UNIVERSITY OF CALCUTTA

Notification No. CSR/ 12 /18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

List of the subjects

Sl. No.	Subject	Sl. No.	Subject
1	Anthropology (Honours / General)	29	Mathematics (Honours / General)
2	Arabic (Honours / General)	30	Microbiology (Honours / General)
3	Persian (Honours / General)	31	Mol. Biology (General)
4	Bengali (Honours / General /LCC2 /AECC1)	32	Philosophy (Honours / General)
5	Bio-Chemistry (Honours / General)	33	Physical Education (General)
6	Botany (Honours / General)	34	Physics (Honours / General)
7	Chemistry (Honours / General)	35	Physiology (Honours / General)
8	Computer Science (Honours / General)	36	Political Science (Honours / General)
9	Defence Studies (General)	37	Psychology (Honours / General)
10	Economics (Honours / General)	38	Sanskrit (Honours / General)
11	Education (Honours / General)	39	Social Science (General)
12	Electronics (Honours / General)	40	Sociology (Honours / General)
13	English ((Honours / General/ LCC1/ LCC2/AECC1)	41	Statistics (Honours / General)
14	Environmental Science (Honours / General)	42	Urdu (Honours / General /LCC2 /AECC1)
15	Environmental Studies (AECC2)	43	Women Studies (General)
16	Film Studies (General)	44	Zoology (Honours / General)
17	Food Nutrition (Honours / General)	45	Industrial Fish and Fisheries – IFFV (Major)
18	French (General)	46	Sericulture – SRTV (Major)
19	Geography (Honours / General)	47	Computer Applications – CMAV (Major)
20	Geology (Honours / General)	48	Tourism and Travel Management – TTMV (Major)
21	Hindi (Honours / General /LCC2 /AECC1)	49	Advertising Sales Promotion and Sales Management –ASPV (Major)
22	History (Honours / General)	50	Communicative English –CMEV (Major)
23	Islamic History Culture (Honours / General)	51	Clinical Nutrition and Dietetics CNDV (Major)
24	Home Science Extension Education (General)	52	Bachelor of Business Administration (BBA) (Honours)
25	House Hold Art (General)	53	Bachelor of Fashion and Apparel Design – (B.F.A.D.) (Honours)
26	Human Development (Honours / General)	54	Bachelor of Fine Art (B.F.A.) (Honours)
27	Human Rights (General)	55	B. Music (Honours / General) and Music (General)
28	Journalism and Mass Communication (Honours / General)		

The above shall be effective from the academic session 2018-2019.

SENATE HOUSE
KOLKATA-700073
The 4th June, 2018

Paul 4/6/18
(Dr. Santanu Paul)
Deputy Registrar

University of Calcutta

Under Graduate Curriculum under Choice Based Credit System (CBCS)

Syllabus forAbility Enhancement Compulsory Course-2 (AECC-2) in
Environmental Studies

Semester-2

Total Marks-100*(Credit -2)*
(50 Theory-MCQ type + 30 Project + 10 Internal Assessment + 10 Attendance)

[Marks obtained in this course will be taken to calculate SGPA & CGPA]

Theory

Unit 1	**Introduction to environmental studies**	2 lectures
	•Multidisciplinary nature of environmental studies; •Scope and importance; Concept of sustainability and sustainable development.	
Unit 2	**Ecology and Ecosystems**	6 lectures
	•Concept of ecology and ecosystem, Structure and function of ecosystem; Energy flow in an ecosystem; food chains, food webs; Basic concept of population and community ecology; ecological succession. •Characteristic features of the following: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, wetlands, rivers, oceans, estuaries)	
Unit 3	**Natural Resources**	8 lectures
	• Concept of Renewable and Non-renewable resources • Land resources and landuse change; Land degradation, soil erosion and desertification. •Deforestation: Causes, consequences and remedial measures •Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). •Energy resources: Environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs.	
Unit 4	**Biodiversity and Conservation**	8 lectures
	•Levels of biological diversity: genetic, species and ecosystem diversity; • Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots •India as a mega-biodiversity nation; Endangered and endemic species of India •Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; •Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. •Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	
Unit 5	**Environmental Pollution**	8 lectures
	• Environmental pollution: concepts and types, • Air, water, soil, noise and marine pollution- causes, effects and controls • Concept of hazards waste and human health risks • Solid waste management: Control measures of Municipal, biomedical and e-waste.	

Unit 6	**Environmental Policies and Practices**	7 lectures
	•Climate change, global warming, ozone layer depletion, acid rain and their impacts on human communities and agriculture •Environment Laws: Wildlife Protection Act; Forest Conservation Act. Water (Prevention and control of Pollution) Act; Air (Prevention & Control of Pollution) Act; Environment Protection Act; Biodiversity Act. •International agreements: Montreal Protocol, Kyoto protocol and climate negotiations; Convention on Biological Diversity (CBD). •Protected area network, tribal populations and rights, and human wildlife conflicts in Indian context.	
Unit 7	**Human Communities and the Environment**	6 lectures
	•Human population growth: Impacts on environment, human health and welfare. •Case studieson Resettlement and rehabilitation. • Environmental Disaster: Natural Disasters-floods, earthquake, cyclones, tsunami and landslides; Manmade Disaster- Bhopal and Chernobyl. •Environmental movements: Bishnois.Chipko, Silent valley,Big dam movements. •Environmental ethics: Role of gender and cultures in environmental conservation. •Environmental education and public awareness	
Project/ Field work		Equal to 5 lectures
	•Visit to an area to document environmental assets: Natural resources/flora/fauna, etc. •Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. •Study of common plants, insects, fish, birds, mammals and basic principles of identification. •Study of ecosystems-pond, river,wetland, forest,estuary and agro ecosystem.	
	Total	50 Lectures

Suggested Reading:

Asthana, D. K. (2006).*Text Book of Environmental Studies*. S. Chand Publishing.

Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

Basu, R. N., (Ed.) (2000). *Environment*. University of Calcutta, Kolkata

Bharucha, E. (2013). *Textbook of Environmental Studies for Undergraduate Courses*. Universities Press.

De, A.K., (2006).*Environmental Chemistry*, 6th Edition, New Age International, New Delhi.

Mahapatra, R., Jeevan, S.S., Das, S. (Eds) (2017). *Environment Reader for Universities*, Centre for Science and Environment, New Delhi.

Masters, G. M., &Ela, W. P. (1991).*Introduction to environmental engineering and science*. Englewood Cliffs, NJ: Prentice Hall.

Odum, E. P., Odum, H. T., & Andrews, J. (1971).*Fundamentals of ecology*. Philadelphia: Saunders.

Sharma, P. D., & Sharma, P. D. (2005).*Ecology and environment*.Rastogi Publications.

Project

(Study of Local Flora and Fauna Diversity)

Scottish Church College

Environmental Studies

B.SC(Hons)
Sem-II

C.U Registration no: 223-1113-0396-19
C.U. Roll no: 193223-21-0011

Index

INTRODUCTION:

- **Asansol** is a metropolitan city in the Indian state of West Bengal. It is the second largest and most populated city of West Bengal and the 39th largest urban agglomeration in India.
- "Asan", a species of tree which generally grows thirty meters tall, is found on the banks of the Damodar River; "sol" refers to land. The name "Asansol" is a combination of these two words. Asansol is a city on the banks of Damodar and its land is rich in minerals.
- Of all the living organisms on the planet, the most commonly seen by us are the plant life and the animal life. Apart from these two, more forms of life abound in the earth, but are harder to see with the naked eye. This is why the flora and fauna i.e. plant and wildlife of the earth are fascinating to observe and study.
- Flora and fauna are words originating from Latin. Flora in Latin means the goddess of the flower. Flora is also derived from the word floral, which means relating to flowers. Therefore flora is a group of indigenous plants in an ecosystem of a geographical region.
- The origin of the word fauna is a bit shrouded in mystery. According to Roman mythology, Fauna refers to the goddess of fertility. Fauna is sometimes referred to as Fauns, meaning forest spirits. By definition, fauna is a group of indigenous animals of any geographical region.
- So, the term flora and fauna was coined by biologists to refer to a collection of plant and animal specifies in a given geographic location. This is why you hear phrases like flora and fauna of India, flora, and fauna of Indonesia and so on.

Importance of Flora and Fauna

1. Maintains Ecological Balance

Without flora and fauna, humans cannot exist. The flora generates and releases oxygen, which is needed by the fauna for respiratory purposes. In return, the fauna produces and releases carbon dioxide, which is needed by the flora for photosynthesis.

It's a symbiotic kind of relationship. In the same line, humans cannot get by without both flora and fauna. The oxygen that we breathe in comes from the flora, and the carbon dioxide we exhale is vital for the flora.

Also, humans benefit a lot from flora and fauna in regards to sources of food, medicine, and water. Our main source of food emanates from plant and animal species. Over 90% of medicine we use to cure diseases comes from flora. If it were not for the flora, there would be no water, which means we would not exist right now.

Animals also maintain the equilibrium across the board by predating on plants and other animals that could have otherwise exploded in regards to population. They also enable other rare species of plants to mushroom by pollinating other plants.

Animal droppings are a source of fertilizer for plants. When animals die, they act as a supplemental mineral for plants. Also, microorganisms on the Earth' surface benefit from abundance of food as a result of animal droppings.

2. Medicinal Importance

In addition, flora and fauna are medicinally important for us as a wide range of medicines and herbs can be extracted from them. All animals of a particular region or habitat make up the Fauna population that majorly contribute to producing medications and drugs to treat human ailments. Similarly, drugs and herbs can be produced from plants existing in nature that help in human- well being.

3. Aesthetic value

Humans love and appreciate nature. Many like spending time in outdoor settings such as forests, natural areas, parks and other green-spaces because of their aesthetic value. This aesthetic value is mainly contributed by spread of flora and fauna.

Statistics tell the story, each year, up to half a billion people visit beautiful protected sceneries like national parks, recreation areas, indigenous forests, historic sites, wildlife refuges and wild and scenic rivers to experience the beauty of the landmarks. This further underlines the significance of flora and fauna to our day to day lives.

4. Expands local economies

Flora and Fauna leads to enhanced tourism, be it attracting tourists and scientists at Amazon forests or sanctuaries, which further leads to regulating and increasing the economical value. Widespread flora and fauna have huge importance in expanding local economies.

Exotic vacation locations like the Caribbean, Bahamas, Panama, Indonesia and so on attract more tourists than any country due to the widespread flora and fauna.

AREA OF STUDY:

Lower Chelidanga, Asansol - 713304.

23°692389 and 23°41'32.6“ North

86°959917 and 86°57'35.7“ East

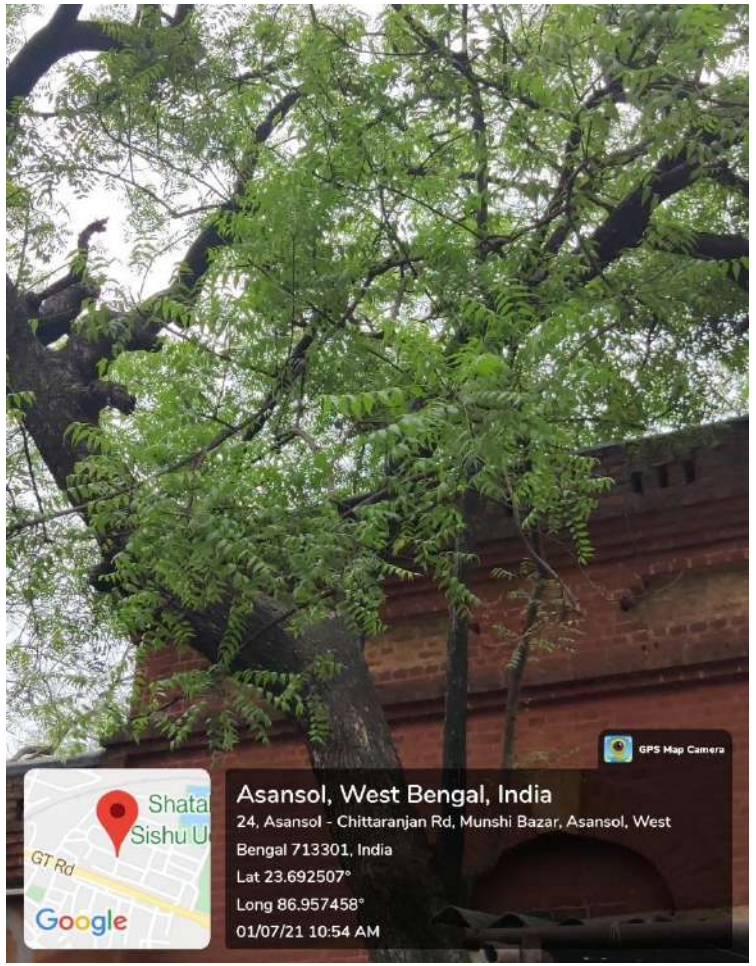
METHOD OF STUDY:

Visiting local areas and taking pictures and collecting information of bird and plants.

Observation

Flora:

1) MARGOSA TREE



Scientific name: *Azadirachta indica.*
Vernacular Name: Neem, Kadu-limb.

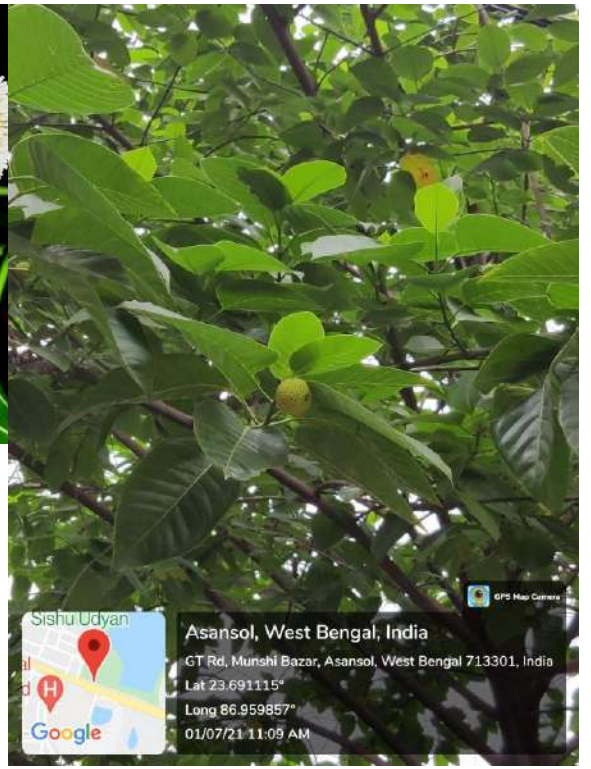
Source :The leaves, bark, flowers, fruits and seeds are used as a drug.

Family: Meliaceae, it is native of Burma but grown all over India.

Chemical composition: The alkaloids are the main active principles. They are nimbin, nimbinin, nimbidine, nimbosterine and nimbectin etc. fatty acid present in the plant and seed contain 40 to 45 % fixed oil.

Uses: The leaves are carminative, expectorant, anthelmintic, diuretic and insecticidal properties. Fresh leaf juice with salt given for intestinal worms, jaundice, skin disease and malarial fever. The leaves are applied for boils, chronic ulcers, swelling and wounds. Bark is used for liver complaint, remove round worms. Gum is stimulant, demulcent tonic and used in debility.

2) **BUR-FLOWER TREE**



Scientific name: *Neolamarckia cadamba*
Vernacular Name: Kodom, Nip, Kodombo.

Source : It has scented orange flowers in dense globe-shaped clusters.
The flowers are used in perfumes.
The tree is grown as an ornamental plant and for timber and paper-making.

Family: Rubiaceae

Chemical composition: The ripe edible fruit contains 2.39% fat, 2.11% proteins, and 1.46% total ash, which was found to be higher than mature and immature fruits.

Uses: The fruit and inflorescences are reportedly edible by humans. The fresh leaves are fed to cattle. *N. lamarckia* is grown as an ornamental, and for low-grade timber and paper. The timber is used for plywood, light construction, pulp and paper, boxes and crates, dug-out canoes, and furniture components.

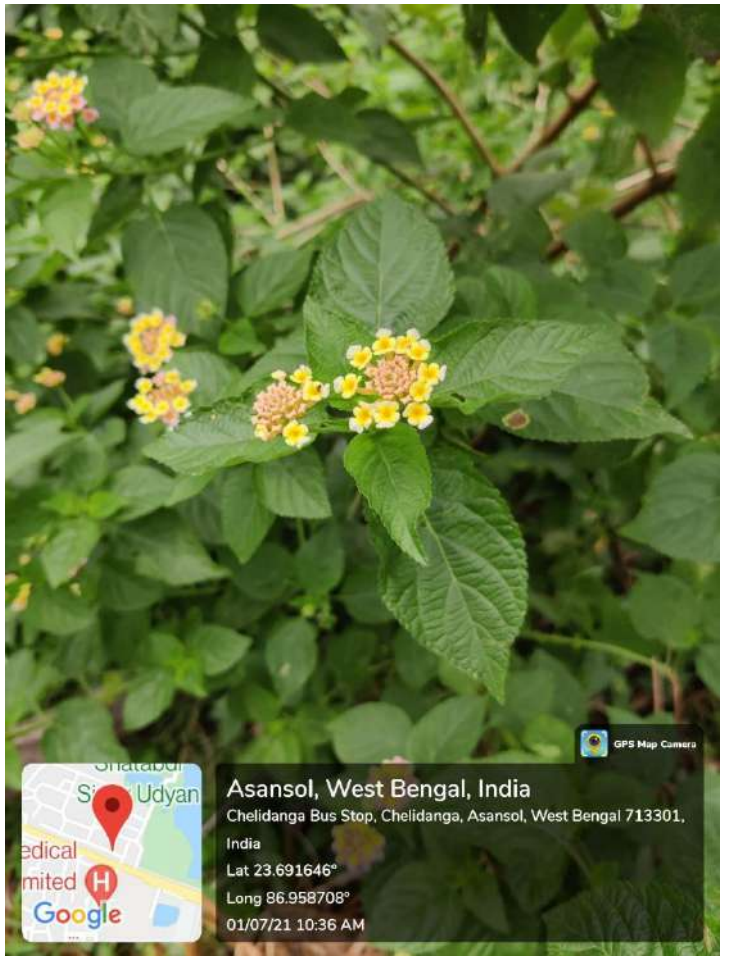
3) LATANA FLOWER

Scientific name: *Lantana camara*
Vernacular Name: Putus, Gu Phool.

Source : Wild weed.

Family: Verbenaceae

Chemical composition: [3,7,11-trimethyl-1,6,10-dodecatriene (28.86%), beta-caryophyllene (12.28%), zingiberene (7.63%), gamma-curcumene(7.50%) and alpha-humulene (3.99%)] represented the major ones.



Uses: *Lantana camara* stalks have been used in the construction of furniture, such as chairs and tables; however, the main uses have historically been medicinal and ornamental.

As a host-plant

Many butterfly species feed on the nectar of *L. camara.* as an opportunistic flower feeder. A jumping spider *Evarcha culicivora* has an association with *L. camara*. They consume the nectar for food and preferentially use these plants as a location for courtship.

4) **JASMINE FLOWER**

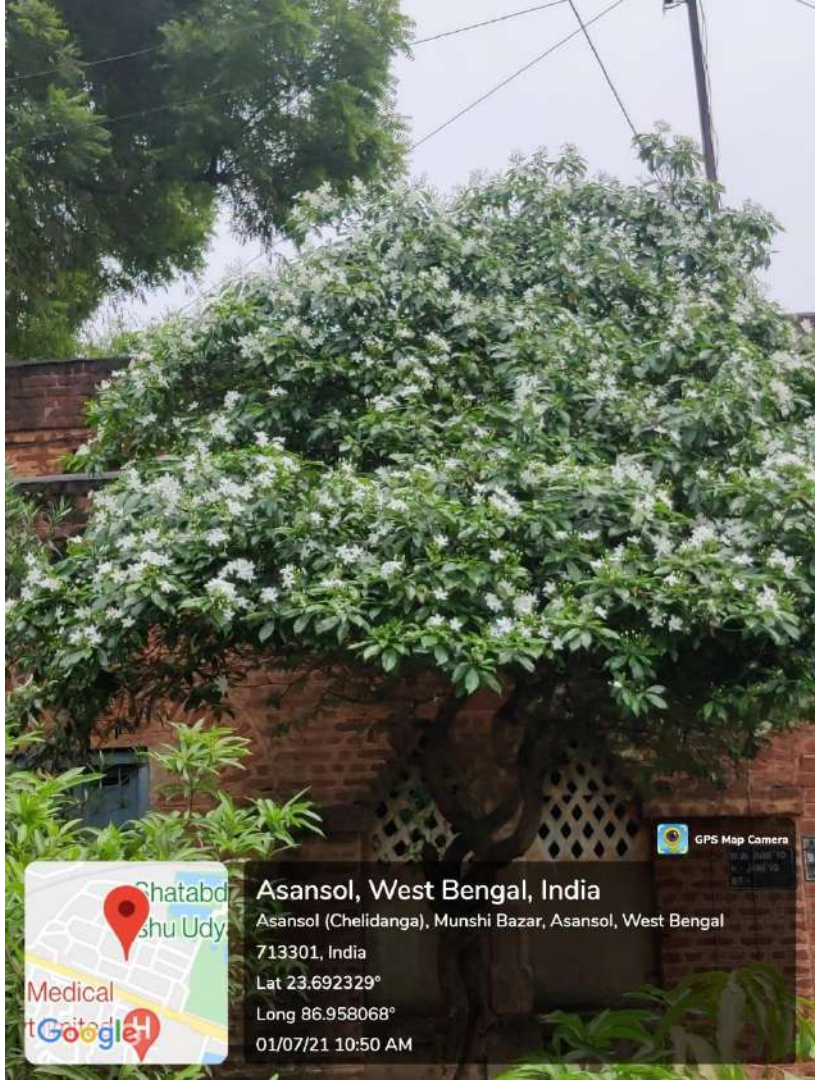
Scientific name: *Jasminum*
Vernacular Name: Tagar Gach

Source: Scented flower , gardening.

Family: Oleaceae

Chemical Composition: Benzyl acetate, linalool, cis-jasmone, benzyl alcohol, benzyl salicylate, cis-3-hexenol, eugenol, methyl anthranylate.

Uses: Widely cultivated for its flowers, jasmine is enjoyed in the garden, as a houseplant, and as cut flowers. The flowers are worn by women in their hair in South and South East Asia.



5) **PERIWINKLE**

Scientific Name: *Catharanthus roseus*
Vernacular Name: Sadaphuli, sadabahar.

Source: The dried leaves and roots of this plant used as a drugs.

Family: Apocynaceae

Chemical composition: Catharanthus mainly consists of glycosides and alkaloids. The alkaloids are present in entire plant, found in more proportion in leaves and root. Some important alkaloids are vinblastine, vincristine, other alkaloids present in the plant are ajmalcine, serpentine, lochnerine, tetrahydroalstonine, vindoline, vindolinine and catheranthine.

Uses: It is used in hypotensive, antidibetic action, other dimer indole-indoline used for curing the anticancer activity. The alkaloids vincristine is highly active in treatment of childhood leukaemia. Vincristine proves effective in breast cancer and the leaves are used in diabetes.

6) **BANANA TREE**

Scientific Name: *Musa acuminata*
Vernacular Name: Kola Gach.

Source: Edible fruits.

Family: Musaceae

Chemical composition: All morphologic parts of **banana plant** contained considerable amounts of ashes (from 11.6 to 26.8%) composed mainly by potassium, calcium and silicium salts. The hemicelluloses in **banana plant** are proposed to be mainly glucuronoxylan and xyloglucan (from 5.5% in floral stalk to 21.5% in petioles/midrib).

Uses: The flower of this plant is **used** to treat ulcers, dysentery, and bronchitis and cooked flowers are good food for diabetics. The astringent ashes of the unripe banana peel and leaves are **used** in the treatment of dysentery and diarrhea and also for the treatment of malignant ulcers.

7) **BASIL PLANT**

Scientific Name: *Ocimum tenuiflorum*
Vernacular Name: Tulsi

Source: Aromatic perennial plant , Herb

Family: Lamiaceae

Chemical composition: Some of the phytochemical constituents of tulsi are oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, and β-caryophyllene (about 8%).

Uses: *Tulsi* (Sanskrit:-Surasa) has been used in Ayurveda and Siddha practices for its supposed treatment of diseases.

For centuries, the dried leaves have been mixed with stored grains to repel insects.

Also used for the common cold, influenza ("the flu"), H1N1 (swine) flu, diabetes, asthma, bronchitis, earache, headache, stomach upset, heart disease, fever, viral hepatitis, malaria, stress, and tuberculosis.

8) **ALOE VERA**

Scientific Name: Aloe barbadensesMills.
Vernacular Name: Korphad, Gritakumari

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

Family: Liliaceae

Chemical composition: The main active principle present in Aloe is crystalline glucoside known as barbaloin, other constituent like resin and derivatives like emodin, chrysophanic acid, anthroquinones, emoclin, also it contain glucose, galactose, mannose and galacturonic acid with protein. The plant contain aloesone and aloesin.

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

9) INDIAN GOOSEBERRY

Scientific Name: Phyllanthus emblica
Vernacular Name: Avala, Dongri Avala, Amla.

Source: Fresh and dried fruit.

Family: Phyllanthus emblica

Chemical composition: The fruit is the richest source of Vitimin C. The other imporntant constituents are gallic acid, tannic acid, gum, sugar, fat, phyllemblin, minerals Fe, P, Ca. Bark contain tannin and seeds contain fixed oil and essential oil.

Uses: Amla fruit which is acrid, cooling, refrigerant, diuretic and mild laxative. Fresh fruit used in intestine worms, pulp of fruit used in to cure the jaundice, anaemia, dyspepsia and scurvy. From this fruit famous ayurvedic tonic 'Chavanprash' and 'Triphala churn' is prepared. Dried fruit are used in haemorrhage (bleeding), diarrhea, dysentery, cough. It is used as laxative, headache, piles, liver. Seed applied in scabies and itching. Fruit juice is used in hair dye and seed oil and fruit juice are used in the preparation of hair oils and shampoos. Leave are used as a fodder. The fruit are also used in preparation of inks.

10) **PURGING CASIA**

Scientific Name: *Cassia fistula*
Vernacular Name: Bahwa, Amaltas

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

Family: Fabaceae

Chemical composition: 1-8 dihydroxyanthraquinone, Tryptamines , Fistucacidin(3,4,7,8,4,pentahydroxyflavan Oxyanthraquinone, Epincatechin, Procyanidin B2, Biflavanoids, Rhenin, Physcion, Kaempferol, Chrysophanol, Fistulin, Fistulic acid.

Uses: The sweet blackish pulp of the seedpod is used as a mild laxative. The wood is hard and heavy 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. Bark is laxative, anthelmintic, emetic, febrifuge, diuretic and depurative. It is useful in boils, leprosy, rignworms affection, colic, dyspepsia, constipation, diabetes, stranury and cardiac problems. Leaves are laxative, antiperiodic and depurative. It is useful in skin diseases, burning sensation, 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, opthalmopathy and general debility. Pulp form fruits called ‘Casia pulp’ is a well known laxative. Bark of tree is rich in tannins. Flowers are bitter, acrid, cooling, emollient, and purgative and are useful in vitiated condition of pitta, burning sensation, leprosy, and skin diseases. It is also useful in cardiac disorders, intermittent fever and general debility.

Ecological Importance of Birds

- Birds occupy many levels of tropic webs, from mid-level consumers to top predators.
- As with native organisms, birds help maintain sustainable population levels of their prey and predator species, and after death, provide food for scavengers and decomposers.
- Many birds are important in plant reproduction through their services as pollinators or seed dispersers
- Some birds are considered keystones species as their presence in an ecosystem affects other species indirectly.
- Birds also provide critical resources for their many host-specific parasites, including lice that eat only feathers, flies adapted for living on birds, and mites that hitchhike on birds from plant to plant and even between countries.

Fauna:

1) INDIAN RING-NECKED PARROT

Scientific Name: *Psittacula kramerii manillensis*
Vernacular Name: Tiya

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

Characters: Very punctual about them.

Vegetation Spectrum*:* *Micheliachampaca, Seracaasoka, Terminaliaarjuna, Ficusbengalensis, F. Religiosa,Disoxylum sp., Borassusflabelliferetc.*

2) ROCK DOVE

Scientific Name: *Columba livia*
Vernacular Name :Payra

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

Characters: Can be used as pets.

