE

(Affiliated to: University of Calcutta)

KOLKATA-700020

ACADEMIC SESSION: 2021 -2022

Submitted By: Procheta Das

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ACKNOWLEDGEMENT

I would like to show my special thanks of gratitude to my Environmental Studies

Teacher Mr. Raj Kumar Barman for giving me this opportunity to do this project

On the topic "A study on Agro-Ecosystem" . I would like to thanks our Principal

Mrs. Atashi Karpha for providing me with the constant facility. And also a

special thanks to my friends and parents who have constantly supported me in

completing this project.

Procheta Das

Contents:-

➢ What is Agriculture ?

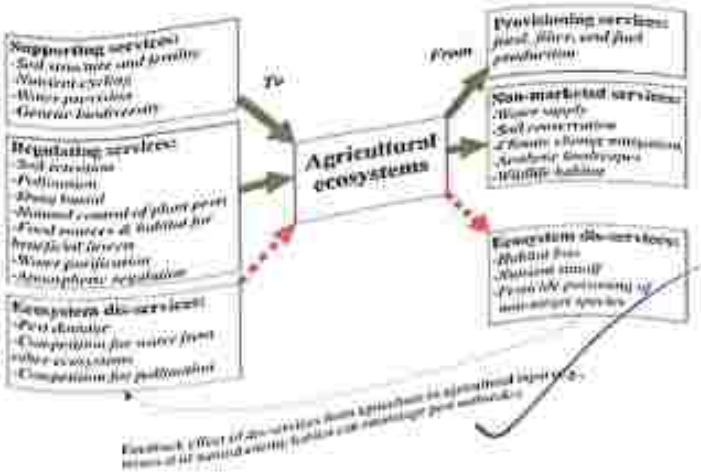
Agriculture is a key motor of the global economy. It supports the livelihoods and subsistence of the largest number of people worldwide and is vital to rural development and poverty alleviation, as well as food and non-food production.

➢ Saliency of Agriculture

The main challenge for the agricultural sector is to simultaneously: secure enough high-quality agricultural production to meet demand; conserve biodiversity and manage natural resources; and improve human health and well-being, especially for the rural poor in developing countries.

➢ Concept Of Agro-Ecosystem (Agriculture+ecosystem)

- Any ecosystem largely created and maintained to satisfy a human want or need is called an agro-ecosystem.
- Agroecological research is the idea that , by understanding ecological relationships and processes, agro-ecosystems can be manipulated to improve production and to produce more sustainably, with fewer negative environment or



➢ Sustainable Agriculture

Sustainable agriculture is farming in sustainable ways meeting society's present food and textile needs, without compromising the ability for current or future generations to meet their needs. It can be based on an understanding of ecosystem services.

The main goals of sustainable agriculture to be achieved are as follow:

- Satisfy human food and clothing (cotton,wool,leather) needs.
- Enhance environmental quality and natural resources
- Use non-renewable resources more efficiently
- Take better advantage of on-farm resources
- Employ natural and biological controls for pests and disease
- Sustain the economic viability of farming.

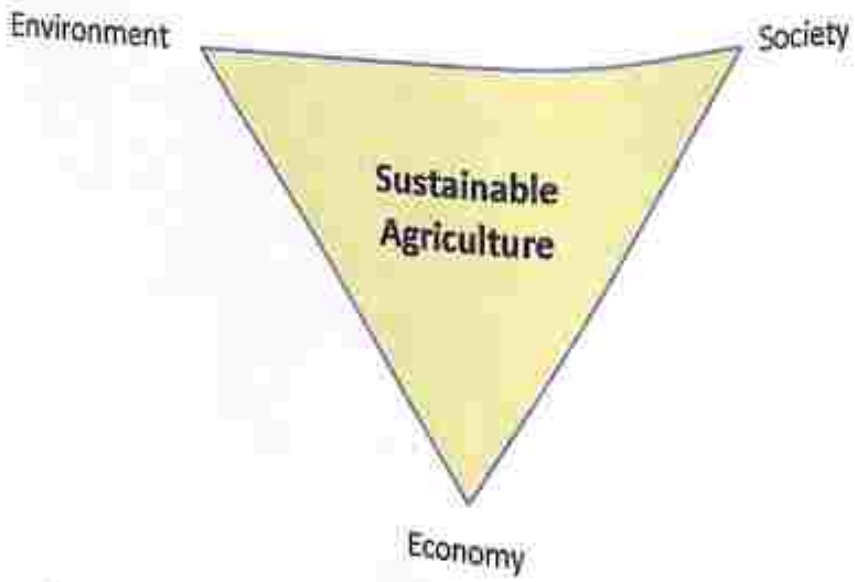
➢ Sustainable Agro-Ecosystem

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.

➢ Types of Agro-Ecosystems

There are three main categories of agroforestry: silvopastoral systems, agrisilvicultural systems, and agrosilvopastoral systems.

- A silvopastoral system is a type of agroforestry that combines livestock with a mixed landscape of trees, shrubs, and grasses.
- Agrisilvicultural systems are a combination of crops and trees, such as alley cropping or homegardens.



➢ Biodiversification

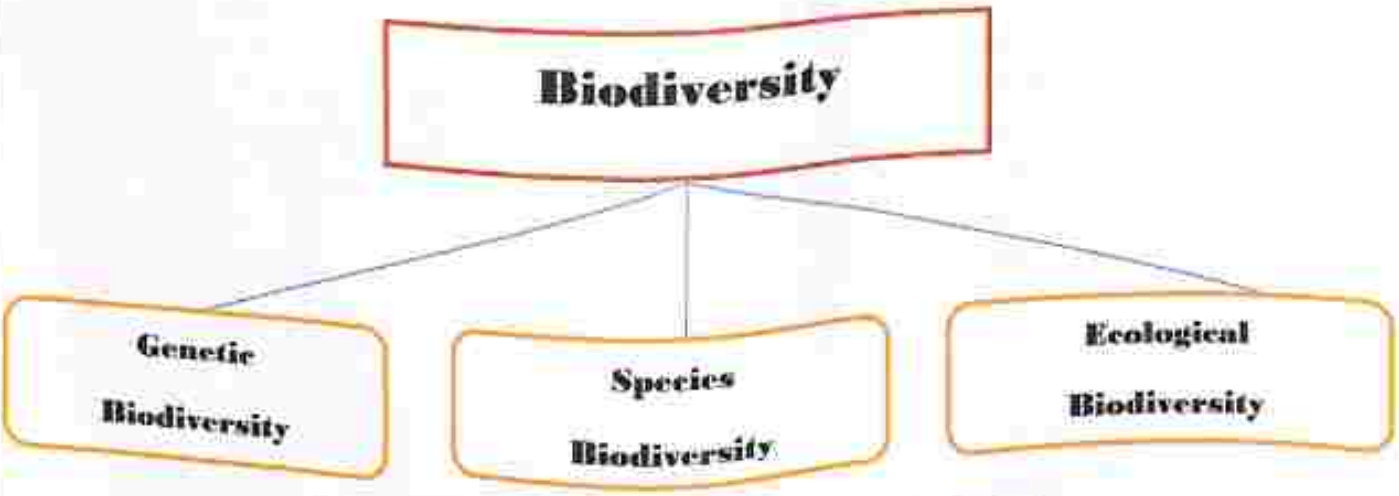
The process by which the diversity of plants or animals develops or is increased within a particular region or group of organisms.

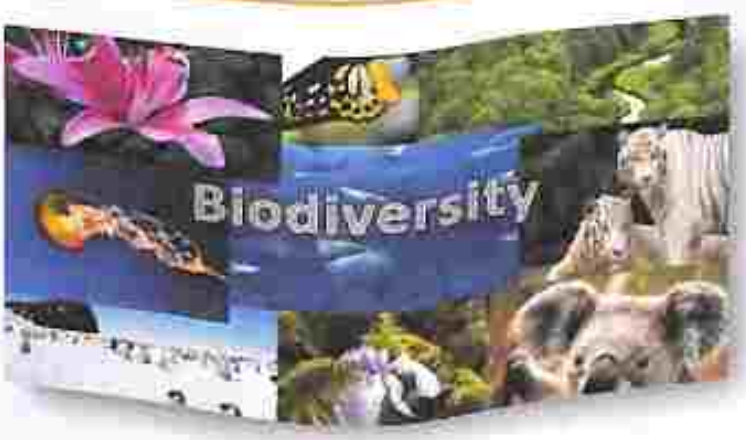
Biological diversity (biodiversity) is the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to climatic conditions and environmental conditions along with their interactions and processes.