Vegetation Spectrum: In rice field and in fallow land. Plants with seeds of *Chrozophoraplicata, Crotonbonplandianum, Brassica nigra, Lathyrus sativa, Triticumaestivum, secale* etc. are common for the birds like rock dove and common dove.

3) COMMON BULBUL

Scientific Name: *Pycnonotus cafer*
Vernacular Name: Bulbuli

Distribution: In all parts of plain and even in low altitude of hilly area
Characters: Clever and very intelligent.

Vegetation Spectrum: *Meliaazadirachta, Morindaangustifolia, Holopteliaintegrifolia, Stephaniahernandifolia, Mikaniascandens, Tremaorientalis, Bamusa sp., Mangiferaindica, Tinosporacordifolia, Ficussp., Pothos sp., Phyllanthusreticulatus, Menilcarasapoda, Inga dulcusetc*.

4) BAYA WEAVER

Scientific Name: *Ploceus philippinus*
Vernacular Name: Babui

Distribution: In plain with low altitude; found India to Indo-China via Malaya.

Characters: Chirping and roosting more time, movement very swift

Vegetation Spectrum: *Strychnosnux-vomica, Meliaazadirachta, Stephaniahernandifolia, Mikaniascandens,Tremaorientalis, Bamusa sp., Mangiferaindica, Tinosporacordifolia, Ficus sp., Pothos sp., Phyllanthusreticulatus,* etc.

5) BLUE MAGPIE-ROBIN

Scientific Name*:* *Copsychus saularis*
Vernacular Name: Doyel

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

Characters: Quiet and calm a bird chirps during dawn or dusk.

Vegetation Spectrum: *Tremaorientalis, Bamusa sp., Mangiferaindica, Tinosporacordifolia, Ficus sp., Pothossp., Phyllanthusreticulatus,Adinacordifolia, Mangiferaindica, Casuarinaequisetifolia, Ravanalamadagascariensis, Plumeriarubra, Tabernemontadivericata,* etc.

CONCLUTION

A. **BIRDS:** We conclude that species spatial distributions are directly effected by global warming and subsequently climate change. In general terms it has been stated by the scientific community that the distribution of species have 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 infact 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 population characteristics and alterations in climatic factors such as temperature and precipitation. The change in population characteristics shows that some sort of shift or generally trended movement is occurring.

B. <u>PLANTS:</u> 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.

AECC 2 –
ENVIRONMENTAL SCIENCE PROJECT

COLLEGE ROLL NO. - 19S-029

C.U. ROLL NO. –

193223-11-0007

C.U. REGISTRATION NO. –

223-1211-0373-19

SUBJECT- BSc. BOTANY HONOURS (BOTA)

SEMESTER 2

PROJECT TITLE

Visit to New Town Eco Tourism Park (Prakriti Tirtha), Kolkata to document environmental assets – natural resources/flora/fauna.

WHAT IS ENVIRONMENT?

The term 'environment' is widely used and has a broad range of definitions, meanings and interpretations. The term environment means the natural landscape with all its non-human features, characteristics and other processes. But, environment also includes human aspects to some extent. The notion of environment is associated with diverse images.

In simple sense, environment of an individual, object, element or system includes all other entities with which it is surrounded.

Environment may be refered to as a space or field in which network of relationships, interconnections and interactions occur between various entities of nature. In fact, the term environment is often interchangeable with an ecological term 'ecosystem' and is defined as a community of interactions of organisms towards their physical surroundings. The notion of interrelationship is a central one in various aspects of environmental science and management, since many environmental issues have occured because one environmental science has been disturbed or degraded – either accidentally or deliberately – as a result of changes in another.

BIOLOGICAL ENVIRONMENT

Ecology is the study of the relation and interactions between organism and the environment. It comprises the floral and faunal community of the area.
The state of West Bengal in the Eastern region of India, is a home to a rich and bewildering variety of forests and wildlife.
From the famous Royal Bengal Tiger at the Gangetic Delta of Sunderbans to the one-horned Indian Rhinoceros grazing in the Terai grassland, the leopards in the foothills of Himalayas and the Red pandas resting in bamboo groves of Himalayas.

The forests of the state has a rich assemblage of diverse habitats and vegetations designated with the help of eight different forest types. The diverse flora and fauna of West Bengal possess the very combined characteristics of the Himalayan, sub-Himalayan and the Gangetic plain.
West Bengal also gives equal importances to the conservation and management of sustainable resources in order to achieve the goal of long term biodiversity conservation.
Inorder to show a glimpse of showing the methods of conservative inniatives taken by the government of West Bengal we have visited Eco Park, New Town Kolkata to make a detailed study of it.

OBJECTIVES OF STUDY

The present biological study was undertaken with the following objectives :-

(i) To access the flora diversity of the area.
(ii) To access the fauna diversity of the area.
(iii) To understand the biodiversity and to understand the resource potential.
(iv) To understand the productivity of the water body.
(v) To ascertain migratory routes of fauna and the possibility of breeding grounds.

METHODOLOGY FOR BASELINE DATA GENERATION

To achieve the above objectives the following methods adopted were as follows :-

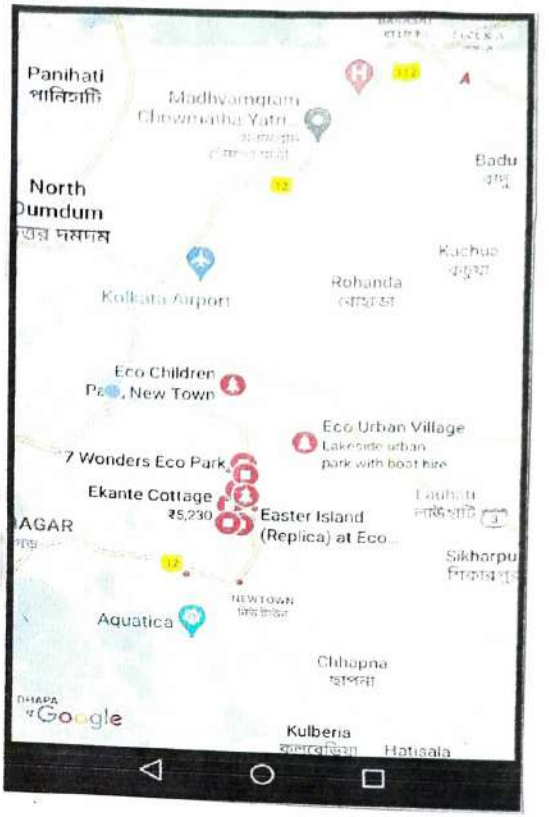
(i) Discussion with local people to elicit information of local flora and fauna.
(ii) Generation of primary data by undertaking systematic ecological studies.

Primary data was generated through :-

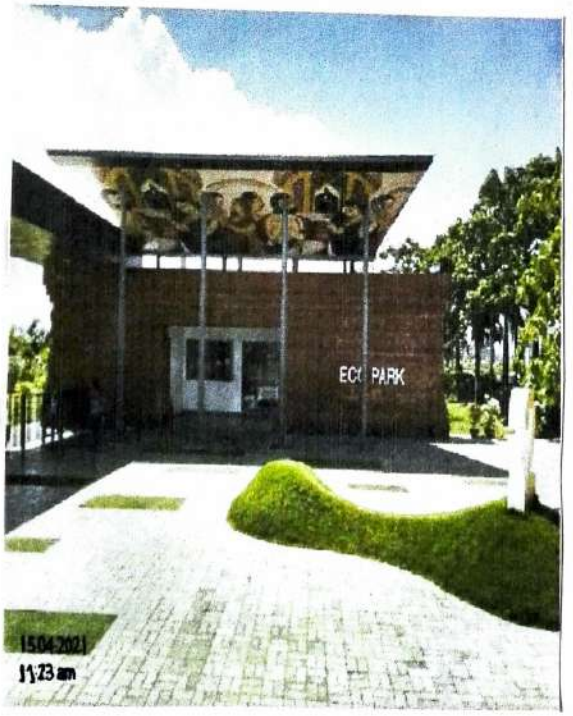
(i) Preparing a checklist of plants encountered in the area
(ii) Determining the population of migratory and local birds.
(iii) Determining population of butterflies and deers of the area.

STUDY AREA

New Town Eco Park (Prakriti Tirtha) is an urban park in New Town, Rajarhat, Kolkata and the biggest park so far in India. The park is situated on a 480 acres (190 ha) plot and is surrounded by a 104 acres (42 ha) waterbody with an island in the middle and a deer park.



DATE AND TIME OF VISIT



The park was visited on 15th April, 2021 (Thursday) at 11:23 am to explore and study the diversity of natural resources (flora/fauna) of that place and to make a detailed study on it.

FLORA DIVERSITY

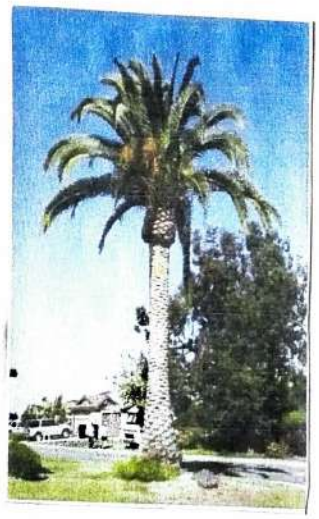
Variety of plant species have been studied and listed accordingly.

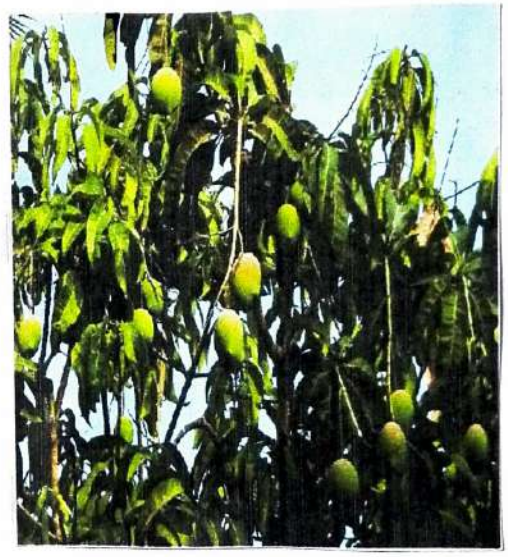
AQUATIC PLANTS OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
Kachuripana	Pontedericaea	Eichhornia	crassipes
Khudipana	Lemnaceae	Lentna	minor
Fupipana	Araceae	Pistia	stratiotes
Pani kochu	Pontedericeae	Monochoria	hastata
Sada Shapla	Nymphaceae	Nymphaea	pubescens
Panilong	Onagraceae	Ludwigia	hyssopifolia
Kalmilata	Convulvulaceae	Ipomoea	acluatica
Dhotkalmi	Convulvulaceae	Ipomoea	jistulosa
Malancha	Amaranthaceae	Alternanthera	philoxeroides
Helancha	Onagraceae	Jussleua	repens
Jonia	Cyperaceae	Fimbristylis	miliceae
Keshur	Cyperaceae	Cyperus	michelianus.

FRUIT PLANTS OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
Am	Anacardiaceae	Magnifera	Indica
Kanthal	Moraceae	Artocarpus	heterophyllus
Payara	Myrtaceae	Psidium	Guajava
Jam	Myrtaceae	Syzygium	cumini
Boroi	Rhamnaceae	zizyphus	mauritiana
Chalta	Dilleniaceae	Dillenia	indica
Tal	Palmae	Borassus	flabellifer
Khejur	palmae	phoenix	sylvestris
Shupari	palmae	Areca	catechu.





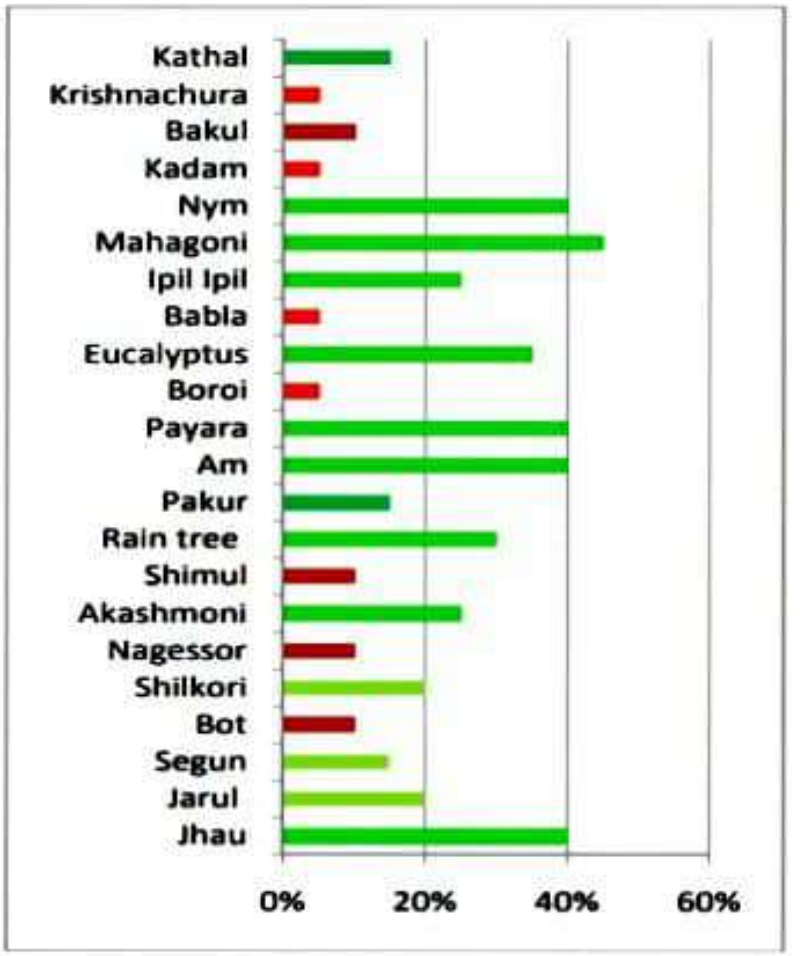
FODDER PLANTS OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
Ipil - Ipil	Mimosaceae	Leucaena	leucocephala
Mandar	Papilionaceae	Erythrina	Vaxiegata
Babla	Mimosaceae	Acacia	nilotica
Jiga	Burseraceae	Gurnga	pinnata
Khoksha	Moraceae	Ficus	hispida

TIMBER PLANTS OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
Akashmoni	Mimosaceae	Acacia	auriculiformis
Eucalyptus	Myrtaceae	Eucalyptus	camaldulensis
Rain tree	Mimosaceae	Albizzia	Saman
Sissoo	Papilionaceae	Dalbergia	Sisso
Pitali	Euphorbiaceae	Trewia	Polycarpa
Jarul	Lythraceae	Lagerstroentia	Speciosa
Mahogoni	Neliaceae	Swietenia	macrophylla
Gamar	Verbenaceae	Gmelina	Arborea
Kadam	Rubiaceae	Anthocephalus	Chinensis
Sheora	Urticeae	Sterblus	asper
Sonalu	Caesalpinaceae	Cassia	Fistul
Simul	Bombaceae	Bombax	Ceiba
Bot	Moraceae	Ficus	bengalensis
Pakur	Moraceae	Ficus	Comosa
Dumur	Moraceae	Ficus	Carica
Bamboo	Gramineae	Baf Ithusa	auruttdinaceae

LIST OF SOME PLANTS WITH ITS ABUNDANCES



FAUNA DIVERSITY

Variety of birds, insects and deers have been studied and listed accordingly.

BUTTERFLY SPECIES OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
1) Silver - spotted skipper	Hesperiidae	Epargyreus	clarus
2) Northern cloudywing	Hesperiidae	Thorybes	pylades
3) Sachem	Hesperiidae	Atalopedes	campestris
4) Cabbage white	Pieridae	Pieris	rapae
5) Clouded sulphur	Pieridae	Colias	philodice
6) Orange sulphur	Pieridae	Colias	eurytheme
7) Sleepy orange	Pieridae	Abaeis	nicippe
8) Monarch	Nymphalidae	Danaus	plexippus
9) Painted lady	Nymphalidae	Vanessa	cardui
10) Red admiral	Nymphalidae	Vanessa	atalanta
11) Carolina satyr	Nymphalidae	Hermeuptychia	sosybius
12) Question mark	Nymphalidae	Polygonia	interrogationis
13) Summer Azure	Lycaenidae	Celastrina	neglecta

BIRD SPECIES OF THE AREA

LOCAL NAME	FAMILY	GENUS	SPECIES
1) Stork-billed kingfisher	Alcedinideae	Pelargopsis	capensis
2) White-bellied woodpecker	Picideae	Dryocopus	javensis
3) Bengal bushlark	Alaudideae	Mirafra	assamica
4) Black bittern	Ardeideae	Ixobrychus	flavicollis
5) Malabar whistling thrush	Muscicapideae	Myophonus	horsfieldii
6) Striated babbler	Leiothricideae	Argya	earlei
7) Cinnamon bittern	Ardeideae	Ixobrychus	cinnamomeus
8) Plaintive cuckoo	Cuculideae	Cacomantis	merulinus
9) Striated grassbird	Locustellideae	Megalurus	palustris
10) Pied cuckoo	Cuculideae	Clamator	jacobinus.

DEER SPECIES OF THE AREA

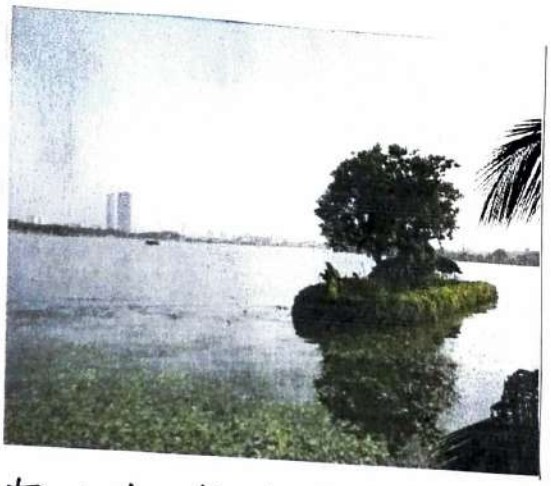
LOCAL NAME	FAMILY	GENUS	SPECIES
1) Barasingha	Cervidae	Rucervus	duvaucelii
2) Chousingha	Bovidae	Tetracerus	quadricornis
3) Sambar deer	Cervidae	Rusa	unicolor
4) Broco - Antlederr	Cervidae	Cervos	eldii
5) Leaf deer	Cervidae	Muntiacus	putaoensis
6) Indian Hog	Cervidae	Hyelaphus	porcinus
7) Barking deer	Cervidae	Muntiacus	muntjak
8) Chinkara	Bovidae	Gazella	bennettii
9) Blue Bull	Bovidae	Boselaphus	tragocamelus
10) Mouse deer	Tragulidae	Tragulus	versicolor
11) Spotted deer	Cervidae	Axis	axis
12) Nilgiri Tahr	Bovidae	Nilgiritragus	hylocrius
13) Red muntjac	Cervidae	Muntiacus	muntjak
14) Indian chevrotain	Tragulidae	Moschiola	indica

IMPACT OF PROJECT ON ENVIRONMENT AND MITIGATION

Identification of all potential environmental impacts due to project is an essential step of Environmental Impact Assessment.

The main objective of the project was to identify the richness of flora and fauna of a particular area and to make a study on it.

By doing the field work to study the diversity of plants and animals we have learnt the importances of environment and environmental sciences in our daily life and the need to study it.



It is important to note that due to increase in the population level these resources are getting depleted gradually. There is a need to make ourselves aware of our natural assets and get concerned about our environment and sustainable wilize the resources. Scope of environmental studies is very wide and nearly covers some aspects of every major discipline (biology, chemistry, physics, geography, resource management, economy, etc).

ENVS PROJECT

COLLEGE ROLL NO: BOTA20F086

CU ROLL NO: 203223-11-0003

CU REG NO: 223-1211-0215-20

SUBJECT: BOTANY

LOCAL FLORA AND FAUNA DIVERSITY

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my teacher Mr. Nilanjan Chakrobarty as well as our principal Mrs. Madhumanjari Mandal who gave me the golden opportunity to do this wonderful project on the topic local flora and fauna diversity which also helped me in doing a lot of Research and I came to know about so many new things I am really thankful to them.

INTRODUCTION

The ecosystem is a complex, interconnected network comprising biotic and abiotic elements. Biotic elements include all living organisms such as plants, animals and microorganisms. Abiotic components, on the other hand, include non-living entities that are vital for the survival of life and these include soil, water, climate, etc. Among all biotic elements, Flora and Fauna are the most fascinating ones.

IMPORTANCE OF FLORA AND FAUNA

The flora and fauna are important for the following reasons:

- **Maintains Ecological Balance:**

Flora and fauna are very important for human existence. The flora liberates oxygen that is consumed by the fauna for respiratory activities. Fauna, in turn, liberates carbon dioxide consumed by the flora for photosynthesis.

Flora and fauna hugely benefit mankind through its medicinal and food offerings. Animals maintain the equilibrium by predating on different plants and animals to balance their population on earth.

Animal droppings are a source of fertilizer. The dead animals decay and act as supplement minerals for other animals.

Aesthetic Value:

The flora and fauna spread across the earth contribute to the aesthetic value of the earth. People visit several biosphere reserves, national parks and zoos, forests, botanical gardens, etc to enjoy the beauty of landmarks. This explains the significance of flora and fauna in our day to day lives.

Expansion of Local Economies:

Flora and Fauna contribute to the local economies through tourism. The flora and fauna of Amazon forests attract tourists and scientists which contributes to about 50 million dollars to the Brazilian economy.

Caribbean, Indonesia, Panama are other tourist locations that attract millions of people due to its widespread flora and fauna.

FLORA

The term flora in Latin means “Goddess of the Flower.” Flora is a collective term for a group of plant life found in a particular region. The whole plant kingdom is represented by this name.

Flora is classified and differentiated based on many factors. The best one among them is the area in which they grow or are found. Some grow in desert regions or in water, some are found in hilly areas while some are endemic to a specific geographic location.

EXAMPLES:

Grasslands, Forests, Flowering and Non flowering plants, Trees.

Sal

Coral

Teak

Mango

Jamun

Sunflower

FAUNA

Fauna represents the animal life indigenous to a region. There are many explanations regarding the origin of the word. As per Roman mythology, Fauna or "*Faunus*" is the name of the goddess of fertility. Another source is "*Fauns*" which means "*Forest spirits*."

Animal kingdom comprises a variety of animal life forms. Hence, the classification of fauna is much more complex than the floral division. Therefore, for ease of classification;

- Birds are categorized under the name Avifauna.
- Fishes under Pisci Fauna.
- Microorganisms including bacteria and virus are generally considered under animal kingdom, they are known as Microfauna.
- All unknown and undiscovered animals are named as cryptofauna.

EXAMPLES:

Birds, Animals, Fish, Insects etc.

Deer

Lion

Parrot

Eagle

Ant

Goldfish

DATE AND TIME OF VISIT

For the detailed study of the project I have visited some areas of my city, Krishnanagar, on 24th June,2021 around 3.30 pm in the afternoon.

FLORA IN MY LOCALITY

COMMON NAME : NEEM	**SCIENTIFIC NAME :** *Azadirachta indica*	**FAMILY:** Meliaceae
COMMON NAME : TULSI	**SCIENTIFIC NAME :** *Ocimum tenuiflorum*	**FAMILY :** Lamiaceae
COMMON NAME : ALOEVERA	**SCIENTIFIC NAME :** *Aloe vera*	**FAMILY :** Asphodelaceae

COMMON NAME : MANGO TREE	**SCIENTIFIC NAME :** *Mangifera indica*	**FAMILY :** Anacardiaceae
COMMON NAME : DEBDARU	**SCIENTIFIC NAME :** *Monoon longifolium*	**FAMILY:** Annonaceae
COMMON NAME : VASAKA	**SCIENTIFIC NAME :** *Justicia adhatoda*	**FAMILY :** Acanthaceae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
JASMINE	*Jasminum officinale*	Oleaceae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
MARIGOLD	*Tagetes*	Asteraceae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
ROSE	*Rosa* sp	Rosaceae

COMMON NAME : COCONUT TREE	**SCIENTIFIC NAME :** *Cocos nucifera*	**FAMILY :** Arecaceae
COMMON NAME : GUAVA TREE	**SCIENTIFIC NAME :** *Psidium guajava*	**FAMILY :** Myrtaceae
COMMON NAME : BANYAN TREE	**SCIENTIFIC NAME :** *Ficus benghalensis*	**FAMILY :** Moraceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
MADAGASCAR PERIWINKLE (nayantara)	*Catharanthus roseus*	Apocynaceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
HIBISCUS	*Hibiscus rosa-sinensis*	Malvaceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
ASIAN PIGEONWINGS (aparajita)	*Clitoria ternatea*	Fabaceae

COMMON NAME : CREPE JASMINE (tagar)	**SCIENTIFIC NAME** *Tabernaemontana divaricata*	**FAMILY :** Apocynaceae

COMMON NAME : SUNFLOWER	**SCIENTIFIC NAME :** *Helianthus annuus*	**FAMILY :** Asteraceae

COMMON NAME : DATURA	**SCIENTIFIC NAME :** *Datura innoxia*	**FAMILY :** Solanaceae

COMMON NAME : BOUGAINVILLEA	**SCIENTIFIC NAME :** *Bougainvillea glabra*	**FAMILY :** Nyctaginaceae
COMMON NAME : ALLAMANDA	**SCIENTIFIC NAME :** *Allamanda cathartica*	**FAMILY :** Apocynaceae
COMMON NAME : KADAM	**SCIENTIFIC NAME :** *Neolamarckia cadamba*	**FAMILY :** Rubiaceae

COMMON NAME : TUBEROSE	**SCIENTIFIC NAME :** *Polianthes tuberosa*	**FAMILY :** Asparagaceae
COMMON NAME : ORANGE JASMINE (kamini)	**SCIENTIFIC NAME :** *Murraya paniculata*	**FAMILY :** Rutaceae
COMMON NAME : DESERT ROSES	**SCIENTIFIC NAME :** *Adenium obesum*	**FAMILY :** Apocynaceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
GRASSES	*Alopecurus pratensis*	Poaceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
ARECA PALM	*Areca catechu*	Arecaceae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
GIANT CALOTROPE (akanda)	*Calotropis gigantea*	Apocynaceae

COMMON NAME : TAMARIND TREE	**SCIENTIFIC NAME :** *Tamarindus indica*	**FAMILY :** Fabaceae

COMMON NAME : JAMUN TREE	**SCIENTIFIC NAME :** *Syzygium cumini*	**FAMILY :** Myrtaceae

COMMON NAME : JACKFRUIT TREE	**SCIENTIFIC NAME :** *Artocarpus heterophyllus*	**FAMILY :** Moraceae

FAUNA IN MY LOCALITY

COMMON NAME : BUTTERFLY	**SCIENTIFIC NAME :** *Papilio polymnestor*	**FAMILY :** Papilionidae
COMMON NAME : BLACK GARDEN ANT	**SCIENTIFIC NAME :** *Lasius niger*	**FAMILY :** Formicidae
COMMON NAME : CELLAR SPIDER	**SCIENTIFIC NAME :** *Pholcus phalangioides*	**FAMILY :** Pholcidae

COMMON NAME : COCKROACH	**SCIENTIFIC NAME :** *Periplaneta americana*	**FAMILY :** Blattidae
COMMON NAME : BEETLE	**SCIENTIFIC NAME :** *Megasoma* sp	**FAMILY :** Scarabaeidae
COMMON NAME : INDIAN BEE	**SCIENTIFIC NAME :** *Apis indica*	**FAMILY :** Apidae

COMMON NAME : DOG	**SCIENTIFIC NAME :** *Canis lupus familiaris*	**FAMILY :** Canidae
COMMON NAME : CAT	**SCIENTIFIC NAME :** *Felis catus*	**FAMILY :** Felidae
COMMON NAME : MONKEY	**SCIENTIFIC NAME :** *Macaca mulatta*	**FAMILY :** Cercopithecidae

COMMON NAME : HOUSE FLY	**SCIENTIFIC NAME :** *Musca domestica*	**FAMILY :** Muscidae
COMMON NAME : HOUSE CRICKET	**SCIENTIFIC NAME :** *Acheta domesticus*	**FAMILY :** Gryllidae
COMMON NAME : MOSQUITO	**SCIENTIFIC NAME :** *Culex pipiens*	**FAMILY :** Culicidae

COMMON NAME : SPARROW	**SCIENTIFIC NAME :** *Passer domesticus*	**FAMILY :** Passeridae
COMMON NAME : CROW	**SCIENTIFIC NAME :** *Corvus splendens*	**FAMILY :** Corvidae
COMMON NAME : PIGEON	**SCIENTIFIC NAME :** *Columba domestica*	**FAMILY :** Columbidae

COMMON NAME : HEN	**SCIENTIFIC NAME :** *Gallus gallus domesticus*	**FAMILY :** Phasianidae

COMMON NAME : INDIAN EAGLE OWL	**SCIENTIFIC NAME :** *Bubo bengalensis*	**FAMILY :** Strigidae

COMMON NAME : COMMON MYNA	**SCIENTIFIC NAME :** *Acridotheres tristis*	**FAMILY :** Sturnidae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
ROHU	*Labeo rohita*	Cyprinidae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
CATLA	*Catla catla*	Cyprinidae

COMMON NAME :	**SCIENTIFIC NAME :**	**FAMILY :**
MRIGAL CARP	*Cirrhinus cirrhosus*	Cyprinidae

COMMON NAME : EARTHWORM	**SCIENTIFIC NAME :** *Lumbricus terrestris*	**FAMILY :** Lumbricidae

COMMON NAME : GARDEN SNAIL	**SCIENTIFIC NAME :** *Cornu aspersum*	**FAMILY :** Helicidae

COMMON NAME : LIZARD	**SCIENTIFIC NAME :** *Hemidactylus frenatus*	**FAMILY :** Gekkonidae

COMMON NAME : CHECKERED KEELBACK	**SCIENTIFIC NAME :** *Xenochrophis piscator*	**FAMILY :** Colubridae

COMMON NAME : BUFF STRIPED KEELBACK	**SCIENTIFIC NAME :** *Amphiesma stolatum*	**FAMILY :** Colubridae

COMMON NAME : BENGAL MONITOR	**SCIENTIFIC NAME :** *Varanus bengalensis*	**FAMILY :** Varanidae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
GOAT	*Capra hircus*	Bovidae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
COW	*Bos Indicus*	Bovidae

COMMON NAME :	SCIENTIFIC NAME :	FAMILY :
BUFFALO	*Bubalus bubalis*	Bovidae

CONCLUSION

We are not the only species in the biodiversity web. There are thousands of other species. Flora and Fauna are two of the most important groups of species that our planet provides to us. Flora and fauna serve as an integral part of our ecosystem. They are crucial for most of the life of our earth. Flora and Fauna provide humanity with precious resources which can be used in several important ways. Flora and Fauna include a huge variety of species which are estimated to range from 7,000,000 to over 11,000,000 species worldwide, depending on the respective study.