➢ Types of Biodiversity

There are the following three different types of biodiversity:

- Genetic Biodiversity.
- Species Biodiversity.
- Ecological Biodiversity.





What is Agro-Biodiversity?

Agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes.

Agricultural biodiversity is the outcome of the interactions among genetic resources, the environment and the management systems and practices used by farmers. This is the result of both natural selection and human inventive developed over millennia.

Strategies of Agro-Ecosystem Conservation

The following strategies should be adopted to conserve and promote agrobiodiversity: (1) *in situ* conservation of agrobiodiversity, including habitat protection of wild populations, maintenance of native species and varieties in traditional agroecosystems, and relevant environmental education; (2) *ex situ* conservation and promotion of agrobiodiversity, including establishment of living collections and germplasm banks, and introduction of species and varieties into agroecosystems for agricultural practice; and (3) promotion and conservation of agrobiodiversity through sustainable uses, including technique development of propagation, cultivation, pest and disease control, on farm and off farm management, and other activities such as new variety breeding and scientific studies.

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ENVS PROJECT REPORT

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SEMESTER: 2

UNIVERSITY ROLL.NO: 213013-13-0024

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DEPARTMENT: ADVERTISING, SALES PROMOTION AND SALES MANAGEMENT

Reg. No. 013-1215-0248-21

TOPIC: Coal Mining and Local Environment: A Study in Talcher Coalfield of India(ODISHA)

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my ENVS teacher and our principal Dr. Atashi kharpa ma'am who gave me the golden opportunity to do this project on this topic. It helped me in doing a lot of Research and I came to know about a lot of things related to this topic.

Finally, I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

INDEX

INTRODUCTION

Since independence, improvement in the health status of the population by raising the access to and utilization of health, family welfare, and nutrition services has remained one of the major thrust for social development in India. But the development projects which have been initiated to reckon the country in the threshold of economic development have always proven to be injurious. At the same time, the drive to accomplish quick economic development both developed and developing countries are utterly harnessing the natural resources. Of the development activities, mining plays an important role in improving the economic aspects of a country. As the obvious reason of mining, diverse range of challenges is occurring. Despite voluminous growth, both in the fields of medical science and health, since some decades, environmental factors remain a major cause of disease and death globally. Even the continuous release of several pollutant particles is causing climate change in a wider aspect. Ecological imbalance is also adding one more feather in the aspect of environmental pollution. Hence, it can be stated that the economic cannot be fortified in its truest sense, whereas the broader impact of mining is on environment.

BACKGROUND

Indian mineral sector is playing a vital role not only to generate employment opportunities and improved livelihoods but also to provide sufficient space for environmental degradation. Moreover, the central impact of mining is long term and devastating as it shades negative impacts on local air and water quality, depletion of natural resources, decrease in rainfall, loss of cultivable land, etc. As per the official confirmation of Ministry of Mines, the country is bestowed with 87 minerals. Of them, the prime contributors are mica, coal, lignite, iron ore, bauxite, manganese, aluminum, and crude steel.Among these mineral reserves, coal has occupied a vital place by fulfilling around 55% of India's energy requirements. According to the report prepared by MoEF, the critically polluted areas of India due to coal mining are Korba, Anugul, Talcher, Hazaribagh-Chatra, Singrauli, Chandrapur, Raigarh, and Jharsuguda.The Central Pollution Control Board (CPCB) has developed a Comprehensive Environmental Pollution Index (CEPI). Central Pollution Control Board has done a nationwide environmental assessment of industrial clusters based on CEPI, and 43 such industrial clusters having CEPI greater than 70, on a scale of 0 to 100, have been identified as critically polluted. In Odisha, 3 clusters—Angul-Talcher, Jharsuguda, and Ib Valley—came under the category of critically polluted. Among these 3 regions, Angul-Talcher secured the highest position acquiring 82.09 CEPI score (SPCB, 2016).Even recently, CPCB has claimed Angul-Talcher region as critically polluted area in Odisha. In the Angul-Talcher region, pollution is caused primarily due to Bhushan Energy, Nalco Smelter, Bhushan Steel along with the Mahanadi Coalfields Limited's (MCL) Bharatpur and Bhubaneswari mines (The Pioneer; June 17, 2017). The central reason behind the pollution of air is the release of suspended particulate matter (SPM).

OBJECTIVES

This Project is an attempt to discuss the following environmental aspects of coal mining at Talcher coalfield region:

- The reasons behind environmental degradation.
- The impact of coal mining on local environment including air and water.

MATERIALS AND METHODS

This study was conducted in MCL region of Odisha, India. Mahanadi Coalfield Limited, a subsidiary of CIL, is divided into 3 parts as per its functioning areas, such as Talcher, Ib Valley, and Vasundhara. However, this study is confined to the opencast mining areas of MCL, Talcher (Map 1).

Map 1.

Talcher coalfield. Adapted from http://mahanadicoal.nic.in.

Talcher coalfield, bounded by latitudes 23°53′N and 21°12′N and longitudes 84°20′E and 85°23′E, covers an area of about 1800 km^2. It has 8 opencast and 3 underground coal mines in its 5 coal areas, namely, Jagannath area, Bharatpur area, Lingaraj area, Hingula area, and Talcher area.

In this study, the targeted population consists of those who bear the negative costs of mining. In the first stage, a list of all those villages which are near the mines was undertaken. Given the choice of a target population, the next step was to put together a list of the target population, known as the sample frame population, from which, ultimately, the sample was drawn. Second, a list of 6

villages was undertaken according to stratified random sampling procedure. The strata were decided on the basis of the distance from the mine. The significance of selection of the villages in this particular way is to capture the variations in the impact of livelihood due to mining activities.

The closer a village is to the mines, the more is the probability that is affected by the mining. Since mines have started operation 20 years ago, it is difficult to go for a before and after analysis. Instead, with and without comparison will be conducted. For the purpose of with and without comparison, 2 more villages are selected that are not affected by mining, but belong to the same district, as control villages. In the last stage, from each sample village households were selected on the basis of circular random sampling methods for final study (Table 1).

Table 1.

Sample villages.

To fulfil the objectives of the study, data were collected from both primary and secondary sources. For primary data collection apart from quantitative techniques, this study used qualitative anthropological tools. As part of qualitative data collection, the techniques such as observation (both participants and nonparticipants), case study, key informant interview, formal and informal interviews, and some of the participatory rural appraisal techniques such as focused group discussions, resource maps, and seasonal analysis were used. For gathering quantitative data, household survey was conducted using the pretested schedules. The secondary data were collected from official records, policy documents, published reports of similar projects, journals, and literature from social science discipline.

COAL MINING AND ENVIRONMENT

With due course of time, many environmentalists agreed that burning coal is the most polluting method for producing electricity and is causing huge environmental damage. The worst thing that occurs during this process is of course the production of greenhouse gases (mostly carbon dioxide emissions) by burning coal, but carbon emissions are not the only negative thing in this process, as it also involves varied harmful compounds that released during burning of coal. Besides burning process, environmental problems are also associated with transportation, storage and disposal, loading and unloading, blasting, etc. Because coal is predominantly mined from the surface of earth, this often causes damage to nearby ecosystems as many of the ecosystems above are degraded or sometimes even completely removed. Coal is usually transported by diesel trains over great distance, which means that it releases extra carbon dioxide and other harmful particles. And there is also coal dust that once produced contributes to particulate matter in the air which ultimately causes air pollution.

The trace factors contained in coal (and others formed during combustion) are a large group of various pollutants with a number of health and environmental effects. As a result, it disturbs ecosystem and endangers human health as well. Some cause cancer, others impair reproduction and the normal development of children, and still others damage the nervous and immune systems. Many are also respiratory irritants that can worsen respiratory conditions such as asthma. There is an environmental concern because they are often damaging ecosystems.

COAL MINING AND AIR POLLUTION

In the era of 21st century, this belt has become an industrial hub. Along with MCL, a good number of coal-based thermal power plants, several heavy industries, coal washeries, and a large number of subsidiary industrial units have come up in the area. All these mining and industrial activities have caused rapid degradation of environmental quality. Although, on one hand, the natural resources available are degrading very first, on the other hand, the demand for resources have risen in this locality because of rise in industries and inflow of outsiders.