Since they are crucial for human life ,we have to make sure that we protect them accordingly. Many of the flora and fauna which were abundant have now become endangered and even extinct. Maintaining a natural balance is essential for the sustenance of the ecosystem. We need strict laws and high fines regarding the destruction of flora and fauna. By doing this, we can protect our ecosystem.

BIBLIOGRAPHY

For this project I have gathered the information from Wikipedia. For the photos some have been clicked by me and the rest were taken from Google photos (as some species are seasonal and are not seen during this time of the year).

PROJECT WORK

SUBJECT : ENVIRONMENTAL SCIENCE

COLLEGE ROLL NO. : BOTA20F087

C.U ROLL NO. : 203223-11-0079

C.U REGISTRATION NO. : 223-1211-0462-20

Deforestation:

Definition, Causes, Effects and Solutions

Introduction

What is Deforestation?

Deforestation refers to the decrease in forest areas across the world that are lost for other uses such as agricultural croplands, urbanization, or mining activities. Greatly accelerated by human activities since 1960, deforestation has been negatively affecting natural ecosystems, biodiversity and the climate. The UN's Food and Agricultural Organisation estimates the annual rate of deforestation to be around 1.3 km^2 per decade.

Deforestation and Forest degradation

The Causes of Deforestation : Why is Deforestation Happening ?

1. Agriculture is the Number 1 Cause of Deforestation (~80%).

According to the Food and Agricultural Organisation, agriculture causes around 80% of deforestation. According to the same report, 33% of agriculture caused deforestation is a consequence of substitence agriculture — such as local peasant agriculture in developing nations.

Commercial or industrial agriculture (food crops and livestock), cause around 40% of forest loss — in the search for space to grow food, fibres or biofuel (such as palm oil, beef, rice, cotton, sugar cane). It is also particularly interesting to note that livestock is believed to be responsible for about 14% of global deforestation. The main reasons have to do with the large areas required both to raise livestock and also to grow its soy based food.

2. Deforestation Caused by New Constructions (~15%)

The logs of cut trees are used for constructions

The construction of human infrastructures has also been driving deforestation. More specifically, 10% of the deforestation can be attributed to new infrastructures that serve the current human lifestyle in four ways :

transportation, transformation and energy generation.

On one hand, roads, rails, ports or airports have been built to move all sorts of goods either directly to trade centres or to transformation sites. So, while at first there were only fruit trees, roads soon arrived to allow transporting them to other regions, and while some goods were collected manually, others such as coal, oil, natural gas, biomass but also meat, dairy required the construction of large extraction, transportation infrastructures.

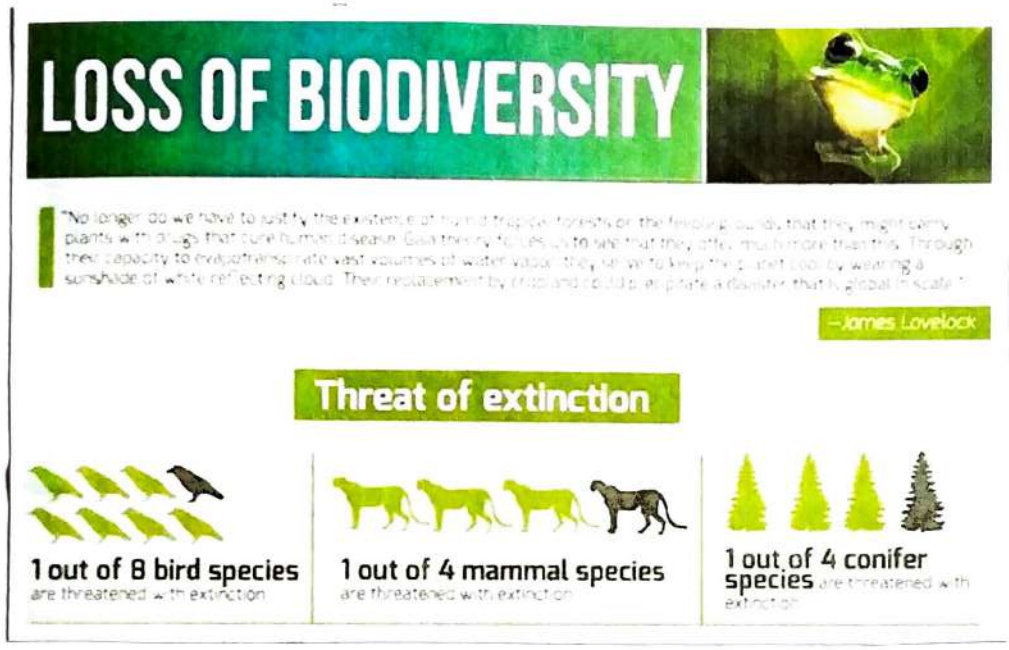
3. How Urbanization is Causing Deforestation (~5%).

Excessive mining causes deforestation leaving the land barren.

The populational shift that is leading people to move from rural to urban areas is also contributing to deforestation. This urban growth – in which 68% of the world's population is expected to live in cities by 2050 – is leading to an exponential growth of housing and consumption sites. As cities become larger, they challenge the natural boundaries surrounding them more often, leading to deforestation.

Deforestation Effects – How does Deforestation affect the Environment?

1. The Effects of Deforestation on Biodiversity.



Loss of Biodiversity as a major effect of Deforestation.

The most known consequence of deforestation is its threat to biodiversity. In fact, forests represent some of the most veritable hubs of biodiversity. From mammals to birds, insects, amphibians or plants, the forest is home to many rare and fragile species. 80% of the Earth's land animals and plants live in forests. By destroying it, human activities are putting entire ecosystems in danger, creating natural imbalances and putting life at threat. The natural world is complex, interconnected and made of thousands of inter-dependencies. Thus destroying it will bring a major imbalance that can never be corrected or replaced.

2. Deforestation for Food may lead to Food Insecurity in the Future.

Today 52% of all the land, used for food production is moderately or severely impacted by soil erosion. In the long term, the lack of healthy nutritious soil can lead to low yields and food insecurity.

3. The Effects of Deforestation on Local People and their Livelihoods.

Healthy forests support the livelihood of 1.6 billion people globally, 1 billion of whom are among the world's poorest. This means, there are people depending on forests for survival and using them to hunt and gather raw products for their small-scale agricultural processes. Locals then have to make two choices. They either decide to abandon "their" land and migrate or embrace the challenge of a difficult life. Or they can stay and work for the companies exploiting it in remote plantations — often getting unfair wages and working under inhumane conditions. Either way it is tough.

4. Soil Erosion is one of the major Consequences.

Deforestation weakens and degrades the soil. Forested soils are usually not only richer on organic matter, but also more resistant to erosion, bad weather and extreme weather events. This happens mainly because roots help fix trees in the ground and the sun-blocking tree cover helps the soil to slowly dry out. As a result, deforestation will probably mean the soil will become

Soil erosion due to deforestation.

increasingly fragile, leaving the area more vulnerable to natural disasters such as landslides and floods.

5. Deforestation Affects and Contributes to Climate Change.

Clearing of Forests leads to increase in temperature.

FFirstly, taking down trees means they will release back into the atmosphere the CO_2 they were keeping. Secondly, fewer trees available means reducing the planet's overall ability to capture and store CO_2. Both these effects negatively contribute to the greenhouse effect and to climate change. It is estimated to be responsible for 10-15% of all anthropogenic CO_2 emissions.

How are Animals Affected by Deforestation?

Animals are heavily affected due to deforestation

1. Loss of Habitat.

Deforestation destroys habitats making it very difficult to live. Forests are a source of shelter, and without them they are exposed to the harsh conditions. Disappearance of the forests can lead to the species becoming extinct.

2. Starvation

Loss of trees makes it very difficult for animals to live properly as one of their major resources has been taken away. Herbivores are the ones directly affected and these leads to their starvation, and once they start dying the entire food chain is shaken and everybody becomes a victim.

3. Increased Interaction with Humans.

The more deforestation occurs, the greater the chance that animals come in contact with humans. This interaction usually leads to a negative outcome as the animals may attack in the act of self-defense and vice-versa. This interaction usually may lead to the reduction of specific animals from the population.

Effects of Deforestation on India:

i) Decrease of bio-source in forests adjacent to rural areas makes people migrate to urban areas for sustenance.

ii) Decrease in forest cover leads to soil erosion which leads to problems like floods, sedimentation and run off of water.

iii) Unfair distribution of wood for domestic and industrial needs.

iv) There will be shortage of raw materials for forest based industries.

v) Disturbance of hydrological cycle leading to droughts.

vi) Decline in fuel wood for those practicing traditional cooking.

Trees being cleared out for cattle ranching in India.

How Can We Stop Deforestation? Solutions to Deforestation

1. Eating Less Meat Helps Stop Deforestation.

Using sustainable products to stop deforestation.

According to the World Wide Fund for Nature (WWF), livestock-caused deforestation is responsible for the discharge of 3.4% of current global emissions of carbon every year.

Some studies, show that without meat and dairy products, global farmland use could be reduced by 75%. In this way reducing our meat consumption is also a big step to stop not only deforestation but also global warming on a large scale.

2. Consuming Less and More Consciously Helps Stop Deforestation.

As Consumers, we can choose to buy less industrial and transformed products such as cookies, noodles or cosmetics that use a lot of palm oil. Instead, we can go for a home-made approach with fewer chemicals and food preservatives that are beneficial for both our planet and health. When it comes to food, buying directly from small farmers using agroforestry practises is the best choice for the planet.

3. To Carefully Use Electronic Devices.

Careful Use of Electronic Gadgets can help stop deforestation.

Our smartphones, laptops, car etc. are all made of aluminium, plastic and rare Earth minerals among other materials. To get these, land was cleared to build mining sites, roads and factories built to transport and transform them. The longer we use these products, the higher, the demand does not grow. Economically speaking, if demand does not grow, production either will not grow, and hence it is not necessary to clear more space or extract natural resources at the cost of the trees.

4. Leaving Fossil Fuels and Palm Oil Behind.

Nearly half of UE's imports of palm oil are used as biofuels — although proposals to ban subsidies are currently under debate. Since diesel and petrol are mixed with biofuels, choosing other modes of transport like walking, cycling can be good ways of reducing palm oil importations and production and to help curb deforestation.

5. Lead by Example and Spread Awareness.

If we start adopting the behaviors mentioned previously we can lead by example. We have to teach our family, friends, colleagues what deforestation is and why is it happening, and suggest them solutions that are readily adoptable.

Broader Perspective: How Can We Stop Deforestation?

1. Fighting illegal logging and limiting them in old-growth forests.

2. Protecting forested areas by creating laws and policies that ensure forests are well protected and restored and betting on land practices such as wildfire corridors.

3. Reforming trade agreements, starting to value differently products obtained through deforestation, and creating incentives for the use of sustainable forestry certifications.

4. Educating local communities and tourists about the need to protect forests and develop and enroll in ecotourism activities.

EVNS PROJECT 2021

COLLEGE ROLL NO. : BOTA20F088

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SUBJECT : BOTANY

ACKNOWLEDGEMENT

I am really grateful to my Professor Mr. Nilanjan Chakraborty) for advising me and introducing the project to me in a easy way ,to understand it better, which has helped me to complete my project effectively on time.

I am thankful to our Principal Dr. Madhumanjari Mandal for giving me an opportunity to work on this project which has provided me with valuable information about the different aspects of River Pollution.

Thank you.

STUDY ON RIVER POLLUTION OF MAHANANDA RIVER

INTRODUCTION

Pollution, also called **environmental pollution**, the addition of any substance (**solid**, **liquid**, **or gas**) or any form of energy (such as **heat**, **sound, or radioactivity**) to the **environment** at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form. The major kinds of pollution, usually classified by environment, are **air pollution**, **water pollution**, **and land pollution**. Modern society is also concerned about specific types of pollutants, such as **noise pollution**, **light pollution**, **and plastic pollution**. Pollution of all kinds can have negative effects on the environment and wildlife and often impacts human health and well-being.

But here , in this project we will mainly focus towards **river pollution,** which falls under the category of water pollution.

WHAT IS WATER POLLUTION ?

W. H. Auden once noted, "**Thousands have lived without love, not one without water**." Yet while we all know water is crucial for life, we trash it anyway. Some **80 percent of the world's wastewater** is dumped—largely untreated—back into the environment, polluting rivers, lakes, and oceans.

Water pollution occurs when harmful substances—often chemicals or microorganisms—contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment

SURFACE WATER

Covering about **70 percent of the earth**, surface water is what fills our oceans, lakes, rivers, and all those other blue bits on the world map. Surface water from freshwater sources (that is, from sources other than the ocean) accounts for **more than 60 percent** of the water delivered to American homes. But a significant pool of that water is in peril. According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, **nearly half of our rivers and**

streams and **more than one-third of our lakes** are polluted and unfit for swimming, fishing, and drinking.

RIVER POLLUTION

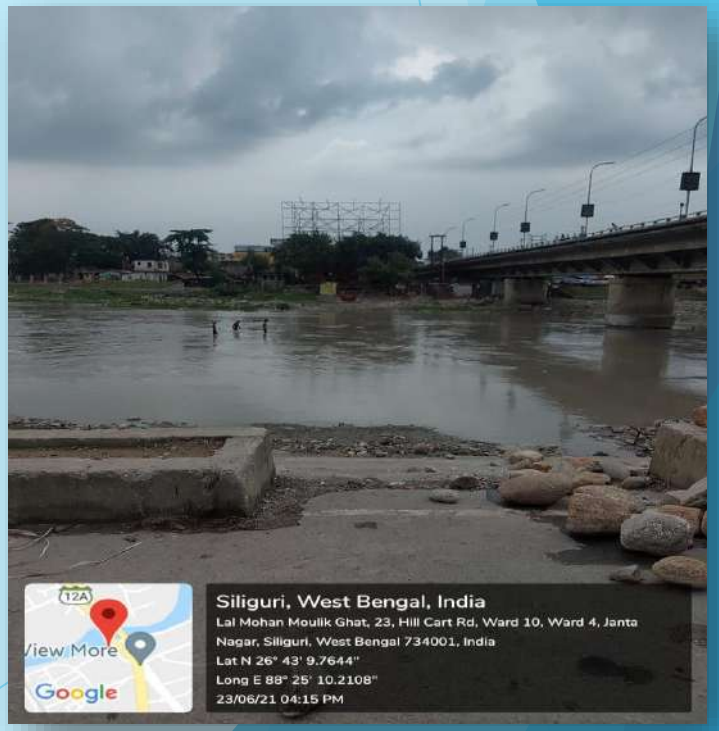
The works in this entry address pollutants affecting **river ecosystems**, including the people who live within or use resources from those ecosystems. Pollution is commonly subdivided based on the primary medium affected by contamination, creating categories such as **air pollution, soil pollution, freshwater pollution, groundwater pollution, or marine pollution.** In reality, of course, all of these media are intimately connected. Atmospheric deposition of contaminants pollutes soil and water bodies. Contaminated groundwater seeps into rivers, and contaminated rivers recharge groundwater aquifers. Fluxes of water, sediment, solutes, and even organisms carrying contaminants within their tissues create vectors to disperse pollutants. This is one of the great challenges to understanding and mitigating pollution: the contaminant is seldom an inert substance that stays in one place. Another great challenge is that there are many different types of contaminants, including human and animal wastes such as **sewage or intestinal bacteria, excess nutrients, heavy metals, petroleum**

products, radioactive isotopes, and an enormous array of synthetic chemicals such as pesticides and personal care products. Each type of contaminant can disperse through environmental media, combining with other chemical compounds to form metabolites that may have different levels of toxicity for organisms or different dispersal mechanisms than the original contaminant. Yet another challenge in understanding and managing pollutants is that a substance that is harmful to one type of organism may not cause harm to another type of organism, but detailed knowledge of how individual pollutants affect the spectrum of living organisms is almost never available. Consequently, the environmental standards set by government agencies for maximum permissible levels of contaminants are based on very limited knowledge and are likely to be inadequate. Most of the standards are also based on acute effects that show up very quickly.

Contaminant levels below permissible standards can cause chronic effects—subtle but pervasive changes that eventually degrade the health of individual organisms and populations. Some chronic effects result from bioaccumulation, as an organism accumulates contaminants within its tissues over the course of its life, and biomagnification, as organisms pass on their accumulated doses to predators or scavengers.

DATE AND TIME OF VISIT AT MAHANANDA RIVER

For the detailed study of my project i have visited the banks of Mahananda river , flowing through my city, Siliguri , on 23rd June, 2021, Wednesday, around 3:00 p.m. in the afternoon. The temperature was around 30 degree Celsius. I have gathered few information from the people in the neighborhood and spoke to some officials as well , all these information that i have gathered are there in the upcoming slides.



MAHANANDA – THE DYING RIVER?

BASIC INFORMATION ABOUT THE STRETCH:

The river Mahananda originates from the Paglajhora Falls near Kurseong in Darjeeling District. With supply water from molten ice and water drained by a number of natural falls and jhoras in the district Darjeeling, the river flows due south-east and enters Siliguri town at Champasari area. The river is non-tidal in nature and receives wastewater from the Siliguri city area. Flow in the river receives enormous amount of discharge of municipal sewage round the year. BOD and Bacteriological count are the principal pollutants in this river stretch. The sources for this river is presented below.

POLLUTED RIVER STRETCH / LENGTH :

Polluted stretch of this river has been identified from Siliguri to Binnaguri, which is approximately 15 km.

MAJOR TOWNS LOCATED ON THE BANK BETWEEN THE STRETCH INCLUDING POPULATION, WATER CONSUMPTION DETAILS:

The only large town located in this stretch is Siliguri City. The Siliguri Municipal Corporation has an area of 260 square kilometer with 47 wards and a population of 513264.

Stretch of river perennial on or non perennial / flow available / water usage in the stretch :

The stretch of the river is perennial and has flow round the year. Water in this stretch is used for fishing and abstraction for city supply after treatment and disinfection.

Water quality of river stretch / drains contributing pollution / ground water :

The water quality status of the river, as influenced by the discharges of the sources mentioned above is monitored on monthly basis at two water quality monitoring stations at up-stream at Champasari as the river approaches the Siliguri town and downstream at Ramghat, before river Balason confluences with Mahananda.

During preparation of the current report, the water quality data of this stretch for the years 2017 and 2018 was analyzed using the latest **"CRITERIA FOR PRIORITISATION OF POLLUTED RIVER LOCATION"** circulated by the **Central Pollution Control Board (CPCB).** Using data of last 24 determinations in two years (January 2017 to December 2019), the river stretch could be identified as **Priority III (Moderately Polluted or Fair)** with the two years' **average BOD data of 6.4 mg/L** and **Fecal Coliform value of 70000 MPN/100mL.** Although this is the average data of two stations, the Ramghat data presents the actual extent of pollution in the river contributed by municipal sewage discharge with **BOD value of 9.8 mg/L and FC value of 128000.**

Drains contributing to pollutions Polluting sources of Mahananda :

1. About 94 nos. of municipal sewage discharge points (Small and large put together) on the left bank of River Mahananda and 60 nos. on the right that drain untreated municipal sewage into the river.

2. Jorapani river at Fulbari and Fuleshwari canal near NJP road carries the municipal sewage of associated municipal wards.

3. Apart from above, indiscriminating dumping of municipal solid waste also contributes to the worsening of the river water quality.

Water quality current as per assessment target:

The water quality of the river on an average over the years (2017 and 2018) data is presented below.

Average BOD for two years (mg/L) = 6.39
Average TC for two years (MPN/100mL) = 70000

Considering the impact of this river water to the sensitive ecosystem of the terai of the Himalayas and the livelihood of the people living on both sides of the river, revival of the water quality of this river is extremely important on context of its utility as it is a perennial River. The ultimate goal for beneficial use of rivers will determine the level of actions to be taken for maintaining the water quality. Under the present circumstances, it appears that river Mahananda serves the purpose of drinking water intake points (for supply after treatment and disinfection), fishery, irrigation and, most importantly, the health of the sensitive terai ecosystems. For achieving this objective, generated municipal sewage should be treated to meet the required standard. Also, the trade and other effluents generated within the catchment of river Mahananda which are ultimately joining and contributing to the pollution load in the river should be treated to meet the effluent discharge standards stipulated under the **GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART-A: EFFLUENTS of the Environment (Protection) Rules, 1986.** The target water quality for this stretch is BOD, less than 3.0 mg/L and Fecal Coliform less than 5000 mg/L.

CHARACTERISTICS OF THE MAJOR DRAINS CONTRIBUTING TO POLLUTION :

More than hundred small and large drains carry municipal wastewater from both sides of the Mahananda as it runs through the city. General characteristics of such drainage water will be reported in 3 months time.

INVENTORY SOURCES OF POLLUTION AND GAPS IDENTIFICATION :

a) Municipal sources / sewage management

i) Sewage generation from towns located on the banks of the polluted river The main source of pollution of the river Mahananda is the discharge of untreated sewage from areas of the Siliguri Municipal Area. The main objective of this treatment proposal is to treat municipal sewage running down to rivers Mahananda, Jorapani and Fuleshwari. Treatment of about **47 Million Liter per Day (MLD)** of municipal sewage is required to be treated.

ii) Number of sewage treatment plants and treatment capacity.

Actual sewage treatment and the gaps in treatment DPR for treatment of the city sewage have been prepared and according to this two STPs are required to be implemented with capacities of 15 and 32 MLD.

The locals collected waste that comprised Styrofoam, plastic wrappers, plastic bottle, polyethene, carcasses of animals and fecal sludge

MY SURVEY

Talking to Mr. Sharma ,he said,

"Currently, the river that originates from the Himalayas in Darjeeling district and descends to the plains in Siliguri can be best described as the dumping ground for city dwellers. Thousands of encroachments on the riverbed's 15 Km stretch that flows from Siliguri to Binnaguri that once served as the lifeline of city, have left the river dry. This stretch, in fact, is the dirtiest stretch of the river. More than 20 large city drains empty into the river carrying at least 400 million tons of untreated waste per day that also contain harmful chemicals. People defecate on its banks and there is a huge problem of illegal sand mining on the riverbed."

According to Mr. Rohit Bagchi who stays in the neighborhood,

"Most people of the district call the river 'Mahaganda' (extremely dirty) instead of Mahananda due to its present situation."

As per an official of Siliguri Municipal Corporation,

The Corporation has taken several steps to save the river from pollution especially during major religious days like Durga Puja and Chatt Puja. Manpower has been deployed from time to time to collect the garbage from the river. While setting up of two major Sewage Treatment Plants (STPs) is underway, cleaning the river and keeping clean are not easy tasks and needs a behavior change from the people residing near it.

This is a picture from 2019 during "MAHANANDA BACHAO ANDALAN". Mahananda Bachao Campaign's awareness programmes are garnering support everyday from the residents, especially the youth.

WASTE MANAGEMENT

i) Industrial waste management:

No hazardous waste generating industry exists in the catchment area of the river in Siliguri. The rest of the industrial waste are treated along with solid waste.

ii) Solid waste management:

Generation of solid waste has been quantitated at 300 MT (approx.) from the city area. A Manure Composting Plant was setup at 2007, with Hindusthan Joibo Rosayan Company in PPP mode, by joint venture. The manure was sold in several tea gardens. But, the company was not agreed to continue this project from 2012 due to some uncanny reason. Since then Siliguri MC have been continuing this project and the manure is being sold to various markets. A mechanical composter will be setup very shortly. Besides, UD&MA Dept. had provided 3 nos. 14 meter cube movable compactor, 1 no. Stationary Compactor etc., under Mission Nirmal Bangla (Urban) to strengthen the waste collection system in addition to existing facilities available within the Corporation area.

III) Gaps identified in waste management

Whatever gap in waste management exists, it is for solid waste management. Although 100 percent door to door collection of solid waste has been achieved for entire municipal area, segregation at source is yet to be initiated. The action plan for initiation of such segregation at source activity followed by other processing and disposals are presented, along with timeline, at Annexure-2.

iv) Proposed actions for solid wastes, industrial waste and bio-medical waste management

An integrated SWM project with processing facility of Waste to Compost, i.e. Compost Plant is prepared. The project may be implemented by 3 years from sanctioning of the project.

v) Remedial plans for control of ground water contamination

Major remedial measures to control ground water contamination has been taken in controlling open defecation and construction drainage system and soak pits in panchayat (rural) areas

i) Construction of platform, pakka drain and soak pits for Tube-wells and compost/ azolla pit at household and cluster level.

i) Providing access of twin leach pit safe and sanitary toilets to every eligible rural household thereby arresting the possibility of discharge of domestic black water to the adjacent or nearby water bodies including rivers. Present sanitation coverage in the rural areas of the state stands at 99.61%.

Following are the initiatives from the Department of Agriculture for controlling the pollution of the river water. The anti-pollution initiatives are divided into following four domains :

1. Increasing water use efficiency through good irrigation practices ;
2. Soil and water conservation ;
3. Cultivation of low water demanding crops ;
4. Propagation of eco-friendly agriculture.

CONCLUSION

Thus, from the above information and data we found out the answer that "**MAHANANDA RIVER IS NOT A DYING RIVER YET IF PROPER STEPS AND MEASURES ARE TAKEN IT CAN BE SAVED"** .River as a valuable asset to the country (not a liability) should be well managed, conserved and rehabilitated from time to time. Water is a natural resource that is vital to human health. It is also a resource that is undergoing a major crisis; its capacity to support plant and animal life is rapidly being destroyed by human activities.

The message of this course is that human health and the health of the natural environment are intimately linked to one another.

‘Perhaps the time has come to cease calling it the “environmentalist view”, as though it were a lobbying effort outside the mainstream of human activity, and start calling it the real-world view.’

SCOTTISH CHURCH COLLEGIE

UNIVERSITY OF CALCUTTA

ENVS PROJECT

2020-2021

CU ROLL NO – 203223-11-0103

CU REGI NO – 223-1212-0248-20

COLLEGIE ROLL NO – BOTA20F089

SUBJECT – BOTANY HONOURS

STUDY OF LOCAL FLORA AND FAUNA DIVERSITY

Introduction:

The ecosystem is a complex, interconnected network comprising biotic and abiotic elements. Biotic elements include all living organisms such as plants, animals and microorganisms. ~~Such~~ Abiotic components, on the other hand include non-living entities that are vital for the survival of life and these include soil, water, climate etc. Among all biotic elements. Flora and Fauna are the most fascinating ones.

Flora:

Flora refers to the plant life found in a particular region. It is naturally occuring or the indigenous native plant life.

Fauna:

The term fauna represents all the animal species found in a particular region at a perticular time. these are the ~~nation~~ naturally occuring animal species of the particular area.

Importance of Flora and Fauna:

The flora and fauna are important for the following reasons:

- **Maintains Ecological Balance:**

Flora and Fauna are very important for human existance. The flora liberates oxygen that is consumed by the fauna for respitary activities. Fauna in turn, liberates carbon dioxide consumed by the flora for photosynthesis.

- **Aesthetic Value:**

The flora and fauna spread across the earth contribute to the aesthetic value of the earth. People visit several biosphere reserves, national parks and zoos, forests, botanical gardens, etc. to enjoy the beauty of landmarks. this explains the significance of flora and fauna in our day to day lives.

- **Expansion of Local Economies:**

Flora and Fauna contribute to the local economies through tourism. The flora and fauna of Amazon forests attract tourists and scientists which contributes to about 50 million dollar to the Brazilian economy.

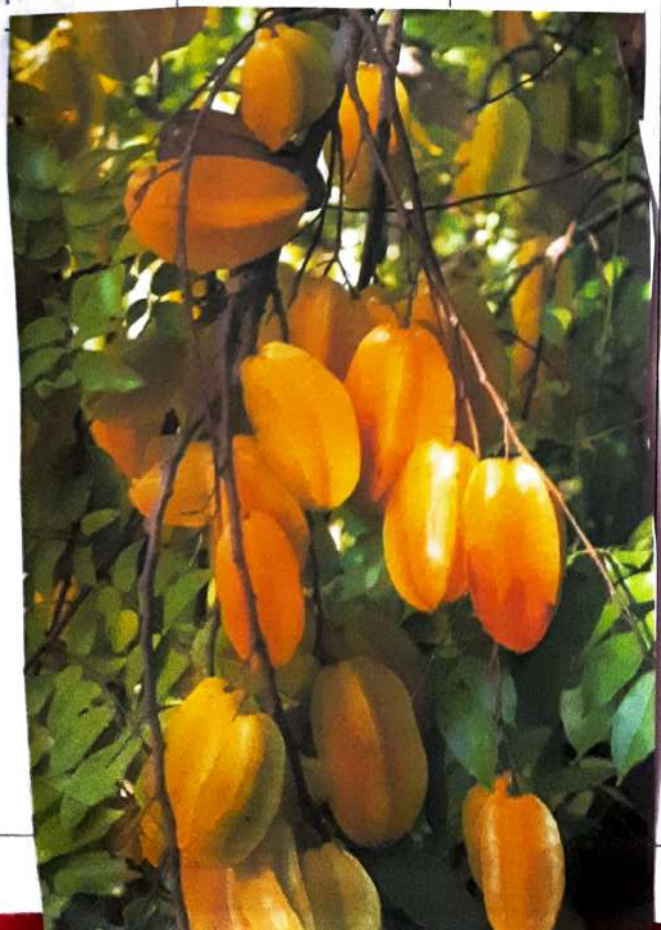
FLORA

Visiting Place : Tamluk

Visiting Date : 2/7/21

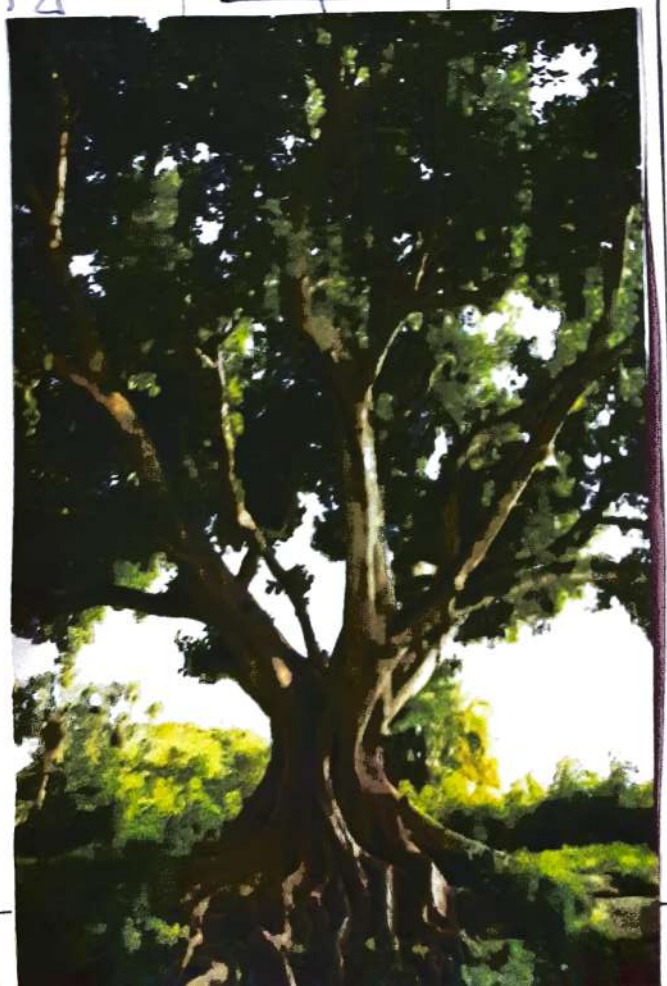
A scientific list of all the flora in our locality —

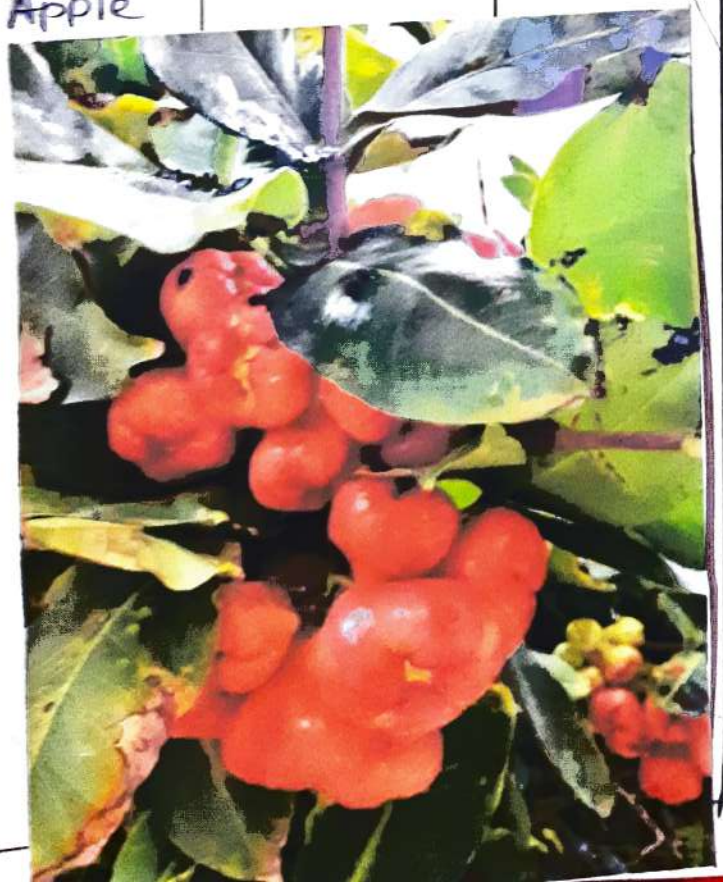
Name of the Plant	Scientific Name	Family	Significance
Hog Plum 	Spondias mombin	Anacardiaceae	i) The flowers are used as a heart tonic, for mouth sores, sore throat and laryngitis. ii) The fruit is used as a mild laxative and can also induce vomiting iii) In term of usage, the palm can be picked, washed and eaten, which acts as a diuretic
Elephant ear plant 	Colocasia esculenta	Araceae	i) Widely used as vegetable; almost every plant part like leaf blade, petiole, rhizome, stale etc. are used as vegetable. ii) The petiole and blade are rich in iron iii) To treat insect stings, the stem leaf can be cut and rubbed on the affected area to prevent swelling and pain. iv) The tubers contain amino acids and are rich in starch.

Name of the Plant	Scientific Name	Family	Significance
Mango Tree 	Mangifera Indica	Anacardiaceae	i) The fruit are rich in Vitamin C, which is important for forming blood vessels and healthy collagen, as well as helping you heal. ii) Wood is extensively used for low-cost furniture, floor ceiling boards, windows frames, agricultural implements etc. iii) The tender leaves of the mango tree contain tannins called anthocyanidins that may help in treating early diabetes.
Star Fruit 	Averrhoa carambola	Oxalidaceae	i) It is rich in vitamin C, Low in sugar and sodium and contains both antioxidant and antimicrobial properties ii) The entire fruit can be eaten, even the waxy skin. The fruit is best eaten when it is firm, yellow with a tinge of green iii) Fruit can be pickled or preserved, made into jellies or jams iv) Fruit can be used as a stain remover on cloth and skin and as brass polish

Name of the Plant	Scientific name	Family	Significance
Supari Tree	Areca catechu	Arecaceae	1) Early research suggests that betel nut might be helpful for schizophrenia. Some patients with schizophrenia who chew betel nut seem to have less severe symptoms. 11) Early research suggests that taking a solution containing betel nut extract might improve speech, strength and bladder function in people who have had a stroke.
Mahagoni tree	Swietenia mahagoni	Meliaceae	1) Mahoganies are the source of an expeeptionally valuable cabinet wood, and are widely considered the most economically important tropical timber trees in the world. 11) Swietenia macrophylla seeds also known as skyfruit are mahagony seeds in Southeast Asia have been used as a remedy for diabetes, hyperlipidemia and shown to have antibiotic properties by its effect on the innate immune system.

Name of the plant	Scientific Name	Family	Significance
Banyan Tree	Ficus benghalensis	Moraceae	i) Banyan tree leaves have powerful healing and anti microbial properties, and can be used for treating disorders like dysentery and chronic diarrhoea. ii) A study concluded that the use of Ficus benghalensis as an dietary supplement can result in numerous health benefits. iii) Banyans are ecological linchpins. They produce vast crops of figs that sustain many species of bird, fruit bats and other creatures which in turn disperse the seeds of hundreds of other plant species.
Sacred fig tree	Ficus religiosa	Moraceae	i) It is rich in medicinal properties. ii) The husk of the fruit is the source of coir, used for ropes and mats iii) Peepal tree also known as Bodhi Statva Vrukska is a sacred tree that holds a major religious, spiritual significance. iv) Peepal tree provides ample oxygen, purifies the surrounding, kills harmful bacteria; control soil erosion, improve soil structure and its fertility, it is also dust and sound absorbent

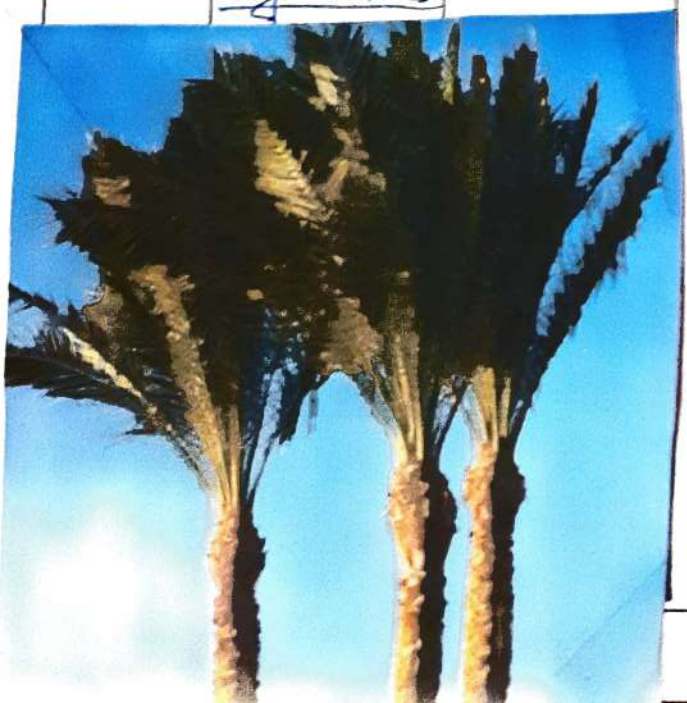


Name of the Plant	Scientific Name	Family	Significance
Elephant Apple tree 	Dillenia Indica	Dilleniaceae	i) It's fruit being naturally low in cholesterol apart from possesing ample potassium, is an ideal remedy for those hypertension. ii) A treasure trove of ~~the~~ three antioxidants, vitamin C, vitamin E, flavonoids; chalta fruits facilitate collagen synthesis to maintain elasticity of skin iii) It is a source of food for elephants and other animals like monkeys, deer and also humans. The tree play major role of in forest ecology
Java Apple 	Syzygium samarangense	Myrtaceae	i) Fruits is rich in vitamin c and other phenolic compounds called flavonoids ii) It reduced risk of stroke iii) It hydrates the body iv) The fruit is regarded as a tonic for the brain and liver.

Name of the Plant	Scientific Name	Family	Significance
Coconut Tree	Cocos nucifera	Arecaceae	i) The fruit flesh is used for food, milk and flour ii) The water is a healthy, refreshing drink. iii) The oil is used for cooking, skin and hairs. iv) The shells is used to steam food and craft with v) The wood is used for fibers in traditional kitchens vi) The flowers is used for medicine.
Pineapple	Ananas comosus	Bromeliaceae	i) The fruit is a good source of vitamin A, B, C and also calcium, magnesium potassium and iron. ii) May help reduce the risk of cancer iii) Pineapples contain bromelain, which has anti-inflammatory properties, it's commonly thought that they may provide pain relief for those with inflammatory arthritis.

Name of the plant	Scientific Name	Family	Significance
Nayantara Plant	Catharanthus roseus	Apocynaceae	i) It's leaf is used for treating a host of health anomalies including diabetes, sore throat, lung congestion, skin infections.
Tulsi Plant	Ocimum tenuiflorum	Lamiaceae	i) Tulsi leaves are used to skin Problem, cure fever, heart disease and fever ii) Tulsi plant protect the environment against chemical pressure such as industrial pollutants and heavy metals.
Aloevera	Aloe Vera	Asphodelaceae	i) Aloe vera farming provides an opportunity for desert-dwellers to cultivate a drought-surviving crop that is remarkably more energy and water efficient than other crops of cattle. ii) It also used to ~~medicinal~~ medicinal purpose
Neem Tree	Azadirachta Indica	Meliaceae	i) Neem leaf is used for leprosy, eye disorders, bloody nose, stomach upset, intestinal worms etc. ii) like other trees, it also brings other environmental benefits such as flood control, reduce soil erosion and less salination.
China Rose Plant	Hibiscus rosa-sinensis	Malvaceae	i) The large colorful flowers attract many pollinators such as butterflies and bees. ii) It also used to medicinal purpose like hair, skin, lower blood pressure, sugar, can protect against skin cancer, Boosts Immune system, help treat depression.

Name of the Plant	Scientific Name	Family	Significance
Guava Tree	Psidium guajava	Myrtaceae	i) Guava fruits are one of the richest source of vitamin C, may help lower Blood Sugar levels, may boost heart health, may aids weight loss. ii) Guava helps anti-aging, skin health, glowing complexion, iii) The fruit is used for the processed product.
Banana Tree	Musa acuminate	Musaceae	i) The fruit is a source of vital nutrients. Rich in vitamins B6 as well as vitamin C, it helps your body absorb iron better, increasing the haemoglobin count and overall blood and cardiovascular health ii) The leaves are used as biological plates
Papaya Tree	Carica Papaya	Caricaceae	i) Fruit is a rich source of vitamins A and C. It has high nutritive and medicinal value. ii) Papain prepared from dried latex of its immature fruits is used in meat tenderizing, cosmetics, for degumming natural silk and to give shrink resistance to wool
Sugar Date Palm Tree	Phoenix ~~dactylifera~~ Sylvestris	Arecaceae	i) It is used as a food which contains high amount of minerals ii) It is used for making molasses.



Name of the Plant	Scientific Name	Family	Significance
Tamarind Tree	Tamarindus Indica	Fabaceae	I) Its partially droped fruit is used to make medicine II) Tamarind tree also finds use in the pharmaceutical and cosmetics industries.
Toddy Palm Tree	Borassus flabellifer	Arecaceae	I) The sap obtained from tapping the inflorescence, of flower stalk is drunk unfermented or fermented and is a source of sugar alchohol and vinegar. II) Trunks are used in construction and furniture making and leaves are used in a variety of ways in domestic economies.
Wood Apple Tree	Aegle marmelos	Rutaceae	I) The wood apple is a cheap highly nutritious and seasonally available fruit that can be preserved for human consumption throughout the year. II) In Ayurveda, all parts of the wood apple plant are used to cure snake bites.
Bamboo Tree	Bambusa ~~tulda~~ vulgaris	Poaceae	I) It is widely planted and used for a variety of purpose, primarily for use in light construction such as houses, huts; boats etc. II) In the present time, it is being used as industrial raw materials for pulp and paper, construction and engineering materials, health food, handy crafts etc.

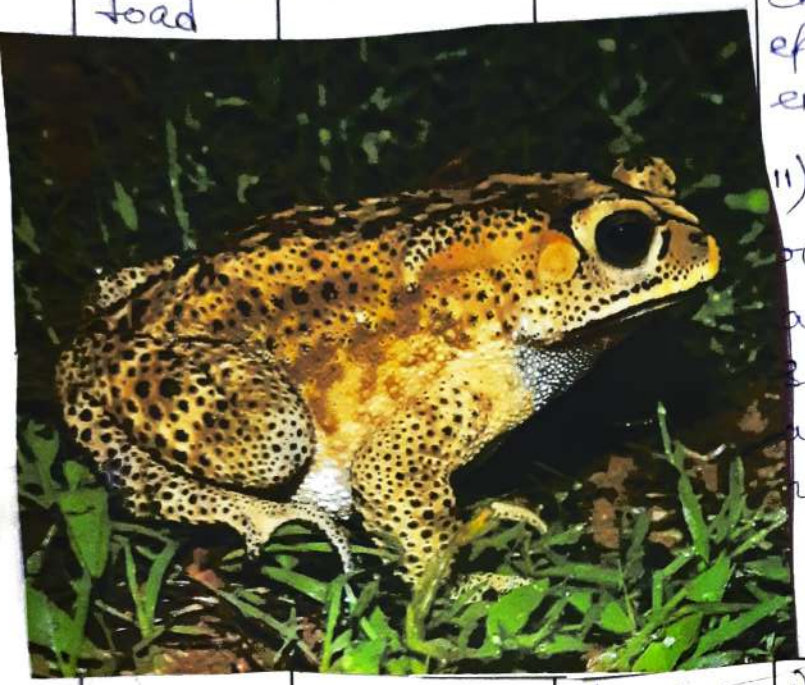
Name of the plant	Scientific Name	Family	Significance
Green chiretta	Andrographis paniculata	Acantha-ceae	i) It has been used in Siddha and Ayurvedic medicine ii) In the traditional medicine of India, it has also been used for jaundice therapy
Kulekha-ra	Hygrophila auriculata	Acanthaceae	i) It helps in increasing hemoglobin contained in blood. ii) The leaves of the kulekhara plant are often used as a part of the daily cuisine especially in eastern India.
Black Plum Tree	Syzygium cumini	Myrtaceae	i) The black plum is known to relieve stomach pain, carminative, anti-scorbutic and diuretic ii) The fruit helps to convert starch into energy and keep your blood sugar levels in check.
Teak Tree	Tectona grandis	Lamiaceae	i) Wood very durable, resistant to fungi. Uses for poles, beams, trusses, columns, roofs, doors, flooring and other constructional work ii) Teak is employed for sound boards of musical instruments, keys etc. and for different grades of plywood.

Name of the Plant	Scientific Name	Family	Significance
Datura Plant	Datura metel	Solanaceae	i) It is used for relieving muscular pain ii) Leaves and flowers of Datura stramonium are the sources of drug 'Stramonium' used to treat asthma and whooping cough iii) Leaves, flowers, berries of Solanum trilobatum are used to treat cough
Thankuni Plant	Centella asiatica	Apiaceae	i) Whole plant is used for medicinal purpose. The leaf juice is used as a good health tonic and also gives relief from hypertension. ii) The plant is aquatic, the different harmful chemicals or pollutants may absorbed into the plant so cultivated plant in dried soil is important for us.
Shiuli Plant	Nyctanthes arbo-tristis	Oleaceae	i) Flowers yield an essential oil similar to jasmine ii) Seed yield a fixed oil iii) Powdered seeds used for scurfy affections of the scalp
Water clover Plant	Marsilea quadrifolia	Marsileaceae	i) In some places it has been used as food for more than 3000 years. ii) The plant is said to be anti-inflammatory; diuretic, depurative, febrifuge and refrigerent iii) It is also used to treat snakebite.

FAUNA

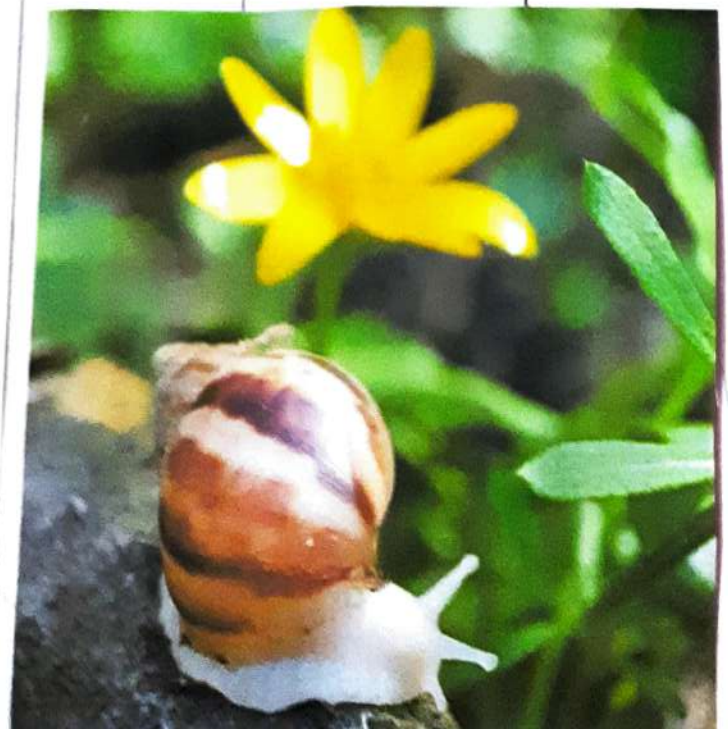
A scientific list of all the fauna in our Locality

Name of the animal bird/Insect	Scientific Name	~~Phylum~~ Family	Significance
Asian Common toad	Duttaphrynus melanostictus	~~chordata~~ Bufonidae	i) Frogs and toads are right in the middle of the food chain and provide a very efficient transfer of solar energy. ii) They play an important role in consuming insects and are an important food source for birds; snakes and other animals throughout the food web.



Kingfisher Bird	Alcedo atthis	~~chordata~~ Alcedinidae	i) Common Kingfishers serve as a good indicator of the health of an ecosystem. ii) As they feed on small aquatic animals, toxins in the water affect them severely. iii) Common kingfishers are also important predators throughout their range of small fish from freshwater habitats, thus controlling their population.

Name of the animal bird/insect	Scientific Name	~~Kingdom~~ family	Significance
Mouse	Mus musculus	~~Chordata~~ Muridae	I) Mice are considered to be useful model organisms for understanding and studying human disease. II) As vertebrates and mammals, mice develop diseases that naturally affect immune, endocrine; nervous, skeletal, digestive and cardiovascular system. III) Mice are keystone species in almost every ecosystem IV) In forests, fields and deserts, mice represent food to predators of all sizes. They link plants and predators in every terrestrial ecosystem.
Burgundy snail	Helix pomatia	~~Mollusca~~ Helicidae	I) Burgundy snails serve an important roll in the ecosystem. They eat very low on the food web, as most land snails will consume rotting vegetation like most leaf litter, and also fungi and sometimes eat soil directly. II) The snails provide calcium and other nutrients vital to the formation of shells and embryos.



Name of the animal bird/insect	Scientific Name	~~phylum~~ Family	Significance
House crow	Corvus splendens	~~chordata~~ corvidae	i) Despite their reputation, crows play vital role in waste management. ii) They consume tons of waste every year, preventing the spread of disease and bad odor. iii) Crows have highly efficient digestive systems like those of vultures and as omnivorous birds, they can feed on meat and plants.

~~Indian Pond Heron~~ Cattle egret	~~Ardeola grayii~~ Bubulcus ibis	~~chordata~~ Ardeidae	i) It scavenges on invertebrates and fishes which are usually laid out for sun drying and has been reported feeding on flies attracted to decaying fish wastes. ii) In South Africa, they are given much importance as controllers of dipterous pests of cattle.

Name of the animal	Scientific Name	~~Phylum~~ Family	Significance
Monarch Butterfly	Danaus plexippus	~~Arthropoda~~ Nymphalidae	i) Monarch butterflies need milkweed plants to lay their eggs. ii) More than ~~butter~~ beautiful, monarch butterflies contribute to the health of our ~~plan~~ Planet iii) While feeding on nectar, they pollinate many types of wildflowers. iv) Monarch butterflies are also an important food source for birds, small animals and their other insects.
Common green grasshopper	Omocestus viridulus	~~Arthro-poda~~ Acrididae	i) Grasshoppers are beneficial and play a critical role in the environment by making it a more efficient place for plants and other animals to thrive. ii) They facilitate a natural balance in the decomposing and regrowth process of plants. Like any other insects or animals, their waste is a good source of fertilizer.

Name of the animal/ bird/insect	Scientific Name	Phylum & Family	Significance
Dragon fly	Sympetrum flaveolum	~~Arthropoda~~ Libellulidae	I) Reasearchers look to dragonflies as ecological indicators. The presence of dragonflies indicates fresh water. II) ~~One of~~ Dragonflies are predators in the insect world and feed on many small to medium sized bugs, eating things like mosquitoes, flies, moths and midges. III) Dragonflies eat their own weight or even more, in harmful insects on a daily basis.
Chameleon	~~Chamaeleo~~ Chamaeleo zeylanicus	~~chordata~~ chamaeleonidae	I) They are insectivorous as a result they play a major role in controlling insect populations

Name of the animal bird / insect	Scientific Name	~~Phylum~~ Family	Significance
Pigeon	Columba livia domestica	~~chordata~~ Columbidae	i) Pigeons play a vital role in the environment; they serve as food for peregrine falcone., hawks, foxes and martins. ii) They also maintain and regulate insect species in an environment as well as weeds such as thistles. iii) These birds also play a part in seed dispersal by eating seeds and distributing them.
Spotted dove	Spilopelia chinensis	~~Chordata~~ Columbidae	i) The doves are important seed dispersers and pollinators, especially of columnar cacti such as the saguaro in western states. ii) The cactus pollen, nectar, fruit and seed provide practically all of the obtainable food and moisture for the desert white-winged doves in summer month.

Name of the ~~animal~~ bird/insect	Scientific Name	~~Family~~ Phylum	Significance
Leech	Hirudinaria granulosa	~~Annelid~~ Hirudinidae	i) Leeches serve as food for some higher predators in the food chain. ii) Leeches have been used as therapy in Veterinary Medicine to treat diseased of domestic animal.
Common earth-worm	Lumbricus terrestris	~~Annelida~~ Lumbricidae	i) They help loosen up and aerate the soil as they burrow deep. This aids in the respiration of the roots of the plants; making them penetrate deeper and grow well ii) They are being used presently in vermiculture to produce high-quality manure iii) they are also used as baits to catch fish. iv) ~~Earth worms, along with~~ bacteria and fungi, decompose organic material. most people know about earthworms and compost but earthworms do the same in pasture soil, decomposing dung and plant litter and processing 2-20 tonnes of organic matter per hectare each year and recycling leaf litter under orchards and in other forested areas.