Across the globe, mining activities have either direct or indirect association with air pollution.[34] Although the effect of mining, ie, opencast and underground, varies, the negative impact of opencast coal mining is much higher than that of underground mines. The activities such as drilling, blasting, and transportation are the central cause behind air pollution.[21,35] Even the release of fugitive dust into the air is also responsible for air pollution.[22] In this study, it is observed that in the mining-affected villages, due to the release of particulates and poisonous gases, the atmosphere has created havoc and panic among the villagers. As a result, all the opencast mines have directly or indirectly are contributing to the air pollution. Even the associated activities of opencast mines such as unloading and loading of coal, transportation of coal, poor condition of roads, and huge quantities of open air coal burning by the villagers are the causes responsible for air pollution. The data collected from field reflected in Table 2 show that around 95.33% households reveal that mining has polluted their local environment. As there is no much variance in responses, the reliability of the questionnaire shows high reliability.

Table 2.

Respondents' response on pollution.

Table 2. Respondents' response on pollution.

NAME OF THE VILLAGE	YES	NO	TOTAL
Balanga Khamar	73 (97.33)	2 (2.67)	75
Langijoda	59 (78.67)	16 (21.33)	75
Hensamul	75 (100.0)	0	75
Naraharipur	75 (100.0)	0	75
Danara	72 (96)	3 (4)	75
Jambu Bahali	75 (100)	0	75
Total	429 (95.33)	21 (4.67)	450 (100)

Table 3 reveals that around 96.44% villagers responded by saying that MCL is not taking any mitigation measures to apprehend the pollution caused by mining operations. Villagers also added that the mitigation measures which MCL claims that are implemented in the affected villages such as use of blast-less technology and use of water sprayer are nothing but white lies, and MCL is violating the environment

laws and its mitigation claims are totally baseless. However, during fieldwork, it was observed that although MCL has taken lots of initiation to control pollution, it failed in reaching at complete solution.

Table 3.

Respondents' response toward MCL's initiation to mitigate the pollution caused by mining.

Table 3. Respondents' response toward MCL's initiation to mitigate the pollution caused by mining.

NAME OF THE VILLAGE	MCL TAKING INITIATIVES TO MITIGATE POLLUTION		TOTAL
	YES	NO	
Balanga Khamar	6 (8)	69 (92)	75 (100)
Langijoda	5 (6.67)	70 (93.33)	75 (100)
Hensamul	5 (6.67)	70 (93.33)	75 (100)
Naraharipur	0	75 (100)	75 (100)
Danara	0	75 (100)	75 (100)
Jambu Bahali	0	75 (100)	75 (100)
Total	16 (3.56)	434 (96.44)	450 (100)

Abbreviation: MCL, Mahanadi Coalfields Limited.

Periodic sampling of air quality in MCL region is being done by the Regional office of State Pollution Control Board, Angul, Odisha. A brief comparison is made using their sampling results for Jagannath Opencast Project which is presented in Tables 4 and 5 and can be considered as a representation for the other opencast mining works in the surrounding region of Talcher coalfield. The highest concentrations of particulate matter are found within the mine with concentrations gradually diminishing with increasing distance from the mine,[37] and hence, the expected concentration within the Jagannath Opencast Project is much higher than the values reported in the above tables.

Table 4.

RSPM (PM_{10}) and SPM concentration in $\mu g/m^3$ (Jagannath Opencast Project).

Table 5.

SPM concentration in µg/m³ (Jagannath Opencast Project).

From tables, it is also observed that the concentration of these particulate pollutants is consistently increasing throughout the last decade. The SPM concentration is alarmingly high at all the sampling locations, whereas respirable suspended particulate matter (RSPM) concentration which once used to be within acceptable limits is now gradually approaching its standard acceptable value of 300 µg/m³. In some cases, it was observed that RSPM has crossed the standard limits. The rise in SPM in Jagannath colony, that is, residential area, is a matter of serious concern. The SPCB data of other mining areas show that both the SPM and respirable particulate matter (RPM) levels have crossed the minimum level even in most of the residential areas. The 2014 data collected from Hensamul village and coal transport of city road of Bhubaneswari mine and Kumuda village of Lingaraj mine show that both the SPM and RPM levels have crossed the minimum level in all the villages.