Name of the animal/ bird/ insect	Scientific Name	~~Phylum~~ Family	Significance
Parrot Bird	Psittacula krameri	~~chordata~~ Psittacidae	I) Parrots have long been 'pigeon-holed' as efficient seed predators and exploiters of plants. II) They also provide benefits to other animal species via the seeds they droop and can even promote the health of their plant food species by removing parasites.
Indian grey mongoose	Herpestes edwardsi	~~chordata~~ Herpestidae	I) Though not a domestic animal; It acts as a natural pest controller, feeding on rodents and insects, maintaing their population in a delicate urban ecosystem.

Name of the animal/ bird/ insect	Scientific Name	Family	Significance
Sunbird	Cinnyris asiaticus	Nectariniidae	i) Sunbird are colourful pollinators of many plants Flowers pollinated by sunbirds are often red or orange and have long tubular flowers with lots of sugar nectar. ii) Sunbirds also feed on insect that visit flowers.
Wild Duck	Anas platyrhynchos	Anatidae	i) Waterbird can maintain the diversity of other organism, control pests be effective bioindicators of ecological conditions and act as sentinels of potential disease outbreaks ii) they also provide important provising (meat, feather, eggs etc.) and culture services to both indigenous and westernized societies

Name of the animal bird/insect	Scientific Name	~~Phylum~~ Family	Significance
Monitor lizards	Varanus varius	~~chordata~~ Varanidae	i) Reptiles are important components of the food webs in most ecosystems; they fill a critical role both as predator and prey species ii) In some areas, they help control the numbers of serious agricultural pests by consuming rodent and insect pests. iii) In human uses, the flesh is eaten for the relief of rheumatic pain, abdominal fat is used as a salve for skin infections.
Indian palm Squirrels	Funambulus palmarum	~~chordata~~ Sciuridae	Because squirrels often fail to reclaim the buried food; abandoned seeds and nuts often take root, establishing trees and other plants in new locations. Thus, squirrels play a vital role in sustaining and expanding plant communities and ecosystem.

Name of the animal bird/insect	Scientific Name	~~Phylum~~ Family	Significance
Indian Honey Bee	Apis cerana Indica	Apidae	i) Honeybees always travel incredible distance to look for pollen. It is because of these amazing journeys that pollination takes place between food crops. ii) Bees not only help with food crops; but they also pollinate wild plants. iii) All honeybees carry the nectar extracted from plant back to the hive. They mix the nectar with their saliva in a cell to produce honey.
Moth	Opodiphthera eucalypti	Saturniidae	i) Both adult moths and their caterpillars are food for a wide variety of wildlife, including other insects, spiders, frogs, toads; lizards, shrews, hedgehogs; bats and birds. ii) But moths also benefit plant by pollinating flowers while feeding on their nectar, and so help in seed production

Conclusion:

Every living creature plays its distinctive role to support life on earth. So flora and fauna serve as an integral part of our ecosystem.

Maintaing a natural balance is essential for the sustenace of the ecosystem. Hence, we need to reconsider our attitude towards nature for the survival of life on earth.

College Roll No: BOTA20F090

CU Registration No: 223-1211-0274-20

EVS Project →

Topic:

→ Pollution in General

- Mainly Discussed:

(i) Air Pollution
(ii) Noise Pollution
(iii) Water Pollution
(iv) Conclusion
(v) Acknowledgement.

What is Ecosystem?

An ecosystem is a community of living organisms in the conjuction with the non-living components of their enviroment, interacting as a system. These biotic and abiotic components are linked together, through nutrient cycle and energy flow.

- Now, as we get to know about the defination of Ecosystem, let's have a look at the term 'Enviroment'.

What is ENVIROMENT?

The natural enviroment or natural world encompasses all living and non-living things occuring naturally, meaning in this case not artificial. The team is often applied to the earth or some parts of Earth.

- Now, after we get to know about the definations of 'Ecosystem' and 'Enviroment', we can now have a look at the differences, between them.

WHAT IS AN ECOSYSTEM?

An ecosystem is a community of living organisms interacting with each other and their non-living environment.

(i)

What makes up an ecosystem?

- All living things (plants, animals, and bacteria)
- Non living things (the sun, rocks, and soil)

(ii)

(i) — what is Ecosystem.?

(ii) — what is Environment.?

DIFFERENCES BETWEEN Ecosystem and Environment —

Environment	Ecosystem
1) It is the surrounding or area where organisms exist.	1) It is the community of organisms along with non-living components where the biotic and abiotic components are in continuous interaction with each other.
2) It is composed of physical components.	2) It is composed of biological or living components.
3) A living space for the elements is provided by the environment on our planet.	3) Interaction between the living and non-living elements is provided by the ecosystem.
4). When an organism moves from one place to another, the environment changes.	4) The ecosystem remains the same despite the movement of the organism.

We can see that there are many differences between ecosystem and environment. But the main destruction factor for both the structures, is, without any doubt — **"POLLUTION"**

- From the next page, we are going to discuss about details and defination of **POLLUTION** →

POLLUTION

- Pollution: Destruction towards the environment & ecosystem.

What is Pollution:

Pollution is the introduction of harmful materials into the environment. These harmful materials are called **Pollutants**. Pollutants can be natural, such a volcanic ash. They can also be created by human activity, such as trash or run off produced by factories. **Pollutants** damage the quality of air, water and land.

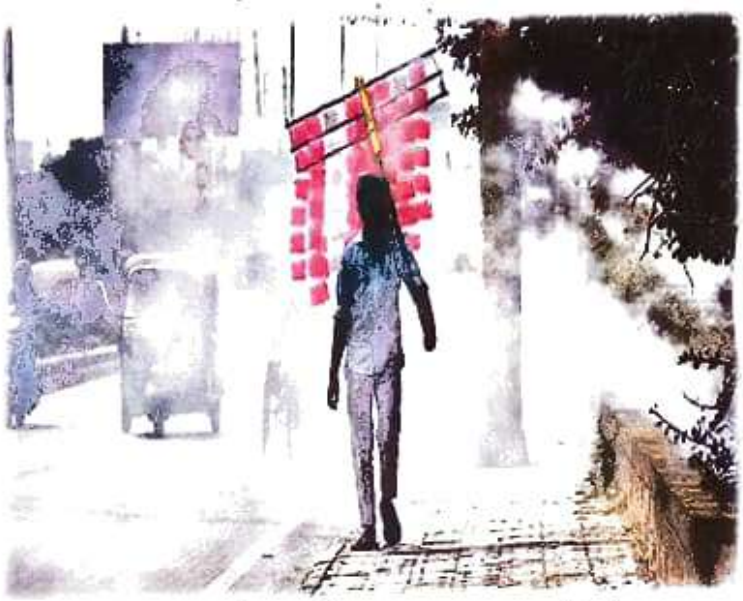
Types Of Pollution=

- Air Pollution
- Noise Pollution
- Water Pollution
- Soil Pollution
- Thermal Pollution
- Radiation Pollution.

AIR POLLUTION=

This may be defined as the presence of any solid, liquid or gaseous substance including noise and radioactive radiation in the atmosphere in such concentration that may be directly and indirectly injurious to humans or other living organisms, plants, property or interferes with normal environmental

→ Sources of air Pollution



↳ unbreathable polluted Air

Particulate air pollutants, Their sources and Effects:

POLLUTANT	SOURCES	EFFECTS
Suspended particulate matter / dust	Smoke from domestic, industrial and vehicular soot.	Depends on specific composition. Reduces sunlight and visibility, increase corrosion. Pneumoconiosis asthma, cancer and other lung diseases.
Fly Ash.	Part of smoke released from chimneys of factories and power plants.	Settles down on vegetations, houses, Adds to the suspended particulate matter (SPM) in the air. Leachates contain harmful material.

➡ Oxides of Iron, almunium, maganese, magnesium, zinc, and other metals have adverse effect due to deposition of dust on plants during mining operations and metallurgical processes. They create physiological, Biochemical and developement disorders in plants and also contribute towards reproductive faliure in plants.

▶ SPM Permissible - residential 140-200 mg/m³, industrial 360-500 mg/m³:

CITY	RESIDENTIAL AREA	INDUSTRIAL AREA
Agra	349	388
Bhopal	185	160
Delhi	368	372
Kanpur	348	444
Kolkata	218	405
Nagpur	140	157

⊛ We should be focused about the informations given about Kolkata.

▶ PREVENTION-

(i) **Indoor Air pollution:** Poor ventilation due to faulty design of buildings leads to pollution of the confined space. Paints, carpets, furniture, etc. in rooms may give out volatile organic compounds. In congested areas, slums and rural areas burning of firewood and biomass results in lot in smoke.

(iv). Prevention and control of indoor air pollution:

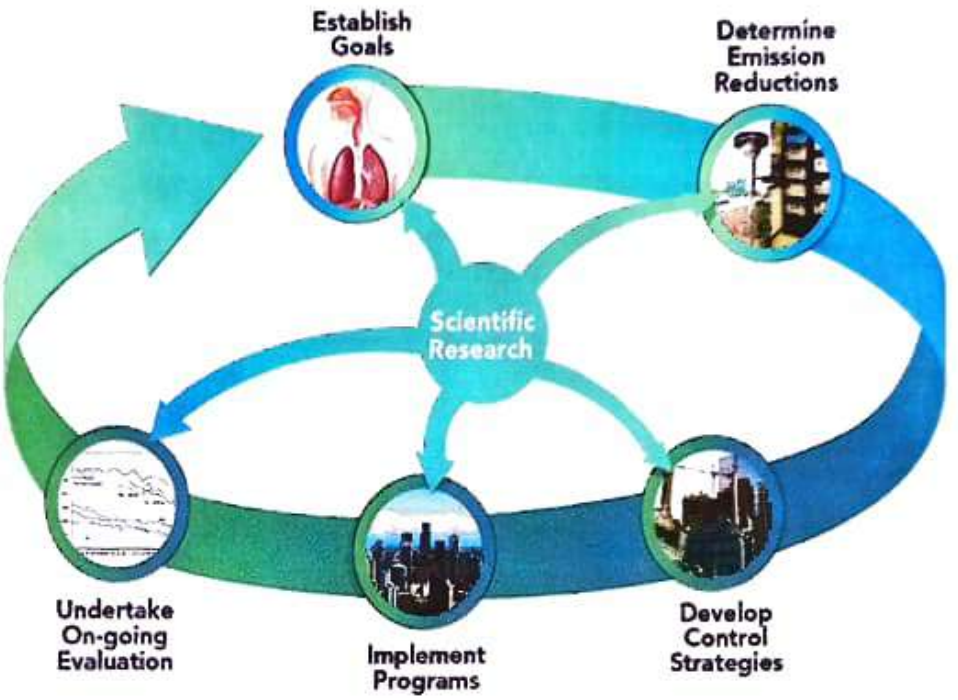
Use of wood and dung cakes should be replaced by cleaner fuels such as biogas, Kerosene or electricity. But supply of electricity is limited. Similarly Kerosene is also limited. Improved stoves for cooking like smokeless chullahs have high thermal efficiency and reduced emission of pollutants including smoke.

Now, Let's have a look on the prevention processes of Industrial pollution:

(a) Use of cleaner fuels such as liquefied natural gas (LNG) in power plants, fertilized plants etc. which is cheaper in addition to being environmentally friendly.

(b). Employing environment friendly industrial processes so that emission of pollutants and Hazardous waste is minimized.

(i) Filters: First remove particulate matter from the gas streams. The medium of a filter may be made of fibrous materials like cloth, granular material like sand, a rigid material like screen.



— Prevention of Air Pollution —

(ii). **Electrostatic precipitators (ESP)** : The emanating dust is charged with ions and the ionised particulate matter is collected on an oppositely charged surface. The particles are removed.

(iii) **Scrubbers** : Scrubbers are wet collectors. They remove aerosols from a stream of gas either by collecting wet particles on a surface followed by their removal.

- Now let's discuss about the Ozone depletion and that structure destruction —

The Stratosphere has an ozone layer which protects the earth's surface from excessive ultraviolet (UV) radiation from the sun. Chlorine from chemicals such as chlorofluorocarbon (CFCs) used for refrigeration, air conditioning, free extinguishers, cleaning solvents, aerosols cause damage to ozone molecules to form Oxygen (O_2). There has been a reduction of Ozone umbrella or shield over the arctic and Antartic regions. This is known as **Ozone Hole**.

GLOBAL WARMING AND GREENHOUSE EFFECT:

Atmospheric gases like carbondioxide, methane, nitrous oxide, water vapour, and chlarofluorocarbons are capable of trapping the out-going infared radiation from the earth. Infra-red radiations trapped by the earth's surface cannot pass through these gases and to increase thermal energy or heat in the atmosphere. Thus, the temperature of the global atmosphere in 1990 it was decided to completely phase out CFC's to prevent damage of ozone layer.

NOISE POLLUTION:

Noise is one of the most pervasive pollutant. A musical clock may be nice to listen during the day, but may be an irritant during sleep at night. Noise by defination is 'sound without value' or 'any noise that is unwanted by recipient. Noise in industries such as stone

cutting and crushing, steel forgings, loudspeakers, shouting by hawkers selling the wares, movement of heavy transport vehicles, railways and airports leads to irritation and an increased blood pressure, loose of temper, decrease in work efficiency.

Source	Intensity	Source	Intensity
Aircraft noise	90 – 120 dB	Beat music	120 dB
Motor Cycle	105 dB	Launch	140 dB
Jet engine	140 dB	Space vehicle	140 – 179 dB
Lawn Mower	60 – 80 dB	Traffic Noise	60 – 90 dB.

(i)

(ii)

(i) & (ii) Both pictures are showing the cause of noise pollution-

EFFECTS OF NOISE POLLUTION :

~~Noise pollution is is~~

- Noise pollution is highly annoying and irritating. Noise disturbs sleep, causes hypertension (high blood pressure), emotional problems such as aggresive, mental depression and annoyance.

- **Prevention :**

(i) Road traffic noise can be reduced by better designing and proper maintenance of vehicles.

(ii) Noise abatement measures include creating noise mounds, noise attention walls and wall mentianed and smooth surfacing roads.

(iii) A green belt of trees is an efficient noise absorber.

(iv) Air traffic noise can be reduced by appropiate insulation.

WATER POLLUTION:

It is the most serious environmental problems. water pollution is caused by a variety of human activities such a industrial, agricultural and domestic. Agricultural runs off lades with excess fertilizers and pesticides, industrial effluents with toxic substances and sewage.

Control of water Pollution:

(i) The water requirement should be minized by altering the techniques involved.

(ii) water should be reused with or without treatment

(iii) Recycling of water after treatment should be practiced to the maximum extent possible.

(iv) The quantity of waste water discharge should be minimized.

(i)

(ii)

(i) & (ii) Dirty water sewage and Oil spreading in sea water -

Conclusion:

We get know about various kind of pollutions like- Air pollution, Water pollution, noise pollution etc. The whole point is, the main cause of pollution and destruction is created and caused by humans only. If we get a little bit careful as well as concerned about our environment & ecosystem, then these kind of pollutions can be easily handled.

ACKNOWLEDGEMENT-

I am really really grateful to my Professor Mr. Nilanjan Chakraborty for advising me and introducing the project to me in a easy way to understand which has helped me complete my project.

Date: 5th July, 2021.

Scottish Church College, Kolkata

ENVS PROJECT

CU Roll No. : 203223-11-0021

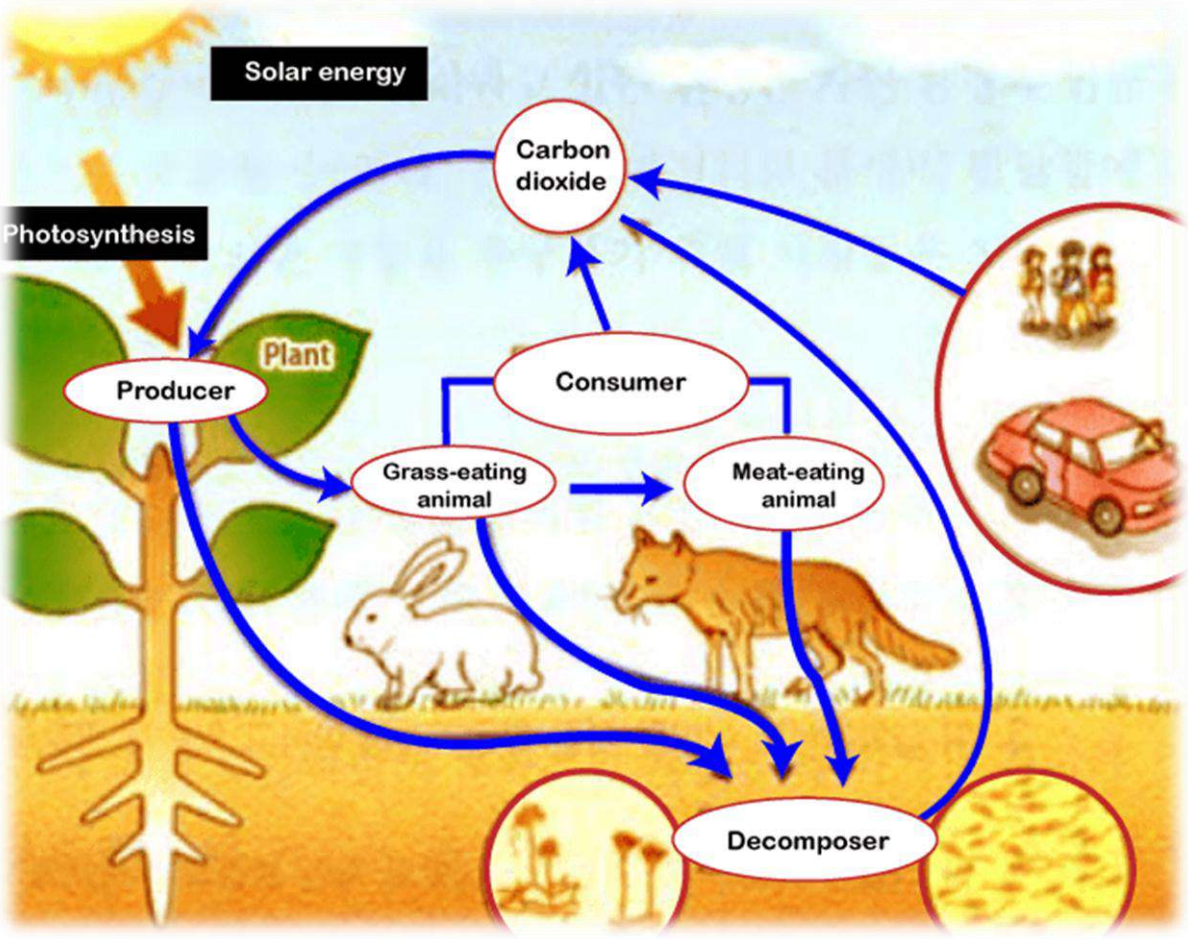
CU Reg. No. : 223-1211-0281-20

College Roll No. : BOTA20F091

STUDY OF LOCAL FLORA AND FAUNA DIVERSITY

ECOSYSTEM:-

- An **ecosystem** consists of a community of organisms together with their physical environment.
- Ecosystems can be of different sizes and can be marine, aquatic, or terrestrial. Broad categories of terrestrial ecosystems are called **biomes**.
- In ecosystems, both matter and energy are **conserved**. Energy flows through the system—usually from light to heat—while matter is recycled.
- Ecosystems with higher biodiversity tend to be more stable with greater **resistance** and **resilience** in the face of **disturbances**, or disruptive events.

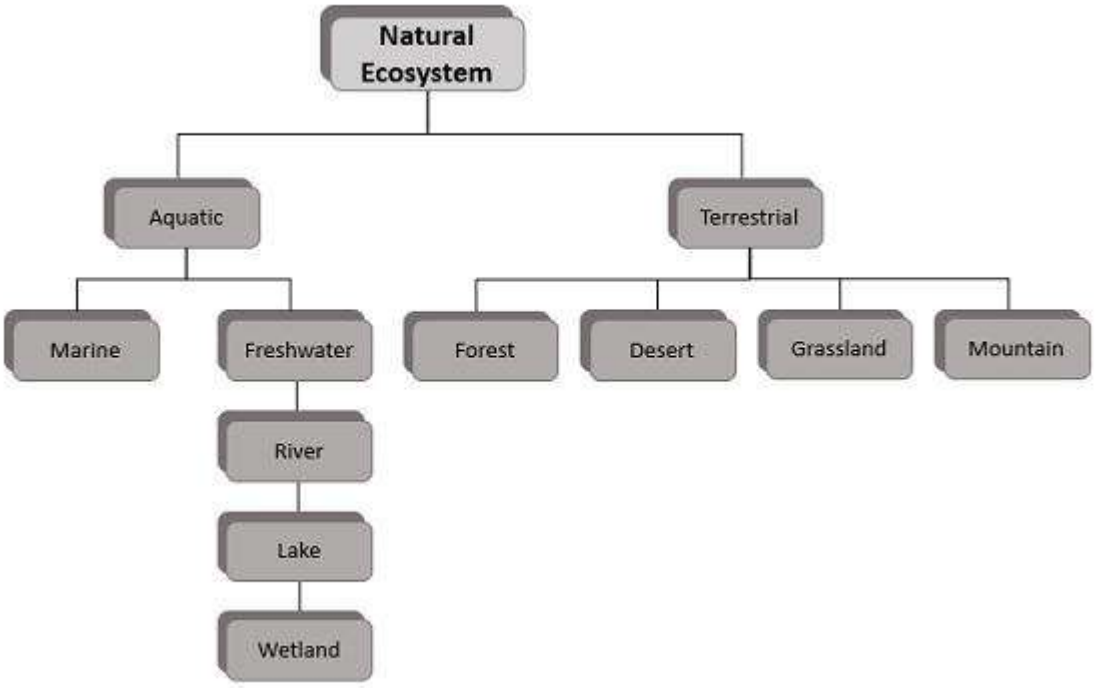


TYPES OF ECOSYSTEM:-

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.

TYPES OF NATURAL ECOSYSTEM:-

An ecosystem is a self-contained unit of living things and their non-living environment. The following chart shows the types of Natural Ecosystem –



BIOTIC (LIVING COMPONENTS):-

Biotic components in ecosystems include organisms such as plants, animals, and microorganisms. The biotic components of ecosystem comprise –

- Producers or Autotrophs
- Consumers or Heterotrophs

- Decomposers or Detritus

ABIOTIC (NON-LIVING COMPONENTS):-

Abiotic components consist of climate or factors of climate such as temperature, light, humidity, precipitation, gases, wind, water, soil, salinity, substratum, mineral, topography, and habitat. The flow of energy and the cycling of water and nutrients are critical to each ecosystem on the earth. Non-living components set the stage for ecosystem operation.

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.

Aquatic ecosystem can be broadly classified into Marine Ecosystem and Freshwater Ecosystem.

Marine Ecosystem:

These ecosystems are the biggest of all ecosystems as all oceans and their parts are included in them. They contain salt marshes, intertidal zones, estuaries, lagoons, mangroves, coral reefs, the deep sea, and the sea floor.

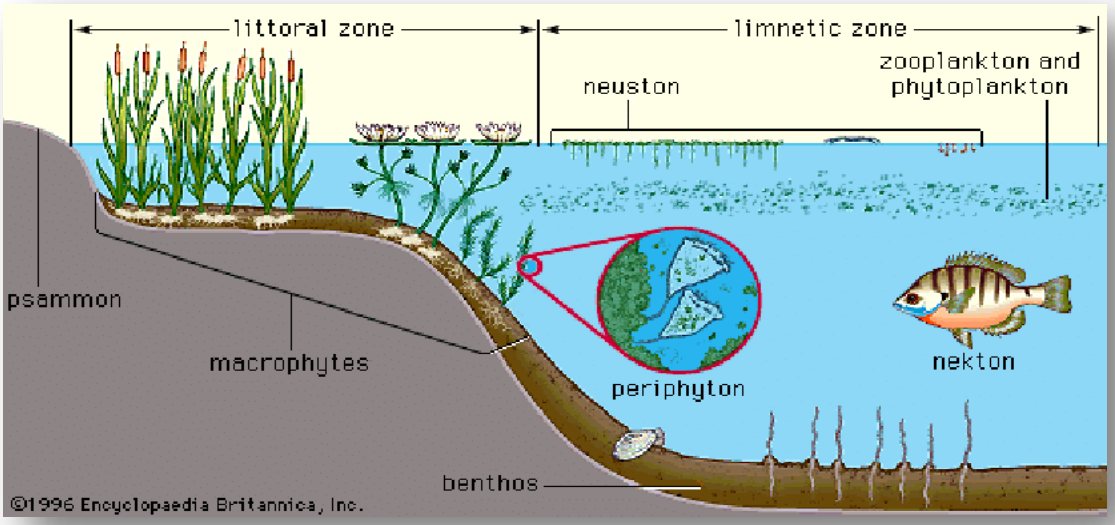
Marine ecosystem has a unique flora and fauna, and supports a vast kingdom of species. These ecosystems are

essential for the overall health of both marine and terrestrial environments.

Salt marshes, seagrass meadows, and mangrove forests are among the most productive ecosystem. Coral reef provides food and shelter to the highest number of marine inhabitants in the world. Marine ecosystem has a large biodiversity.

Freshwater Ecosystem:

Freshwater ecosystem includes lakes, rivers, streams, and ponds. Lakes are large bodies of freshwater surrounded by land.



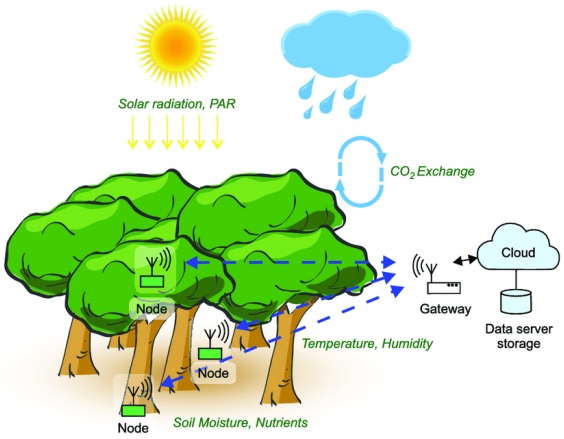
Plants and algae are important to freshwater ecosystem because they provide oxygen through photosynthesis and food for animals in this ecosystem. Estuaries house plant life with the unique adaptation of being able to survive in fresh and salty environments. Mangroves and pickle weed are examples of estuarine plants.

Many animals live in freshwater ecosystem. Freshwater ecosystem is very important for people as they provide them water for drinking, energy and transportation, recreation, etc.

TERRESTRIAL ECOSYSTEM:-

Terrestrial ecosystems are those ecosystems that exist on land. Water may be present in a terrestrial ecosystem but

these ecosystems are primarily situated on land. These ecosystems are of different types such as forest ecosystem, desert ecosystem, grassland and mountain ecosystems.



Terrestrial ecosystems are distinguished from aquatic ecosystems by the lower availability of water and the consequent importance of water as a limiting factor. These are characterized by greater temperature fluctuations on both diurnal and seasonal basis, than in aquatic ecosystems in similar climates.

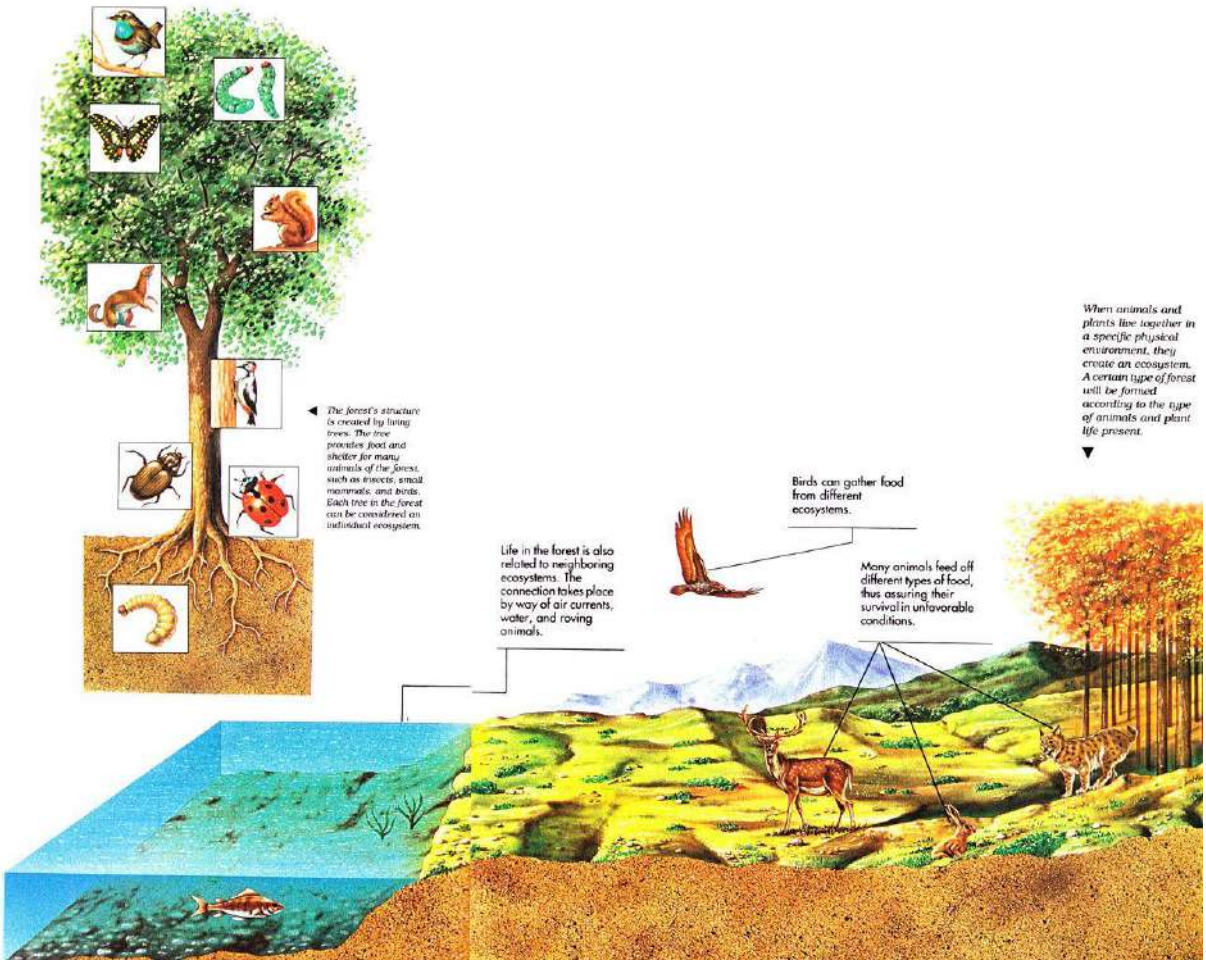
Availability of light is greater in terrestrial ecosystems than in aquatic ecosystems because the atmosphere is more transparent on land than in water. Differences in temperature and light in terrestrial ecosystems reflect a completely different flora and fauna.

Terrestrial ecosystem is broadly classified into four types:-

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.

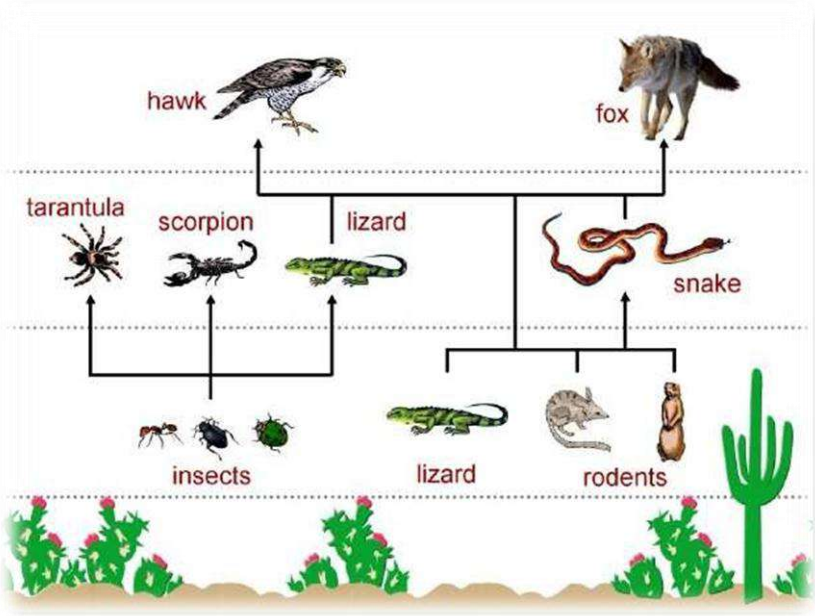


DESERT ECOSYSTEM:-

Deserts ecosystem cover about 14 percent of the earth's land and occur mainly near 30º north and south latitude where global air currents create belts of descending dry air. Some desert ecosystem are also produced in the rain shadows of high mountain ranges, leeward slopes that face away from incoming storms and thereby receive little rainfall. Most deserts ecosystem receives some rain during the year and has at least a sparse cover of vegetation.

Annual net primary productivity of true deserts is less than 2000 kg per hectare. The dominant soils of the arid zone are light-textured and devoid of any significant structural development. These are prone to severe wind

erosion. Desert ecosystems have very low water retention capacity – with high infiltration rate and low hydraulic conductivity. Water is hardly retained in deserts soil as it is not soaked into the earth, and rushes off in torrents. The moisture in the arid zones is insufficient to support living beings.

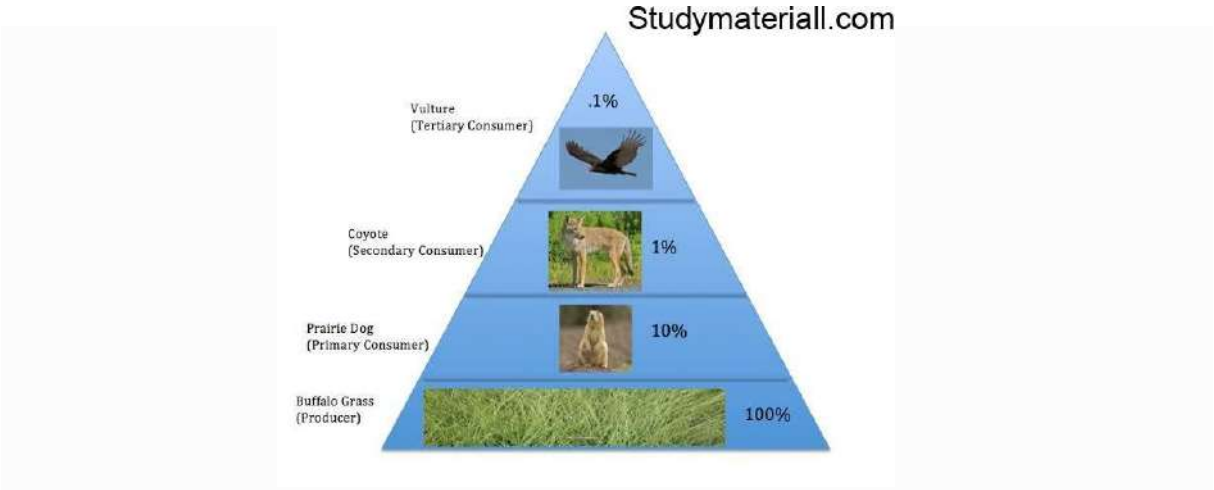


But despite such harsh living conditions, desert ecosystem exhibits a spectacular biological diversity. A large number of plant and animal species thrive in the deserts due to their morphological, anatomical, physiological and behavioural adaptations.

GRASSLAND ECOSYSTEM:-

Grassland ecosystems are influenced over time by the organisms and plants that live there, the local climate, the natural landscape and natural disturbances to the environment such as fires or floods. Various species such as buffalo, elephants, badgers, armadillos and many insects have adapted to and are located in grassland environments throughout the world. Physical features of grasslands such as wide open grass-covered plains or scattered trees located next to scarce streams help to create a diverse environment within the grassland ecosystem.

Grasslands covered to cropland or farms reduces the food source for many wild animals. In this case, the animals are considered pests by the farmers when they feed on the crops, or attack domestic herds. This can lead to migration or possibly the wildlife starvation.

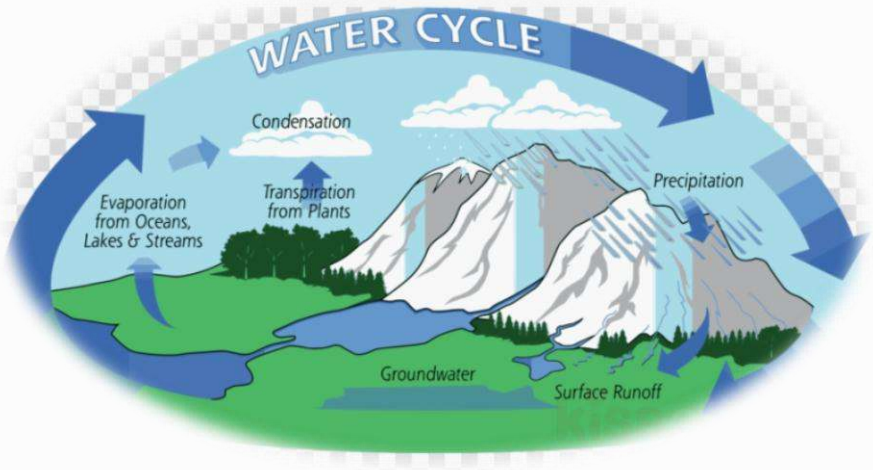


Not only does the conversion of land into crops change the ecosystem, but so does the farming of livestock. If livestock are allowed to graze in areas where wild animals live, they compete for the food source and can deplete it. This overgrazing is a problem especially in the drier grassland regions, where the grass resources can be depleted. Over-ploughed land strips rich nutrients from oil. Salts from irrigation waters damage soil, resulting in dust bowls, similar to what happened in the 1930s American West.

MOUNTAIN ECOSYSTEM:-

Mountain environments have different climates from the surrounding lowlands, and hence the vegetation differs as well. The differences in climate result from two principal causes: altitude and relief. (For more information *see* climate: Climatic classification: World distribution of major climatic types: Highland climates.) Altitude affects climate because atmospheric temperature drops with increasing altitude by about 0.5 to 0.6 °C (0.9 to 1.1 °F) per 100 metres (328 feet).
The relief of mountains affects climate because they stand in the path of wind systems and force air to rise over them. As the air rises it cools, leading to higher

precipitation on windward mountain slopes (orographic precipitation); as it descends leeward slopes it becomes warmer and relative humidity falls, reducing the likelihood of precipitation and creating areas of drier climate (rain shadows).



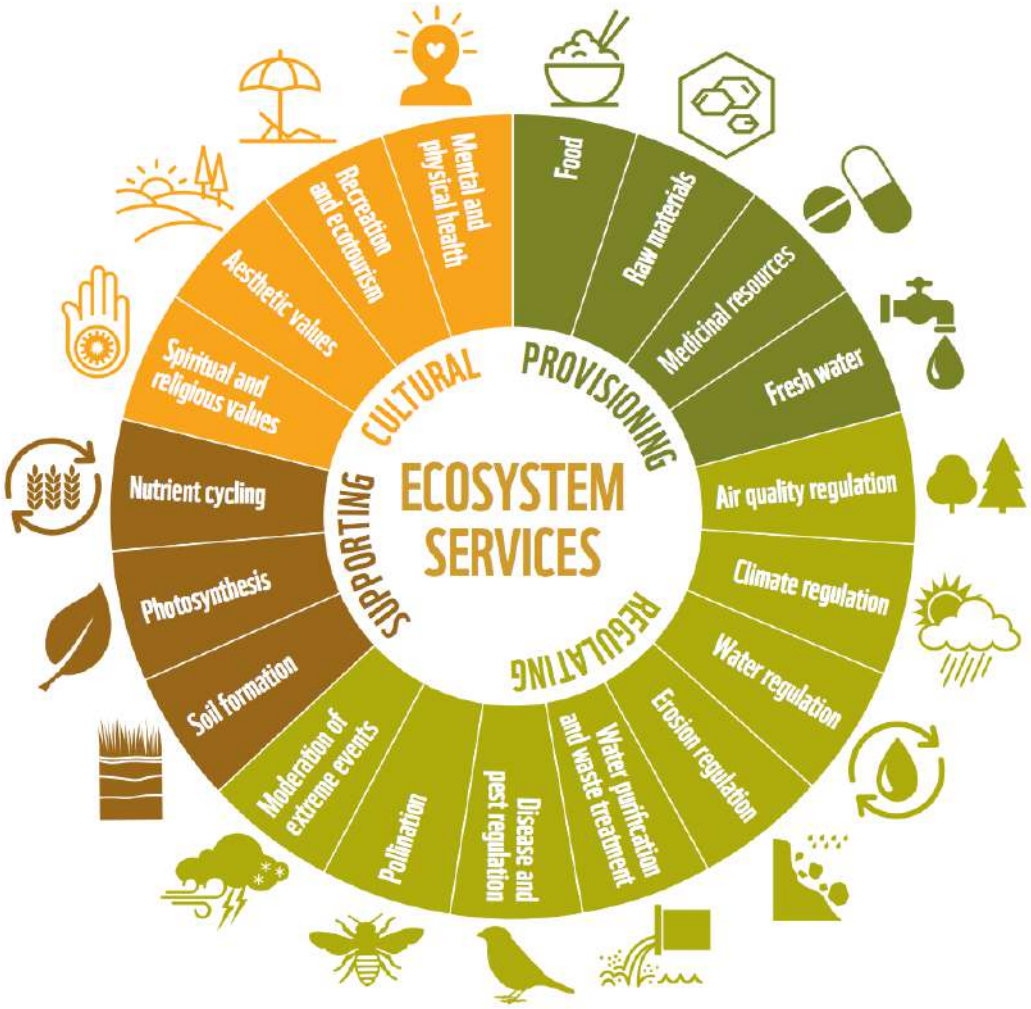
The largest and highest area of mountain lands occurs in the Himalaya-Tibet region; the longest nearly continuous mountain range is that along the west coast of the Americas from Alaska in the north to Chile in the south. Other particularly significant areas of mountain lands include those in Europe (Alps, Pyrenees), Asia (Caucasus, Urals), New Guinea, New Zealand, and East Africa.

IMPORTANCE OF ECOSYSTEM

All of the Earth's plants and animals rely on ecosystems to provide food and habitat. Ecosystems must maintain a delicate balance in order to stay vital. For example, a deer living in the meadow ecosystem needs water to drink, vegetation to eat and shrubs and bracken to sleep and hide in. If the deer population increases too much for their current ecosystem to provide these things, the extra deer will have to search for food and shelter elsewhere, encroaching on the habitats and ecosystems of other species.

Living organisms within an ecosystem interact in many ways including predation, cooperation, competition and

symbiosis. Each species has a niche, or special role, such as eating small insects, decomposing matter or converting sunlight to energy through photosynthesis.



WAYS TO SAVE ECOSYSTEM:-

The ways to save our ecosystem are given as follows:-

1. Use Reusable Bags

Plastic grocery-type bags that get thrown out end up in landfills or in other parts of the environment. These can suffocate animals who get stuck in them or may mistake them for food. Also, it takes a while for the bags to decompose.

2. Recycle

Recycling is such a simple thing to do, but so many people don't do it. Many garbage disposal companies offer recycling services, so check with the company you use to see if they can help you get started! It is as simple as getting a bin and putting it out with your trash cans for free!

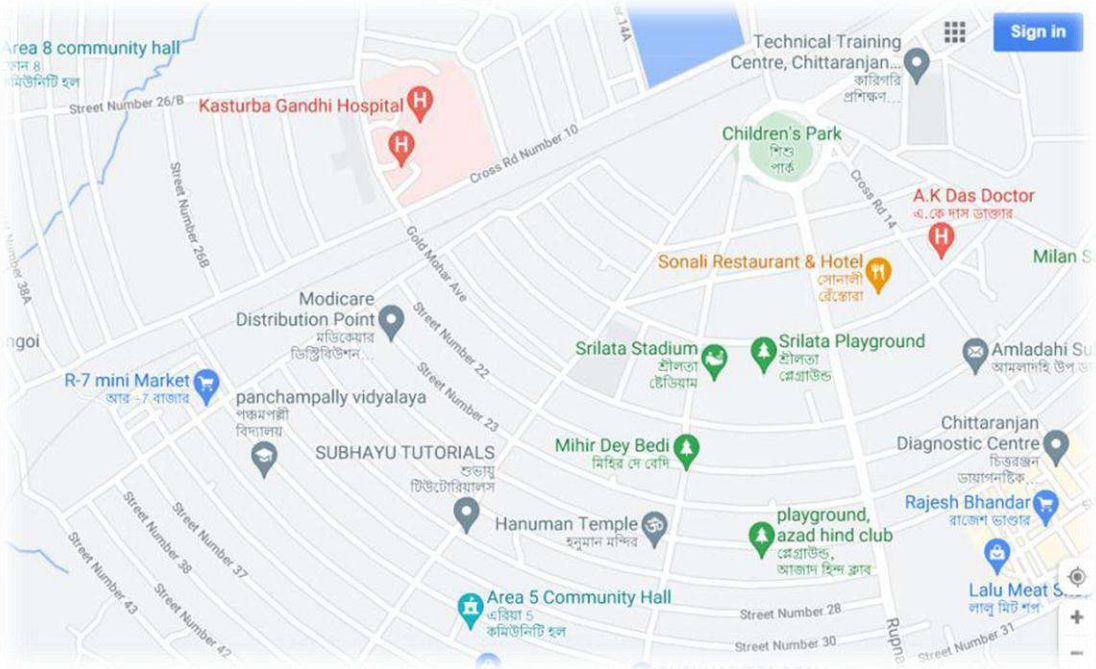
3. Save water

We should use water carefully, and avoid the wastage of water as far as possible.re-use of water should be promoted and water harvesting system installations should be promoted.

4. Save electricity

We should ensure the proper usage of electricity. Switching off fans and light when not in use, saves a lot of power.

BASIC IDEA ABOUT PROJECT WORK



LOCATION:-

CHITTARANJAN,PASCHIM BURDWAN

DATE OF VISIT:-

25TH JUNE,2021

TEMPERATURE AS RECORDED:-

33° CELCIUS,

HUMID WEATHER

RAINFALL AS RECORDED:-

50 percent chance of precipitation

APPARATUS USED :-

Copy,pen,magnifying glass,pencil,camera and eraser.

FLORAL DIVERSITY

Sl. No.	SCIENTIFIC NAME:-	COMMON NAME:-	FAMILY:-	ECOLOGICAL OR ECONOMICAL ROLE (IF ANY):-	PICTURE OF THE PLANT:-
1	*Ipomoea nil*	Japanese morning glory	Convolvulaceae	These are regarded as diuretic, anthelminthic and laxative and are prescribed for oedema and constipation, to promote menstruation or cause abortion.	
2	*Mimosa pudica*	Shame plant or Touch me not plant	Fabaceae	Wounds and eczema can be treated by applying a paste of the whole plant and leaves.	
3	*Hibiscsus mutabilis*	Confederate rose	Malvaceae	None	
4	*Crocus sativus*	Saffron crocus	Iridaceae	Saffron is a spice derived from the flower of *Crocus Sativus.*	

5	*Dahlia pinnata*	Dahlia	Asteraceae	Tubers of dahlia are rich in medicinal compounds.	
6	*Gerbera jamesonii*	Gerbera daisy	Asteraceae	None.	
7	*Hibiscus rosa*	China rose	Malvaceae	Flower has medicinal values.	
8	*Lonicera japonica*	Honeysuckle	Caprifoliaceae	Mostly occurring as invasive species. Also used as ornamentals.	
9	*Jasmine polyanthum*	Jasmine	Oleaceae	Cures stomach pain caused due to severe diarrhea(dysentery).	

10	*Nelumbo nucifera*	Lotus	Nelumbonaceae	Edible in many cases	
11	*Tagetes erecta*	Marigold	Asteraceae	Used in a number of medicines	
12	*Orphys apifera*	Orchids	Juss	Vital for the forest ecosystem with a highly intricate mutual relationship with other biota	
13	*Helianthus annus*	Sunflower	Asteraceae	Oil exctracted from the sunflower seeds.	
14	*Papaver rhoeas*	Poppy	Papaveraceae	Seeds are extracted for medicinal purpose and are also edible.	
15	*Viola tricolor*	Pansy	Violaceae	Has medicinal quality in treating pulmonary disorders.	

16	*Viola odorata*	Violet	Violaceae	Has medicinal qualities same as pansy.	
17	*Lilium candidum*	Lily	Liliaceae	Lily is effective in treating the tumors,ulcers,etc.	
18	*Anemone hupehensis*	Anemone	Ranunculaceae	Anemone is effective for people suffering from panic attacks .	
19	*Gladiolus dalenii*	Gladiolus	Iridaceae	Gladiolus is effective for treating common cold,constipation and diarrhoea.	
20	*Bougainvillea glabra*	Bougainvillea	Nyctaginaceae	Beneficial for cough and diabetic patients.	

21	*Bellis perennis*	Daisy	**Asteraeceae**	It is used as an effective remedy to injuries to soft tissues.	
22	*Lobularia Maritima*	Alyssum	Brassicaceae	Used as food as well as medicine.	
23	*Amaranthus dubuis*	**Amaranthus**	Amaranthaceae	It is a medicinal herb.	
24	*Cosmos bipinnatus*	Cosmos	Asteraceae	None	
25	*Spinacia oleracea*	Spinach	Amaranthaceae	Edible.	
26	*Trigonella foenum-graecuum*	Fenugreek	Leguminaeceae	Helps in digestion.	

27	*Corchorus olitorius*	Molokhia	Malvaceae	It is a fibre crop	
28	*Moringa oleifera*	Drumstick	Mornigaceae	The leaves and fruit has medicinal values	
29	*Momordica charantia*	Bitter gourd	Cucurbitaceae	Effective for curing diabetes.	
30	*Eucalyptus globulus*	Eucalyptus	Mytraceae	Reduces pain and cold	
31	*Aloe vera*	Aloe vera	Asphodelaceae	Has many health benefits.	
32	*Mentha spicata*	Spearmint	Mints	Reduces nausea and inflammation.	
33	*Melissa officinalis*	Lemon balm	Lamiaceae	Cures upset stomach and vomiting tendency.	

34	*Madhuca longifolia*	Mahua	**Sapotaceae**	Used economically to manufacture soaps and detergent.	
35	*Butea* ***monosperma***	Sacred tree	Fabaceae	Treats eye diseases, hypertension.	
36	*Terminalia arjuna*	Arjuna tree	Combretceae	Used as medicine.	
37	*Clerodendrum infortunatum*	Hill glory bower	Lamiaceae	Used as an anti-dandruff agent.	
38	*Calotropis gigantea*	Crown flower	Apocynaceae	Analgesic acivity	
39	*Pterocarpus marsupium*	Vijayasaar	Fabaceae	Helps blood sugar management	
40	*Pithecellobium dulce*	Jungle jalebi	Legumin aeceae	Treats tuberculosis.	
41	*Aegle marmelos*	Wood apple	Rutaceae	Eases digestion.	

42	*Vachellia nilotica*	Babul tree	Fabaceae	Has medicinal values.	
43	*Polianthes tuberosa*	**Rajnigandha**	Asparagaceae	Used in manufacture of perfumes.	
44	*Dalbergia sissoo*	Shisham tree	Fabaceae	Used in manufacturing furnitures.	
45	*Alstonia scholaris*	Saptaparni plant	Apocynaceae	Used in manufacturing drugs for curing asthma.	

FAUNAL DIVERSITY:-

SCIENTIFIC NAME	COMMON NAME	FAMILY	PICTURE
1.Capra aegagrus hicrus	Goat	Bovidae	
2.Felis catus	Cat	Felidae	
3.Canis lupus familiaris	Dog	Canidae	
4.Bos tauras	Cow	Bovidae	
5.Bubalus bubalis	Buffalo	Bovidae	
6.Ratufa indica	Squirrel	Sciuridae	
7.Bubo bengalensis	Owl	Strigidae	

8.Passer domesticus	**Sparrow**	**Passeridae**	
9.Melanerpes superciliaris	**Woodpecker**	**Picidae**	
10.Corvus splendens	**Crow**	**Corvidae**	
11.Anas platyrhynchos	**Duck**	**Anatidae**	
12.Mus musculus	**Mouse**	**Murids**	
13.Columba livia	**Pigeon**	**Columbidae**	
14.Equus caballus	**Horse**	**Equidae**	
15. Canis aureus	**Jackal**	**Canidae**	
16. Acridotheres tristis	**Indian myna**	**Sturnidae**	

17. Pycnonotus cafer	**Bulbul**	**Pycnonotid Ae**	
18. Orthotomus sutorius	**Common tailorbird**	**Cisticolidae**	
19.Centropus sinensis	**Greater coucal**	**Cuculidae**	
20.Psittacula krameri	**Parrot**	**Psittaculidae**	

CONCLUSION:-

Hence from the project we understand the different components of the ecosystem and the need to save it. The diversity of flora and fauna has also been depicted above, showing the variety of plants and animals found in this local area (i.e. Chittaranjan, West Bengal).

ACKNOWLEDGMENT

First of all, I would like to thank God Almighty for giving me peace of mind to complete this project. Then, I would like to express my gratitude to Dr. N.C. Sir for guiding me throughout my project work.

I would also like to thank our Principal- Dr. Madhumanjari Mondal, and our Vice-Principal- Dr. Supratim Das for providing me with all the facility that was required.

Finally, I would like to thank my family and friends, without this project would not have been completed.


ENVIRONMENTAL
SCIENCE
PROJECT

COLLEGE ROLL NUMBER:
BOTA20F092

C.U. REGISTRATION NUMBER:
223-1213-0285-20

C.U. ROLL NUMBER:
203223-11-0117

TOPIC

STUDY ON LOCAL BOTANIC GARDEN

THE

LLOYD BOTANIC GARDEN DARJEELING

(VISITED ON 20/06/2021)

INDEX

INTRODUCTION

The Garden was handed over to Silviculture (Hills) Division, Research wing, of the Forest Directorate Government of West Bengal, during the year 28th July, 1994 and since then the Garden is maintained and developed by this Division.

The Lloyd Botanic Garden, Darjeeling, carries the memory of Mr. William Lloyd, an old, generous and well known resident of Darjeeling, who in 1878 donated one of the beautiful piece of land within the heart of town for creation of this botanical garden in the Himalaya as a branch establishment of the than Royal Botanic Garden, Calcutta. The land Scaping was done with terracing under the guidance of Late George King with arranging a variety of combination of alpine plants Arum, Lilies, Geraniums, free flowering Composite, spectacular Azaleas, Rhododendrons and various conifers.

LOCATION AND GENERAL INFORMATION

The Garden is situated just below the Sahid Durga Malla District Hospital at an altitude of 1850m (amsl) in an open slope covering an area of about 40 acres, butted and bound by Tenzing Norgay Road (NH 55) and Victoria Road on the North, by J.N. Mitra Road and Hari Ghosh Road on the South, by Sahid Durga Malla District Hospital on the East and Victoria Road on the West. In the summer the average minimum and maximum temperature ranged between 18-24°C and 0-12°C in the winter season respectively.

This Garden is one of the main attractions to the visitors to Darjeeling with a treasure of many beautiful, rare and endangered plants. The patches of typical forest of tall Cryptomeria, Bucklandia and Alnus with thick mass of Lianas and shrubby undergrowth with some of the loveliest slopes, make this

place favourite spot of either recreation, a paradise to the students and research workers in Botany.

The Garden is divided into three main section:

i) An upper indigenous containing dominant species of Eastern as well as Western Himalayas and Burma.

ii) A middle Coniferous and

iii) A lower exotic containing acclimatized specimens of different countries.

There are more than two thousand species in the Garden, arranged in twenty divisions, representing seventeen countries of the world.

MAJOR ATTRACTIONS

HERBARIUM

Herbarium and the Office building is an old Heritage building constructed in the late Elizabeth style, surrounded by hedges of "American Pillars". It contains unique collection of 14295 specimens of dried plants collected since 1850's.

ORCHIDARIUM

Orchidarium of Lloyd Botanic Garden is one of the important place of attraction. There is a collection of more than 100 species of Eastern Himalayas wild orchids of immense biological importance. To name a few important species are Pleione hookeriana (Lindley) J. Moore, the Blue Vanda Griff ex. Lindl and Cymbidium eburneum Lindl.

CONSERVATORY

Inside of this conservatory, beautiful seasonal as well as perennial flowers and ornamental plants have been displayed in number of galleries. It consist of more than 20 different species of Cactii. Most conspicuous of them are Mammillaria, Notocactus, etc. A number of important species of succulents including precious ferns etc. conspicuous among them are Platycerium alcicorne, Asplenium nidus L, etc and among the succulents Bowiea volubilis, Gastinia, etc.