WATER POLLUTION

Another ill effect of coal mining is its impact on the water resources which perhaps is the most important aspect as far as the existence of the villagers is concerned. Villagers in the affected villages claimed that coal-related waste and coal sludge are often injected in the nearby water bodies which makes the water unfit for domestic use. The ponds which the villagers earlier used as a bathing *ghat* no more exist as either water has dried up or the water bodies have been clearly dominated by the coal-associated waste materials. During the field study, it was found that mining operations have exploited huge acres of lands. Few learned villagers also exclaimed that erosion normally causes loading of sediments which has chemical pollutants that cause varieties of environmental issues. In each and every mining-affected villages, it was witnessed that waste heap which consists of waste rocks may have coal-associated waste which can enter the groundwater through leaching and may cause contamination of groundwater. Villagers also expressed that they have also experienced a change in the taste of drinking water. Sources of water pollution.

Table 7. Sources of water pollution.

SOURCES OF WATER POLLUTION	FREQUENCY	PERCENTAGE
Mining water going to existing water sources	101	22.4
No recycling	60	13.33
Dumping ash	186	41.3
All	103	22.9
Total	450	100.0

Adapted from Field study.

Both the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) tests are a measure of the relative oxygen-depletion effect of a waste

contaminant. Both have been widely adopted as a measure of pollution effect. The BOD test measures the oxygen demand of biodegradable pollutants, whereas the COD test measures the oxygen demand of biodegradable pollutants plus the oxygen demand of nonbiodegradable oxidizable pollutants. The data presented above show that suspended sediments and COD in most of the mining areas and BOD in few cases have crossed the specified standard. Aquatic life will be disturbed due to reduction in photosynthesis, high suspended sediments, COD, and BOD. However, the recent initiation taken by MCL for zero discharge of mining water will solve most of the water related problems.

Drainage water from the mines discharged into various streams and rivers has affected the aquatic life. Many wildlife species are highly dependent on vegetation growing in natural drainages. This vegetation provides essential food, nesting sites, and cover for escape from predators. The development of mining projects destroys vegetation near ponds, reservoirs and reduces the quality and quantity of habitat essential for waterfowl, shore birds, and many terrestrial species. The loss of habitat requirements for many animals did not permit them to adjust to changes created by land disturbance. As a result, it has reduced wildlife.

NOISE POLLUTION

Coal mining is a loud, daylong, and nightlong process that includes blasting, drilling, and continuous movement of heavy vehicles. These mining-related activities have resulted in emission of loud noise which has disrupted the lives of those in the surrounding communities and has reduced the quality of life.[32] During field investigation, there was clear evidence that the ill effects of mining affected not only the environment but also the human habitats as well. Blasting which is done for the coal extraction shakes the ground for some distance around the blast site. Residential properties around the quarry have experienced significant increases in the effects of blasts. Villagers were very sad about the fact that they had invested astronomical amount of money for their houses, but the vibration which emerges out due to mining has given the villagers a big jolt. More than 60% of the villagers expressed that blasting-related operations are making the children terrified and have brought disturbance in their studies. According to some residents, they could not sleep at night because of the blasting and the fact that heavy-duty trucks operate virtually all night to cart coal to the company's plant. Table 9 represents that around 91% of the households reported blasting as the major cause of noise

pollution and 9% of the households replied that the movement of heavy vehicles in the mining area creates a noise pollution which was not found in the control villages. Due to noise pollution, the households faced a lot of problems, ie, hearing, mental disturbance, disturbance in students' studies, and house cracking, which are clearly shown in Table 10.

Table 9.

People's Perception towards Causes of Noise Pollution.

Table 9. People's Perception towards Causes of Noise Pollution.

CAUSES OF NOISE POLLUTION	FREQUENCY	PERCENTAGE
Movement of heavy vehicle	42	9.3
Blasting	408	90.7
Total	450	100.0

Adapted from Field study.

Table 10.

Issues associated with noise pollution.

Table 10. Issues associated with noise pollution.

PROBLEMS FACED DUE TO NOISE POLLUTION	FREQUENCY	PERCENTAGE
Hearing	23	5.1
Mental disturbance	58	12.89
Student study disturb	3	0.7
House cracking	366	81.3
Total	450	100.0

Adapted from Field study.