HERBAL GARDEN

The herbal garden was created during the year 2003 with the financial assistance of Medicinal plants Board, GoI under the project Ex-situ Conservation of Medicinal plants. In this herbal garden 132 species of well identified medicinal plants with proper labeling, parts used and uses have been displayed to all the individual plant for easy field identification.

OTHER NOTABLE FEATURES

LIVING FOSSIL TREES: There are two very old Maiden hair tree (Ginkgo biloba) planted in the garden. It is reported to have been in existence since one hundred and twenty million years ago in Cretaceous period. The Down red wood a beautiful conifer (Metasequoia glyptostroboides) growing fairly represents immense botanical and geological interest. Both the living fossils were planted in the year 1944.

Wisteria chinensis: Two giant very old flowering climbers with beautiful fragrant is present in the conservatory. Flowering takes place in 1st week of April every year.

Birds of paradise: (Strelitzia reginae) Semi hardy perennial with beautiful orange yellow flowers looking like bird's head, also contribute to make the place colourful.

PLANTS FOUND IN THE GARDEN

LIST OF ORCHIDS & FLOWERING TIME

SL. No.	BOTANICAL NAME	FLOWERING TIME
1.	Pleione humilis D.Don	Jan-March
2.	Paphiopedilum hirsutissimum Pftz.	Feb-April
3.	Coelogyne corymbosa Lindl.	March-April
4.	Calanthe chloroleuca Lindl.	April-May
5.	Coelogyne nitida Lindl	May-June
6.	Agrostophyllum callosum Rchb.f	June-July
7.	Cremastra appendiculata (D.Don) Makino	July-Aug
8.	Coelogyne punctulata Lindl.	Aug-Sept
9.	Vanda coerulea Griff ex Lindl	Sep-Nov.
10.	Acrochaene punctata Lindl	Oct-Nov
11.	Paphiopedilum villosum Lindl	Nov-Jan
12.	Eria vittata Lindl	Dec-March

PLANTS INSIDE CONSERVATORY

Sl. No.	BOTANICAL NAME
1.	Echinocactus ingens Zucc
2.	Opuntia microdasys Lehm
3.	Opuntia macrodasys var. alba Hort
4.	Opuntia scheeri Web
5.	Opuntia salmiana Parm
6.	Crassula argentea Thunb
7.	Haworthia reinwardtii Haw
8.	Haworthia venosa Haw
9.	Iris variegata Linn.
10.	Platycerium alcicorne Desv.


Bowiea volubilis Harv

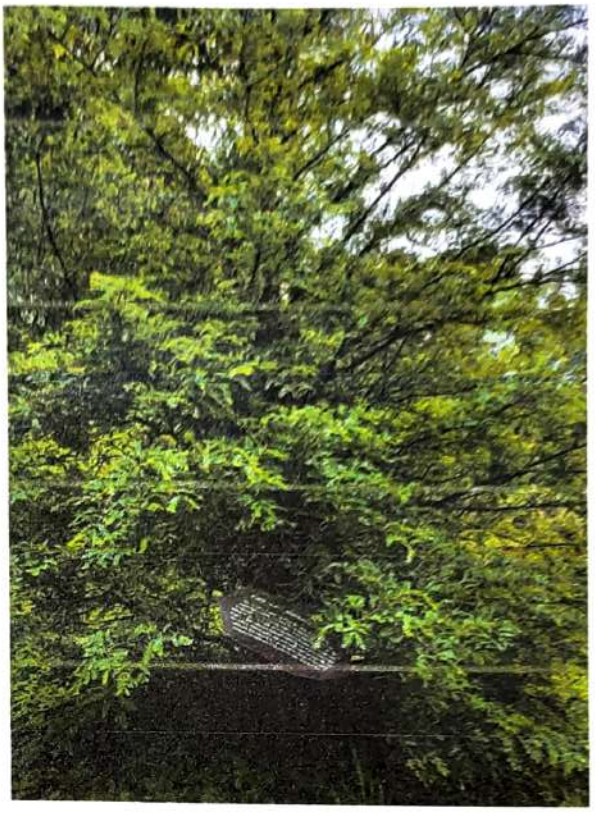

Crassula argentea Thunb

EXOTIC PLANTS

Sl. No.	BOTANICAL NAME	FAMILY	DESCRIPTION
1.	Ginkgo biloba Linn	Ginkgoceae	It is also known as "maiden hair" because of the resemblance of its bi-lobed leaves to those of the maidenhair ferns. It is the oldest living seed plant and regarded as "Living fossil". as it is only living species in the division Ginkgophyta.
2.	Metasequoia glyptostroboides Hu & Cheng	Cupressaceae	The "dawn redwood", is a fast-growing, endangered deciduous conifers, the sole living species of the genus Metasequoia. It is the living fossil from Mesozoic Era of 150 million years old. It has an evolutionary lineage that dates back to genus Metasequoia, Climate cooling and drying that began about 65.5 million years ago.

Sl. No.	BOTANICAL NAME	FAMILY	DESCRIPTION
3.	Liquidambar formosana Hance	Altigiaceae	Commonly known as the Taiwanese sweet gum or Formosan gum, is a species native to East Asia. The tree is 30-40m tall and leaves are three-lobed. The foliage of the L. formosana turns a very attractive red colour in autumn.
4.	Quercus agrifolia Nees	Fagaceae	It is a beautiful evergreen oak. This tree has a much branched trunk. Some specimes may attain an age exceeding 250 years. They'll amend the soil over time with their own leaves and build the natural mycorrhizal fungus in the soil they need to survive. They become islands of natural fertility.

Ginkgo biloba Linn



Metasequoia glyptostroboides

Liquidambar formosana

Quercus agrifolia Ness

PLANTS HAVING MEDICINAL VALUES

Sl. NO	BOTANICAL NAME	LOCAL NAME	FAMILY	PLANT PART USED	MEDICINAL USE	FLOWERING TIME	FRUITING TIME	BEST METHOD OF PROPAGATION
1	Agrimonia eupatoria L	Bel	Rosaceae	Aerial parts, dried roots	Heals wounds, sluggish liver and useful for gall stones.	July - Aug	Sep - Oct	By seeds
2.	Curcuma candollii	Ban Hardi	Zingiberaceae	Rhizome & root	Small pox, headache and antidote to snake bite	April - May	Sep - Oct	By Rhizome.
3.	Mentha viridis Linn	Podina	Labiateae	Leaves	Leaves used for fever, bronchitis & vomitting.	June - Sept.	June - Sept	By seeds & rooted sucker
4.	Paris polyphylla Sm.	Satuwa	Liliaceae	Rhizome	Anthelmintic and used in snake bites and fever.	June - July	Aug - sept	By seeds
5.	Pimpinella diversifolia DC.	Pimpinella	Umbelliferae	Whole plant	The herb is used as carminative.	June - July	Aug - Sept	By seeds.

Paris polyphylla Sm.

Mentha virdis Linn.

Pimpinella diversifolia
DC.

Curcuma aromatica
Salish

Agrimonia eupatoria
Linn

Sl. No.	BOTANICAL NAME	LOCAL NAME	FAMILY	PLANT PART USED	MEDICINAL USE	FLOWERING TIME	FRUITING TIME	BEST METHOD OF PROPAGATION
6.	Acanthus ilicifolius Linn	Hargoza	Acanthaceae	Leaves	Rheumatism and neuralgia, asthma and paralysis.	March-Aug	March-Aug	By Seeds
7.	Bidens pilosa Linn	Kuro	Compositae	Whole plant	Rheumatism and skin diseases.	June-July	Oct-Nov.	By Seeds
8.	Justicia adhatoda Linn	Asuro	Acanthaceae	Root & leaves	Roots used in cough, bronchitis and asthma. Leaves used in rheumatism jaundice & dyspepsia.	Dec-April	Dec-April	By seeds and branch cutting
9.	Urtica dioica Linn	Lekha sishnu	Urticaceae	Leaves & flowers	Leaves and flowers useful for high blood pressure.	Oct-Nov	Nov-Dec	By seeds
10.	Zanthoxylum ovalifolium Wight	Boke Hurbur	Rutaceae	Fruits, seeds, flowers.	Useful in diarrhoea, dyspepsia, asthma, carminative and tonic in fever.	June	Sep-Nov	By seeds

Urtica dioica Linn

Bidens pillosa Linn

Zanthoxylum ovalifolium Wight

Acanthus ilicifolius Linn

Justicia adhatoda Linn

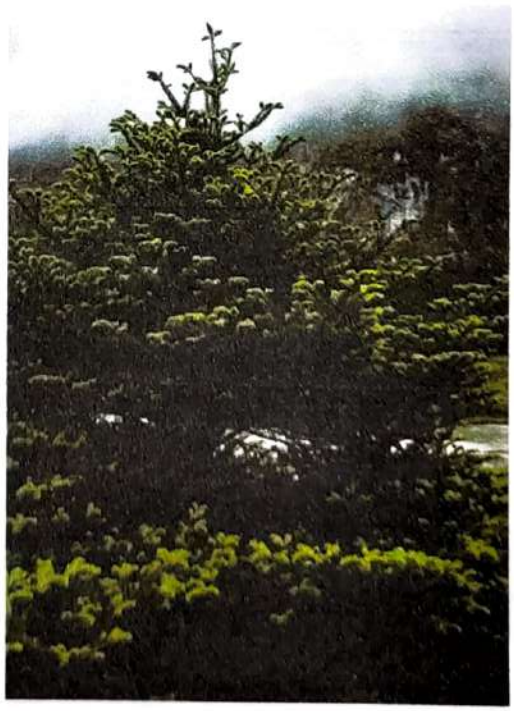
Sl No.	BOTANICAL NAME	LOCAL NAME	FAMILY	PLANT PART USED	MEDICINAL USE	FLOWERING TIME	FRUITING TIME	BEST METHOD OF PROPAGATION
11.	Abies densa Griff	Gobre Salla	Coniferae	Leaves and Gums	It is tonic and used in hoarse voice, internal haemorrhage and tuberculosis.	June	Oct - Nov	By Seeds.
12.	Quercus incana Roxb	Kaths	Fagaceae	Acorms	Given as diuretic in gonorrhea and also as an astrigent in indigestion.	March-April	Nov-Dec	By Seeds.
13.	Rhododendron arboreum Smith	Lali Gurash	Ericaceae	Flowers, young leaves	Fresh and dried flowers are used in dysentry. Leaves are used in case of headache.	March-May	May-June	By Seeds.
14.	Spondias axillaris Roxb	Lapsi	Anacardiaceae	Fruits	Rich in vitamic 'C' and are good for blood.	April	Dec.	By Seeds
15.	Taxus bacatta Linn	Dhargre Salla	Taxaceae	Leaves	Leaves are used in asthma, bronchitis. Taxol extracted from leaf needle is used as anti breast cancer drug.	March-April	Sept-Nov.	By seeds or branch cutting.

Quercus incana
Roxb

Rhododendron
arboreum Smith

Spondias axillaris
Roxb

Taxus baccata
Linn



Abies densa Griff

CONCLUSION

Botanic gardens can be considered as a learning resource centre with live examples. It is an exploratory centre to facilitate the free flow of qualitative and quantitative information on economic plants. Moreover it is a learning laboratory that provides a frame work for training in horticulture, tissue culture, etc. Thus botanic gardens can be considered as the second largest classroom in nature. Success depends on the unique combination of facilities, opportunities, expertise and link with other gardens. Moreover, modern botanic gardens have a role in society with new and extremely important elements in it. These includes "ex-situ" maintenance of rare and endangered species. "In vitro" cultivation field gene bank research on reproductive biology etc.

ACKNOWLEDGEMENT

I would like thank our project guide Sir Nilanjan Chakraborty and also my mentor Ma'am Camellia Nandi. This project would not have been completed without their enormous help and guidance.

I am also very grateful to the incharge of the Garden who let me in although the Garden was closed during this pandemic situation.

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

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- Wikipedia
- College Botany text book

SCOTTISH CHURCH COLLEGE

University of Calcutta

ENVS PROJECT

2020-2021

CU ROLL NO. - 203223-11-0132

CU REG. NO. – 2231211063220

COLLEGE ROLL NO. – BOTA20F093

SUBJECT – BOTANY HONOURS

STUDY OF RIVER ECOSYSTEM (GANGA RIVER)

Introduction

Definition - An ecosystem is a community of living and non living things that work together - it consist of abiotic (soil, water, air) and biotic parts (flora and fauna).

The ecosystem can be classified into aquatic and terrestrial ecosystem. The aquatic ecosystem are water-borne and terrestrial ecosystem are land-based. Based on the quality of water involved, the aquatic ecosystem are further classified into fresh water and marine types. Being potable and pure, fresh water are mostly used for domestic purpose, agricultural purpose. In addition to natural water bodies, artificial reservoirs are constructed to preserve the freshwater without letting them into seas and natural lakes. Freshwater ecosystem deal with both running and standing waterbodies, ~~artificial reservoir~~ and their lives. Lentic ecosystem and lotic ecosystem deal with both running waterbodies and standing waterbodies and are the name given to standing and flowing water bodies, respectively. Almost all ecological factor like temperature, light, pH, dissolved gases and salts of water, turbidity, alkalinity, salinity, depth and ecological characteristics of the lotic ecosystem like a river are going to be discussed. The following are the modulus included :-

(i) River as an ecosystem
(ii) limiting factor and structure
(iii) Characteristic of Lotic adaptations
(iv) life along river
(v) ~~longitudinal~~ zonation.

River as an Ecosystem - Water is an essential component of life. Surface water resources are the mostly preffered location for life settlements. Most of the human civilization were also originated near water sources, especially along the major rivers.

A river is a large natural course of flowing water obtained from precipitation. The surface water moves down along the slopes due to the action of gravity. Streams, tributaries, brooks, creeks and springs are the different types of water courses, especially along the major rivers are classified on the basis of dimension and distribution.

- A river is also termed as major, medium and minor, based on its number of tributaries, stage of development, area of catchment and geomorphic condition.
- Every major river must have a place of origin in the upstream side, which is called as the headwaters, and a point of confluence with the sea or waterbody at the downstream end.
- A river water is always on the move.
- Every river has its own longitudinal profile and different cross-sections.
- The longitudinal profile indicates the nature of slope existing at different places and levels.
- The cross-section of a river varies from headwater zone to the mouth. These are called as river valley which may be ranging from sharp canyon and gorges to wider flat streams nearer to the delta.
- The level at which water flows in a river is called river stage.
- The velocity of water flowing in a stream is not uniform along the longitudinal profile, also within their cross-sections.

° A river is a powerful geological agent. It has the capacity to erode, transport and deposit the sediments. These are called river alluvium.

° The alluvial deposits, clay and silt of a river are the material suffered for different activities.

A river can be classified into 3 types-

ⓐ In a perennial river, there is continuous flow of water throughout the year.

ⓑ In inter streams, the flow is seasonal.

ⓒ In ephemeral streams, the flow is rare.

Characteristics of River Ecosystem

River ecosystem are influenced by the effect of continuous moving water, pollution, suspended sediments, floods and other human activities.

The animal and plants living in river ecosystem have certain specific adaptation.

They are subjected to varieties of dynamic environmental factors, like water currents, pollutants and suspended sediments.

The unique characteristic of river water habitat :-

- The establishment of firm habitat attachment with the substratum. Most of the sponges, diatoms, moss are the example of these. They live on the wooden log, stones and rock exposure.
- The swimmers are expected to have hook or suckers to maintain grip over the polished surface.
- Some of them have built nets around them for food trapping.
- Some of them, like snails and worms, may have sticky buttoms to move long the base.
- The life living in river, have a stream-lined shape of body. They

may have a body rounded anteriorly and tapering posteriorly.

- Some have a flat body to stay within the cracks and clevices of rocks.
- Clinging habitat is another feature of life in river ecosystem. Some organism mostly stay closer and mavec to the hard bodies and materials
- Some of the life forms in river has characteristic feature of osmo regulation Especially, the protozoans release excess water through the contractile vacuole.

Life Along River

In rivers, there are varieties of life like fishes, plants, animals and numerous micro-organisms that we can't see. In addition to these, along river banks, trees and shrubs grow which are the shelter belts of birds and mammals.

Many tiny organisms also exist in river water and play a crucial role in food supply for the entire ecosystem. They act as feders, collectors and grazers. They help in in breaking down the plant matter that grows along the streams on falling from overhanging vegetation.

The river snails works for processing the calcium present in water to built their shells

in this area. The species of Toxfish are found in region and biodiversity is abundant near Shivpuri. Sand dunes, flood plains and of how lakes are formed at Gadmukhteshwar area. Dolphines, crocodile, tortoise are found in this region. This place is called as Ramsar. The quantity of debris increases as the river approaches Farukhabad. The flood plain becomes broader. Agriculture, fishery, animal husbandry, human population and settlement increases in this region. The religious rituals like holy bath and funerals are performed on the banks of the river. The number of organisms like insects, birds of different species and creeping organism increases. The region from Bithur to Kanpur has polluted Ganga river the most. The faecal sludge that flows into the river by the cities situated on the both sides of the river by the planktons are greatly affected. The growth of plankton are found in abundance in this region. They are very sensitive which are affected by human activities like bathing, religious rituals and bathing. Various species of birds, insects-moths, fish, tortoise are found in this region. This place is important from the perpective of religion and archaeology. The ancient Brahma temple of Bithur is of much significance. Meanders, flood plains, lakes are the most common landscape of this region. This is the region of special landform in this Khadar and Bhangar. Dense forest are found in Doab and lowland and swamps and muddy areas found in the region. Gomti and Ghaghra are the main rivers of the region.

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Some of the trees and plants act as shades for other life and filter the pollutants and extract trace metal from the full sediments.

Predator-prey relation are more along the rivers. The largest fish eats the smaller-ones and smaller predatory organisms parasitize the larger fish commonly in the rivers.

Varieties of local and migratory birds, snakes, frogs, bears and other land animals, including cattles and human, all come to the river for drinking water, fishing, preparing food, bathing, washing and living.

Every life along river produce waste which becomes food for some other feeders.

The producers or autotrophs are green plants including the chemosynthetic micro-organisms present in rivers.

The micro consumer of the rivers are the herbivores, predators and parasites.

The decomposers or micro-consumers are the worms, bacteria and fungi.

In a stream ecosystem, food is constantly being produced, consumed and recycled.

Pollution and other human activities can change the food sources and impair the life cycle of the creatures living in and around the life water sources.

All the living beings along the river depends on the other, any change in the system parameters will affect all other as well.

When I visited?

For the study of ecosystem of Ganga river I have visited different sources of Ganga River :-

(i) Upper Source :- I have visited upper source of Ganga in Rishikesh on 15th October 2020

(ii) Middle source :- I have visited middle source of Ganga in Benaras on 25th December 2020

(iii) I have visited lower source of Ganga in Kolkata on 19th May 2021

Observation:

Facts about Ganga Basin:

Length of River Ganga	2,071 km
Total drainage region	9·51 lakh sq. km
Total drainage region in India	8·61 lakh sq. km
Total percentage of area in India	26%.
Total percentage of population residing	45%.

Statewise distribution of Drainage Region of Ganga

States	Total number of cities situated on the bank	Drainage area
Uttrakhand and UP	890	294,364
MP and CG	394	198,962
Bihar and Jharkhand	130	143,961
Rajasthan	222	112,491
West Bengal	373	71,485
Haryana	106	34,341
Himachal	57	4,317
Delhi	01	1,484

Mountainous Region (Upper Source)

- Ganga is the national river and considered as the most sacred river of India. Since ages Aryan Indians have been residing along this river. Ganga has nurtured Ram, Krishna, Gautam, Mahavir and Nanak in its cradle. It is believed that this sacred river washes sins and thus making the way to heaven easier. The origin of Ganga river is in the form of Alakananda and Bhagirathi. The height from sea level to the place of its origin is about 3140 meters. The main branch of Ganga is Bhagirathi which originates from Gomukh in Gangotri Glacier of Kumaon Himalayas. It incarnates from a small cave like structure, the water basin sources of which is at 5000 meters from sea-level. Many associate river play important role in the formation of Ganga. At DevPrayag, these river confluence to form Ganga river. It travels through narrow mountainous route in Shivalik Himalayas for 200 kms enters through Hrishikesh into plain areas at Haridwar. On this travel route, it creates deep valleys passing through zigzag route in Shivalik Himalayas for 600 metres deep at some places Rocks, boulders, pebbles, stones and sand are found on both banks of the river. The slopes on each side is very steep.

- Upper Plain region

  Biodiversity, cultural and spiritual aspects are much significant

Mid Ganga Plains:

Eastern Uttar Pradesh and Bihar constitutes the mid Ganga Plains. These are densely populated areas. Major occupation of the residents in the region are agriculture, animal husbandry, fisheries and small industries associated with these occupations. The main tributaries of this region are Ghgra, Gandak, Kosi, Son. The pace of flow of Ganga becomes slower in this region. The water is not suitable for drinking and bathing due to excessive pollution. The floods in Koshi river causes damage to human property. Shark, crocodile, tortoise, alligators and fishes are main living organisms of the river. The Vikramshila Dolpin sanctuary is spread over 50 kms of region in Bhagalpur district. In this series Dolphin has been declared as national aquatic organism in May 5, 2010. The Dolphin are also called as fresh water tiger. This region is filled with dense forest and wild animals.

Lower Ganga Plains:

The region from Krishnaganj (Purnima-Bihar) to whole West Bengal (excluding northern mountaneous region) and Bangladesh come under the lower Ganga plain. In this region, Ganga and its tributaries are divided into many small stream. Low slope and presence of alluvial soil presents a magnificient view in the deltaic region. The total

area of the delta region is 60,000 sq. km. The total area of this delta region is 60,000 sq. km. The total forest found in swampy areas facing side are called Sunderbans. This region is preserved area in both countries India and Bangladesh. It is one of the foremost areas in terms of biodiversity in the world. Mangrove and tidal type plants are found in this region and hence the name of the region is Sunderwan. The charectaristic of the ecosystem is the plants and living organisms can survive in the mixture of both fresh water and brackish water. This largest delta region of the world is spreading towards the sea. The world's famous Royal Bengal tiger of are found in this sa forests. Apart from types of herbivorous and carnivorous animal are found in Sunderbans. This region is known for rice production and jute production in the world. This region is affected by tropical cyclone that causes huge losses to human property and this region has hot humid monsoon type climate. Hence tropical wet mangrove forest are found here. Since, the production of rice and fishes are in abundance, the rice and fish form staple food.

Fig :- Ganga River Basin

Bio-Resources of Ganga

Fungi

- In water : 51 species
- In sediment : 54 species
- Dominant genera : Aspergillus (11 species)

Algae

- Chlorophyceae : 264 species
- Cyanophyceae : 237 species
- Bacillariophyceae : 240 species

Macrophytes Invertebrates

- Protozoa : 28 species
- Rotifera : 104 species
- Oligochaetes : 37 species
- Polychaetes : 11 species
- Hirudinea : 14 species
- Cladocera : 36 species
- Bivalves : 36 species
- Gastropode : 40 species

New records : 39 aquatic species (annelids)

- 27 Oligochaeta
- 10 Hirudinea
- 2 Polychaeta

Fish : 375 species

Amphibians : 11 species

Reptiles : 27 species

Aves : 177 species

Mammals : 11 species

Fishes of Ganga River

Fishes play a unique role in biotic structure, of fishes transferring nutrients and maintaining ecological balance in the aquatic ecosystem. Freshwater fishes have also inspired art, literature and societies. Fish has been inscribed in the Hindu mythology as an incarnation of lord Vishnu, which symbolizes the restoration of true knowledge, subverted by egoism that has to be destroyed in this process.

Indian rivers and freshwater ecosystem harbour around 75% of freshwater fishes. The distinguished hydrology and geology climatic conditions in the upper, middle and lower structure of Ganga river supports distinctive fish fauna. The Ganga river is home of more than 143 species of fish that belong to 11 orders, 72 genera and 32 families, which is about 20% of total freshwater fishes reported in India. The alteration in freshwater habitat in Ganga, its tributaries and wetlands due to loss of connectivity, hydrology, alteration through dams and barrages, change in physio-chemical water quality and overexploitation has affected several fish species of Ganga river.

Fishes of Ganga (Major Carps)

Rohu fish:- (*Labeo rohita*)

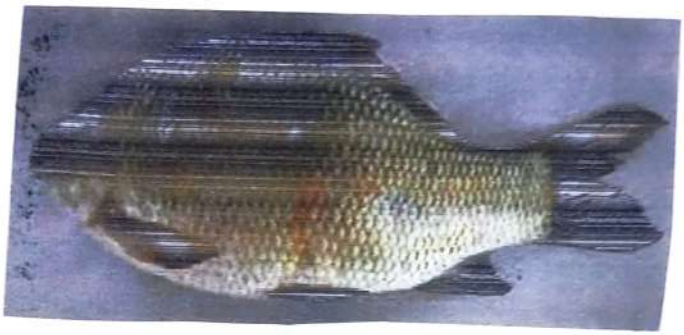
(*Cirrhinus mrigala*)

Katla fish:- *Catla catla*

(*Labeo calbasu*)

Fishes (Minor carps)

(Labeo bata)



(Labeo fimbriatus)

(Cirrhinus Sp.)

Some important fishes of Ganga River ([redacted]) (Threatened)

Golden mahseer

Scientific name :- Tor putitora

The species has been reported across the Himalayan region and elsewhere in South and south-eastern Asia. It inhabits montane and sub-montane regions, in streams and rivers, with rocky bottom riverine pools and lakes. The fish is a column feeder in freshwater and in subtropical condition of 13°C to 30°c. It is omnivorous, feeds on algae, macrophytes, rotifers, small fish, crustaceans This species is declining from its natural habitat.

Snow trout

Scientific name :- Schizothorax richardsonii

Distributed in the Himalayan river, the species is recorded from Uttarakhand, Nagaland and Jammu and Kashmir. Found in the upper stretches of Ganga River. The body is streamlined and scales very small. Adults inhabit mountain streams and river, with rock substrate. The species is a herbivore and feeds mainly on algae, aquatic plants and debitus. Introduction of exotic fish species, damming and overfishing are the major threats to the species.

Silver Mahseer

Scientific name – Tor tor

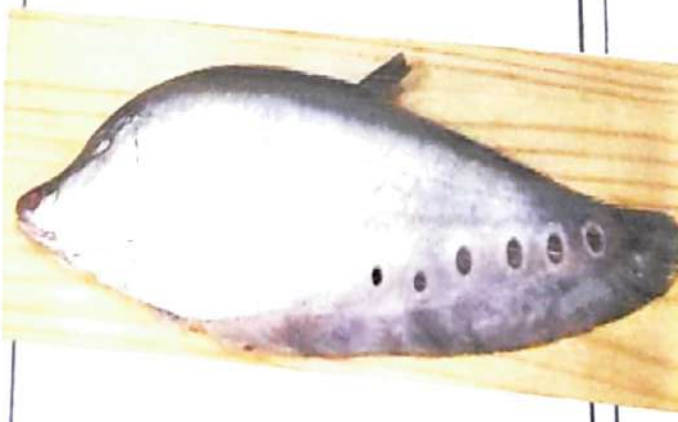
Distributed in the Himalayan and sub Himalayan river of India, the species is recorded from the upper stretches of River Ganga. The characteristic feature is small mouth, with thick lips. The species inhabit river and rapid stream with rocky bottom. The species travel toward headwater at the start of the rainy season. It is omnivorous and feds on filamentous, water beetles and crustaceans. Over exploitation and habitat loss are major factor threatening the survival of species.

Fishes in [redacted] of River Ganga (Threatned)

Feather Back

Scientific name → Chitala chitala

Distributed in the middle and lower stretches of Ganga River, the species inhabit freshwater river, lakes, beels, reservoir, canales and pond. Maxilla extends beyond posterior edge of eye. Pelvic fin is rudimentary. Anal fin is very long, confluent, and with reduced caudal. Transverse silky bars are found on the back. 5 to 9 black rounded spots are found near the caudal region. Lateral line is curved and complete.



Indian mottled eel

Scientific name → Anguilla bengalensis

Distributed in the middle and lower stretches of the Ganga river. Its body is elongated with robust chemical head and is flattened. Mouth is terminal with thick lips. Eye of the species is very catadromous. It lives in freshwater stream, pools and reservoir and commonly found in the mud substrate of tanks and in deep rock pools of river, but it occurs in eastuaries and in sea during early life and near maturity. It feeds of insects and other aquatic invertibrates.