So far, noise pollution is a concern; it is due to heavy machineries and blasting operations. So, workers in mines should be provided with hearing protection devices and duration of exposure should be reduced to minimize the adverse health effects. It was noticed that the company is providing sufficient hearing protection materials (earplugs and earmuffs) to operators and workers to reduce health hazards from noise. But it is seen that operators are not following the norms. Although officials from MCL said that blasting time is very much limited and its effect is minimized using electronic delay detonators, the villagers claimed that they are highly victimized due to blasting, and during fieldwork, most of the households have also visualized cracks in their walls.

IMPACT ON LOCAL BIODIVERSITY

The development of coal mines has led to the loss of forest cover and simultaneously affected biodiversity and wildlife corridors in these forest areas. According to the Ministry of Coal (MoC), about 60% of coal resources are located in the forest areas (MoC, 2005). Most coal blocks allocated in the last few years have been in or adjoining forest areas. Of all the coal leases acquired by CIL, 28% lay under forest region, ie, out of which 2 00 000 ha are coal leases and 55 000 ha lay under forest cover (Greenpeace Report, 2012).

The MoC estimated that given the rising demand the need for forestland for mining will increase from about 22 000 ha in 2005 to 75 000 ha by 2025. In Angul-Talcher region in Odisha, for instance, forest cover has reduced by 11% between 1973 and 2007 due to coal mining (Singh, 2010). Coal mining, especially opencast mining and the evacuation of coal, requires large tracts of land for extraction processes, industrial purposes such as thermal power plants and captive plants, as well as ancillary processes such as OB dumps, pipelines, railway lines, and public works. It destroys not only the standing forests but also animal corridors, which diverted the streams.

Mining has affected the local environment and associated biota through the removal of vegetation and topsoil, the displacement of fauna, the release of pollutants, and the generation of noise. Mining of coal, both surface and subsurface, causes enormous damage to the flora, fauna, hydrological

relations, and soil biological properties of the systems. Destruction of forests during mining operation is invariably accompanied by an extensive damage and loss to the system. The OB of coal mines when dumped in unmined areas creates mine spoils which ultimately affects the surrounding vegetation.

The destruction of ecosystem in postmining period has brought a great loss to the wildlife and their habitat. Both directly and indirectly it has damaged the wildlife. These animals live in communities that depend on each other. Survival of these species can depend on local ecosystem, soil conditions, local climate, altitude, and other features of the local habitat. The impacts stem primarily from disturbing, removing, and redistributing the land surface. Some impacts are short term and confined to the mine site; others may have far-reaching, long-term effects. The most direct effect on wildlife is destruction or displacement of species in areas of excavation and heaping of mine wastes. As per villagers view, most of the wildlife species are extinct. Mobile wildlife species, such as game animals, birds, and predators, have left these areas. More sedentary animals, such as invertebrates, many reptiles, burrowing rodents, and small mammals, are severely affected. The fragmentation of habitats due to mining activities has made difficult for some animals for their ecological move. In some cases, the isolation has led to local decline of species or genetic effects such as inbreeding. Species that require large patches of forest simply disappeared.

CONCLUSIONS

Environmental degradation is inevitable while it is associated with developmental activities such as coal mining. In this study, it was observed that in comparison with control villages, the mining-affected villages witnessed varied environmental issues. With increased production of coal, the environment of mining-affected villages is degrading hurriedly. Although the mining authorities claimed that they have taken varied precautionary measures to control the level of pollution, it still is responsible for air-related, water-related, and noise-related pollutions. Although the concentration of SPM and RSPM in some areas is going beyond the permissible limits, this ultimately is responsible for numerous respiratory diseases. Even it has decreased the average life span of project-affected persons. Similarly, the groundwater quality in Talcher-Anugal industrial complex has crossed more than 100 which is not at all suitable for drinking. The rise in suspended sediments, COD in most of the mining areas and BOD in few cases, has crossed the specified standard in mining drainage water. This may disturb the aquatic

life in local areas. The ill effect of noise pollution is not only increasing the household repairing cost but it is also responsible for some sort of hearing as well as mental disturbances. From the existing air, water, and noise quality data; personal observation; interactions; and through photographic collection of the study area, it can be concluded that a major initiation is required to control the environmental degradation by minimizing several aspects of pollution.

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