Wallago

Scientific name → Wallago attu

Occurs all across India, and in most stretches of Ganga. It inhabits large rivers, tanks and lakes. It is almost the largest, voracious and predatory of local catfish, which thrives well in river, lakes and ponds with grassy margin.

Fishes of ~~Eastern~~ Ganga region (Threatned)

Bata

Scientific name → Labeo bata

Distributed throughout India, found in upper, middle and lower but they are mostly found in the lower region

stretches of Ganga River. The body is elongate, snout slightly projected beyond the mouth, often studded with pores. It is benthopelagic and potamodromous species. It is herbivorous with column feeder. Major threats of the species include loss of habitat and over exploitation

Spotted barb

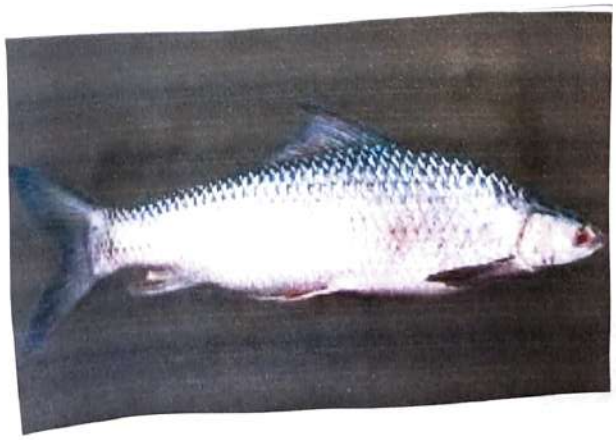
Scientific name → Puntius sophore

Distributed throughout India, found in upper, middle and lower stretches of Ganga river. It inhibits plants and submontane region. A dark spot is present at the tip of tail and other at the base of dorsal fin rays. Breeds during monsoon and during breeding period males develop a scarlet red band along the middle of both sides. Major threats of the species are loss of habitat and over exploitation.

Bronze featherback

Scientific name → Notopterus notopterus

Body highly compressed, colour is silvery white with numerous fine grey spots on body and head. Carnivorous. feeds on insects, fish, crustaceans and young roots of aquatic plants. Breeds in stagnant or sunny water in rainy season.



Crocodiles of Ganga River

Crocodiles have survived millions of years of Earth's environmental changes attributed to their unique adaptability. Ecological and behavioural traits like ectothermity, highly evolved metabolism, higher immunity, wide range of diet and very few natural predators they rapidly move between habitats, transport nutrients and energy between systems and stabilize the ecosystem and habitats linkage.

Modern crocodiles are represented by 23 living species. In India, there are 2 species, Mugger and saltwater crocodile which represent Crocodylidae family and Ghavial is the only surviving members of Gavialidae family. All of these species are distributed in Ganga and its major tributaries.

→ Ghavial
(Gavialis gangeticus)

Mugger crocodile
(Crocodylus palustris) ←

→ Saltwater crocodile
(*Crocodylus porosus*)

Birds of Ganga

The Ganga river, our national river, the lifeline of Indian civilization with deep rooted religious and cultural belief, is one of the largest living river system of the world. The main stem of the river flows through 5 states but provides catchment to rest 11 states.

Some of the important birds of Ganga river are :-

Black bellied tern

(Sterna acuticauda)

Indian skimmers

Indian sarus Crane

(Antigone antigone)

River Laping

Painted stork

Little pratincole

(Glareola lactea)

Great stone-curlew

(Esacus recurvirostris)

River tern

(Sterna aurantia)

Conclusion

The River Ganga has been not only the cradle of the Indian civilization, but is the life-line for the people of this part of the world. The river created vast plains of fertile land which attracted people from central Asia to settle. Over the time several urban settlements came on the banks of the river. The river basin is one of the most thickly populated areas of the world. It remained source of pure freshwater and that of economic, spiritual and cultural activities since time immortal. It sustains thousands of aquatic species of flora and fauna including many endemic and charismatic mega-fauna like Ganga dolphin, Gavialis etc. However, since 1950s the river is facing threat of erosion of the ecological integrity due to anthropogenic pressure in the form of construction dams, barrages and embankments, loss of forest cover in the catchment area leading to heavy siltation, pollution from industrial effluents and domestic sewage degrading the water quality to the extent that the river water is not fit for even bathing purpose what to talk about drinking purposes. The river has very reduced flow, worst between Narora and Allahabad where river has more effluent than freshwater. The declining flow has badly affected the assimilative capacity of the river and the river has lost its self-purifying capacity. Recent ongoing and completed hydroelectric project in Himalayan region are likely to get worsen the situation. Invasion of exotic species is another big threat for the river biota. Apparently, the biotic and river both have resilient capacity. There is immediate need to take measure to increase flow and reduce pollution load in the river. This is possible only if water efficient agricultural practice are opted which will reduced abstraction of river water in irrigational canal, mass scale plantation is undertaken in catchment area of the river, wetlands in the river basin are conserved, stringent measure are taken for pollution abatement, and peoples participation is ensured in 'Save Ganga movement'

Fig:- View of Ganga River

ENVIRONMENTAL STUDIES AECC2 PROJECT

CU REGISTRATION NO: 223-1211-0338-20

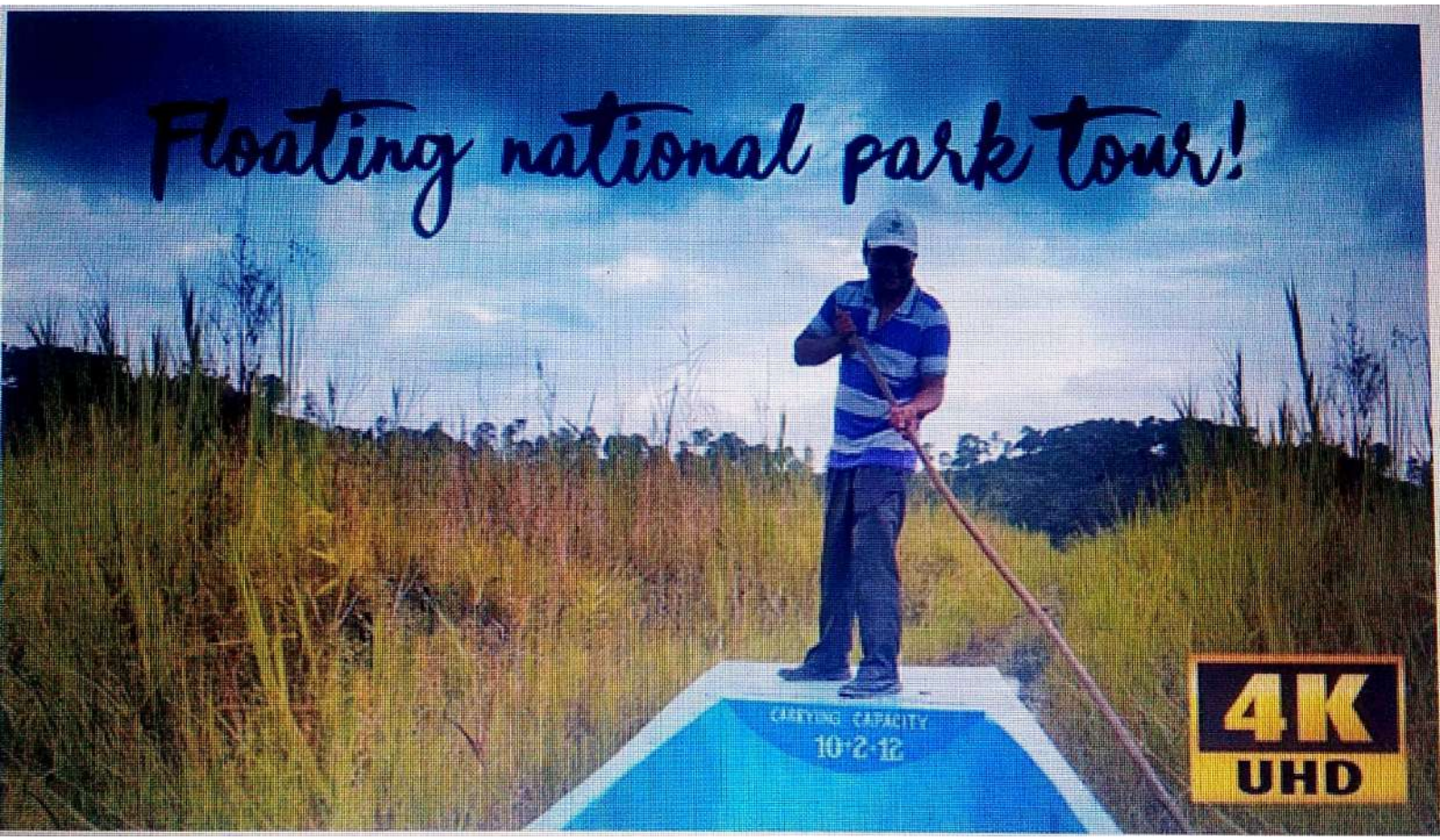
CU ROLL NO: 203223-11-0045

COLLEGE ROLL NO: BOTA20F095

BSc SEMESTER II BOTANY HONOURS

Study of Wetland Ecosys - tem.

- The Keibul Lamjao National Park "World's only floating National Park."



WETLAND ECO SYSTEM

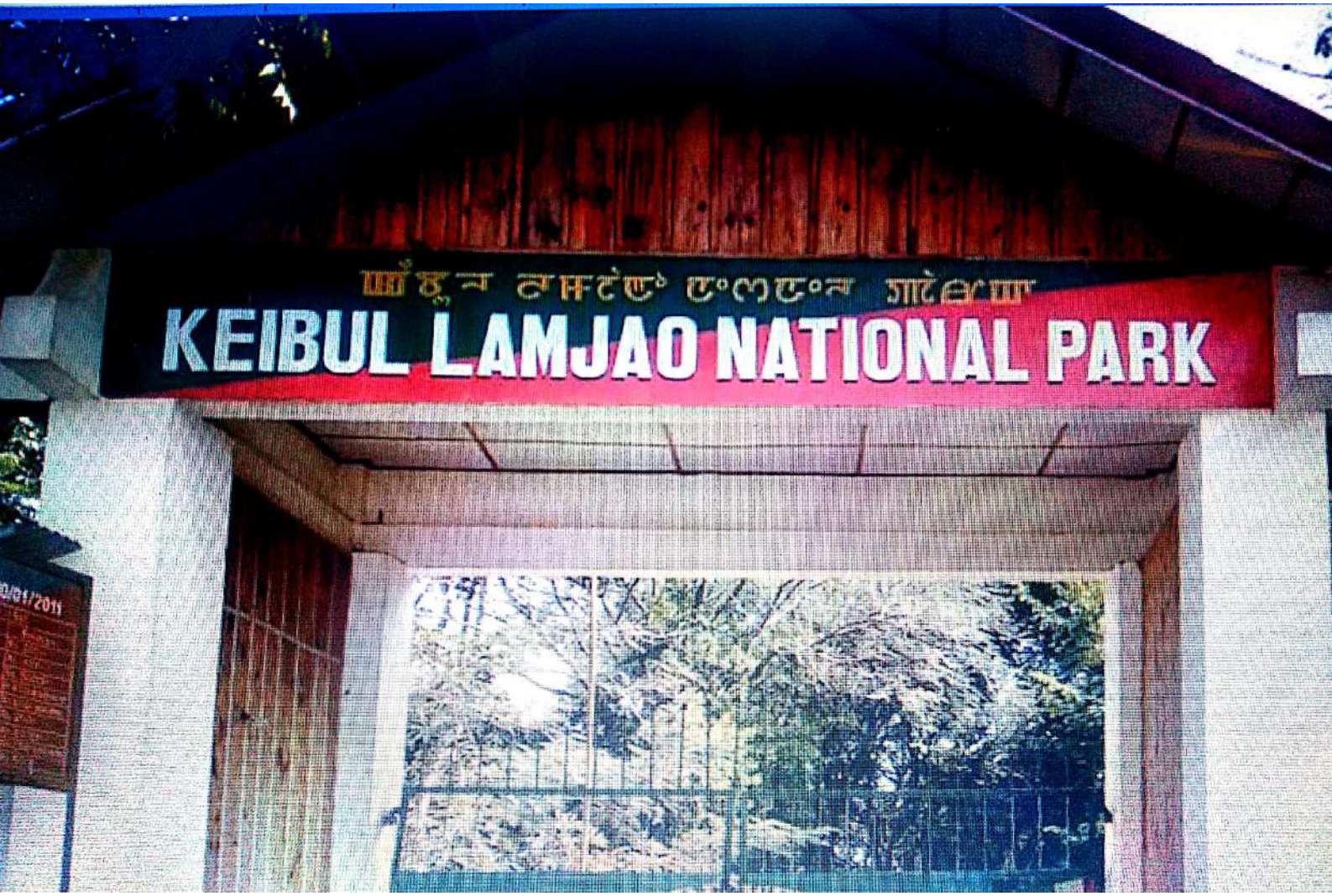
INTRODUCTION

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

There are four main kinds of wetlands: marsh, swamp, bog and fen.

Wetlands habitats serve essential functions in an ecosystem, including acting as water filters, providing flood and erosion control and furnishing food and homes for fish and wildlife. They do more than sustain plants and animals in the watershed. However, many wetlands are not wet year round because water levels change with the seasons. During periods of excessive rain, wetlands absorb and slow floodwaters, which helps to alleviate property damage and may even save lives.

Wetlands also absorb excess nutrients, sediments and other pollutants before they reach rivers, lakes and other waterbodies. They are also great spots for fishing, canoeing, hiking and bird watching and are enjoyable outdoor 'classrooms' for people of all ages.



KEIBUL LAMJAO NATIONAL PARK

The Keibul Lamjao National Park is a national park in the Bishnupur district of the state of Manipur in India. It is 40 km^2 in area, the only floating park in the world, located in North East India and an integral part of the Loktak lake.

COORDINATES: N 24°40' – N 24°25' and E 93°48'–93°50'

ADDRESS : Keibul Lamjao Road, Manipur 795133

AREA : 40 km^2

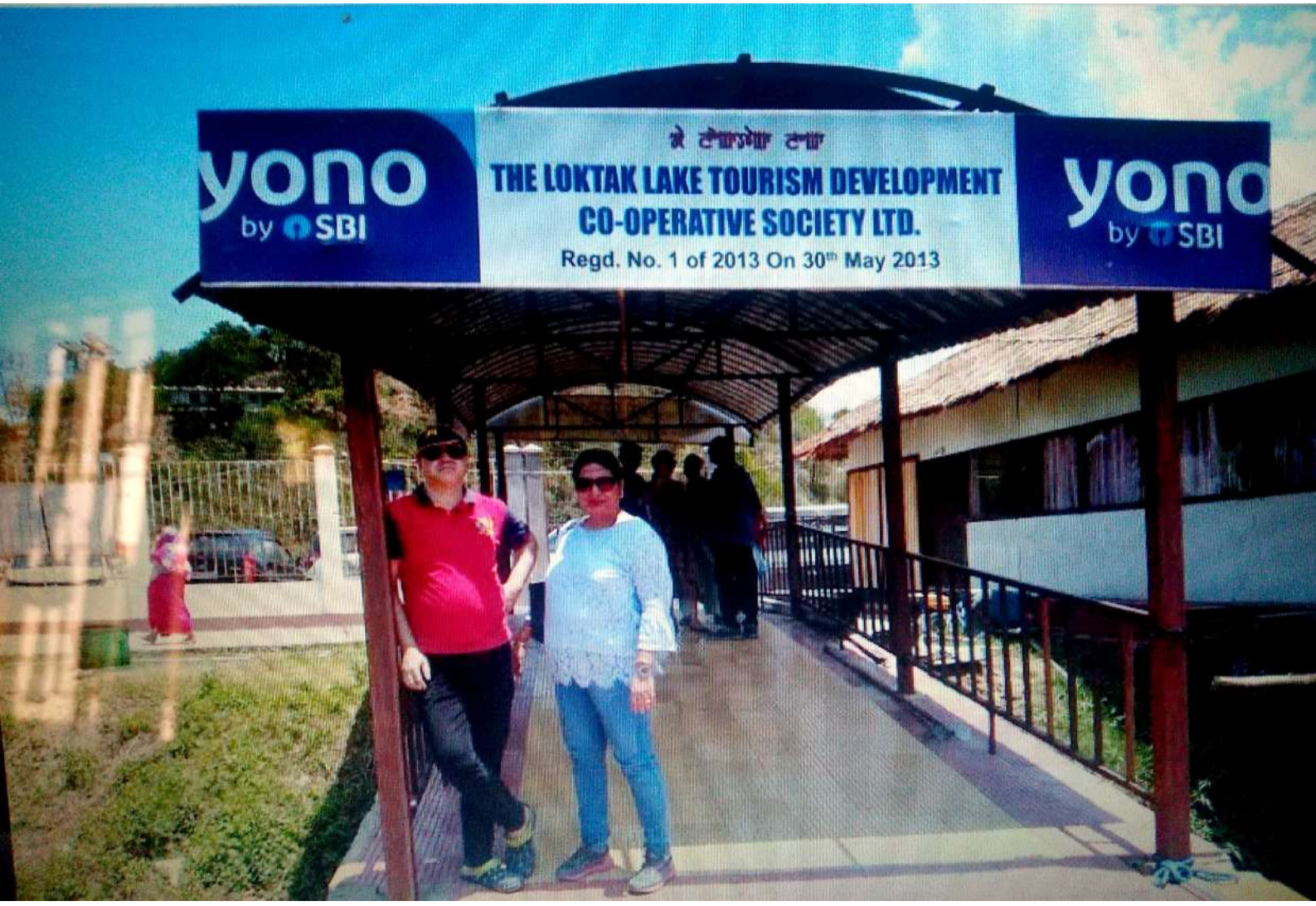
ESTABLISHED : 28 March 1977

MANAGEMENT : Government of India

TIME OF VISIT : 28 May, 2019

The Keibul Lamjao National Park is considered unique as it is the only floating sanctuary in the world. The park has a 1.5 m deep vegetation which keeps floating and is flo - ating foliage is known as phumdi.

A phumdi is a carpet of dead and decaying flora, which floats on the surface of the lake. Tall reeds and grasses grow on these phumdis, often reaching up to 15 ft in height.



FLOATING BIOMASS IN K L N P

The largest area of the phumdi in the Loktak lake is the Keibul Lamjao National Park which is home to Manipur brow-antlered deer Rucervus eldi eldi also properly known as the Sangai. The habitat exclusively consists of floating meadows and an elevated strip of hard ground that dissects the park into northern and southern zones. For effective in-situ conservation of Sangai, Forest Department of Manipur in collaboration with Wildlife Institute of India has developed a plan to reintroduce Sangai in the adjoining area having similar habitat.

The fresh water lake ecosystem of Loktak with Phumdi represents significant ongoing ecological and biological processes. Southern portion of Loktak Lake forms the Keibul Lamjao National Park which is a continuous mass of Phumdi occupying an area of 40 km^2. Phumdi are a heterogeneous mass of soil, vegetation and organic matter at various stages of decomposition. It provides a magnificent vista of green floating islands all over the lake. A phumdi may be initiated with a small mass of undecomposed organic matter or dense growth of water hyacinth that accumulates some suspended

silt and is gradually colonized and other her-baceous plants. The high proportion of vegetable matter in the Phumdis gives it a specific gravity and high buoyancy to keep it afloat. They float on the lake one-fifth of their thickness above and four fifth under the water surface.

The core of Phumdi is composed of detritus material, which is black in colour and is highly spongy. It is constituted of organic carbon (36%), nitrogen (2.08%), organic matter (24.98%) and other residues including mineral matter (37.94%)

FLORA AND FAUNA

Aquatic flora recorded in the park include :

- Zizania latifolia (wild rice, ishing kambong)
- Saccharum munja (khoimom)
- Dioscorea bulbifera (phumba)
- Cynodon dactylon (tinhou)
- Alpinia galanga (pullei)
- Eichhornia crassipes (kabokang)
- Hedychium coronarium (loklei)
- Nelumbo nucifera (thambal)
- Phragmites karka (tou)

Zizania latifolia

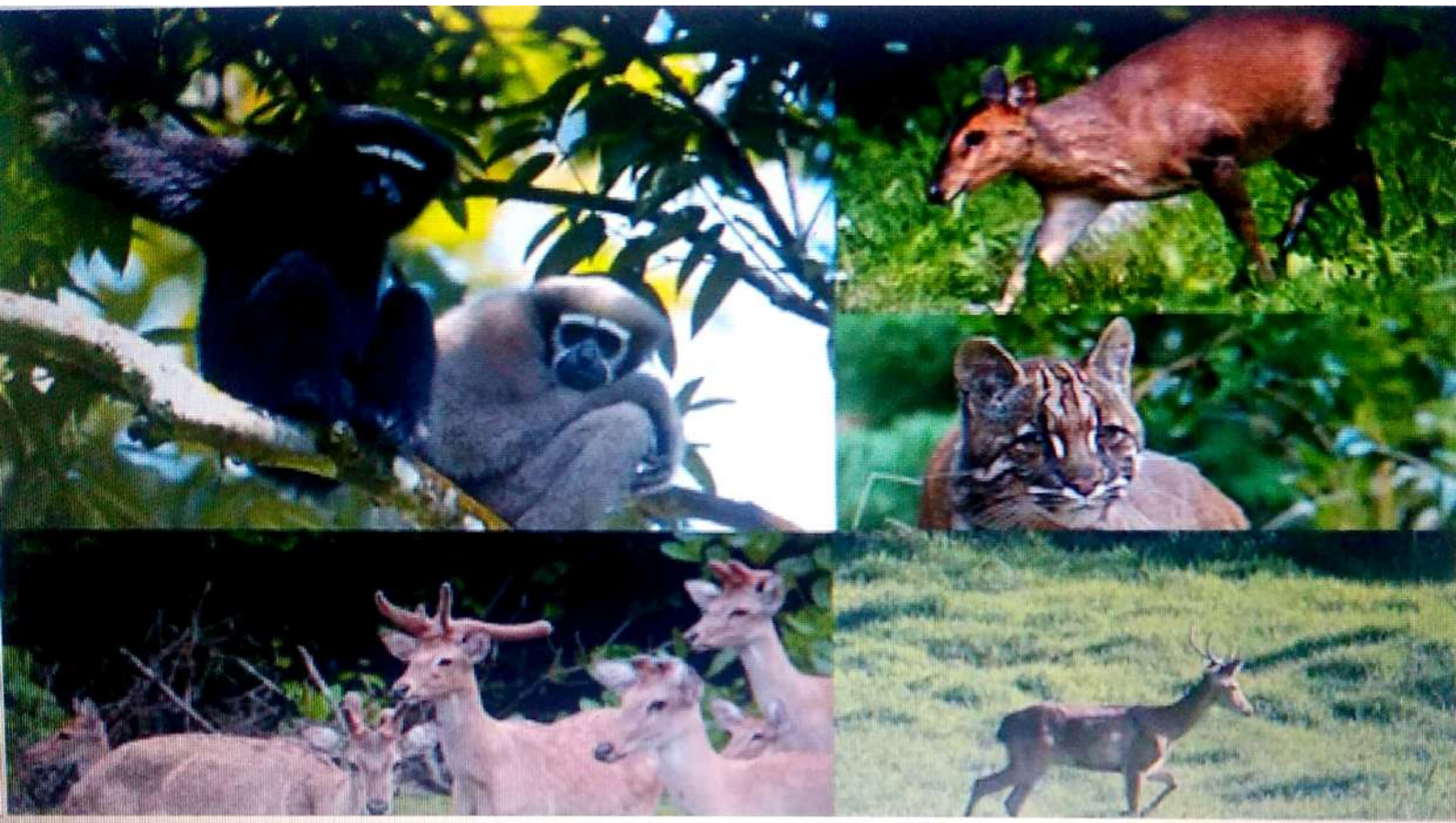
Saccharum munja

Some of the above listed flora has been recorded in two types of phumdis namely the phumdi lataoba (floating) and the phumdi aruppa (sinking), reeds, grasses and other plants growing on a mat of dead and decaying vegetation floating on the lake surface form the lataoba while Phumdi aruppa has mats of vegetation which have sunk to the bottom of the lake and support a rich emergent growth of reeds and grasses. In a 1960 estimate, the phumdi vegitation had been structured into 45% Phragmites karka, 25% Erianthus ravennae (elephant grass), 15% Saccharum munja, 5% Alpinia allughas, 2% Saccharum procerum and 3% other species, including Zizania latifolia, Eicchornia crassipes, Polygonum, Trapa.

FAUNA

Mammals reported are the: hog deer

- hog deer (Hyelaphus porcinus)
- wild boar (Sus scrofa)
- brown antlered deer (Cervus eldi eldi)
- large indian civet (Viverra civetta)
- jungle cat (Felis chaus)



FAUNA AT K L N P – Hog Deer , Jungle Cat , Sangai Deer

- Asian golden cat
- flying fox
- Sambar (Cervus unicolor)

Fishes include :

- Channa punctatus
- Wallago attu
- pool barb

Amphibians and reptiles include :

- keel back tortoise
- viper
- water cobra
- python (Python molurus)
- Asian rat snake (beauty rat snake)
- checkered garter snake
- Russel's viper (Daboia)

AVIFAUNA

- East Himalayan pied kingfisher
- Black kite
- Burmese pied myna (Gracupia contra)
- North Indian black drongos
- Yellow headed wagtail (Motacilla flava)
- Spotbill duck (Anas poecilorhyncha)
- blue winged teal (Spatula discors)
- threatened hooded crane (Grus monacha)
- crimson breasted pied woodpecker.

Channa punctatus

CHECKERED GARTER SNAKE

Yellow Headed Wagtail (*Motacilla flava*)

Panolia eldii eldii

SANGAI

Scientific classification

Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Artiodactyla
Family : Cervidae
Subfamily : Cervinae
Genus : Panolia
Species : P. eldii
Subspecies : P. e. eldii
Trinomial name : Panolia eldii eldii

The Sangai is an endemic and endangered subspecies of brow-antlered deer found only in Manipur, India. It is also the state animal of Manipur. Its common English name is Manipur brow-antlered deer or Eld's deer and scientific name is Panolia eldii eldii. Its original natural habitat is the floating marshy grasslands of the Keibul Lamjao National Park located in the southern parts of the Loktak lake which is the largest freshwater lake in Eastern India.

The number of deer listed in the Red Data Book was only 14 in 1975. After the declaration of the area as a national park and with strict conservation measures taken up by the Forest Department, the fear of its extinction has been greatly reduced.

Why is Sangai deer known as the 'dancing deer'?

While treading through phumdi (grasslands that float on water), the Sangai's hooves sink in the spongy, moist ground which form a distance looks as if it is dancing.

BIOLOGY & BEHAVIOUR

The brow-antlered deer is a medium sized deer with uniquely distinctive antlers measuring 100-110 cm in length with extremely long brow tine which form the main beam. The two tines form a continuous curve at right angles to the closely set pedicels. The antlers of the opposite sides are unsymmetrical with respect to each other. The beams are unbranched initially where as curvature increases as length increases and they get forked also. The sexes are moderately dimorphic in body size and weight. The height

" DANCING DEER"

and weight of a fully grown stag may be approxi-mately 115-125 cm in shoulder and 95 to 110 kg (210 to 230 lb) respectively. The height and weight of the female are shorter and less compared to the male counterpart. The length of the body from base to the ear up to the tail is about 145 to 155 cm in both sexes. The tail is short and rump patch is not pronounced.

Sangai feed on a variety of water living plants, grasses, herbaceous plants and shoots. It exhibits a bimodial activity pattern. The Sangai has a maximum lifespan in the wild of around 10 yrs.

Rutting takes place in the early spring months between February and May. Males compete with each other to gain control of a harem of females that they can then mate with. After a 220 to 240 day long gestation period, normally a single calf is born. The young are spotted at birth, these spots fade as the animal grows. The young are weaned at 7 months of age and becomes sexually mature from 18 months of age onwards.

Sangai in Manipuri Society

Culturally, the sangai finds itself imbedded deep into the legends and folklore of the Manipuris. Based on a popular folk legend, the Sangai is interpreted as the binding soul between humans and the nature. When humans love and respect the Sangai, it is respecting nature. The slaying of the Sangai, an unpardonable sin is conceived as the rude breaking up of the cordial relationship between humans and the nature.

It is believed that the name 'Sangai' (sa "animal" and ngai "in awaiting") was coined from its peculiar posture and behaviour while running. By nature, the deer particularly the males, even when running for its life stops occasionally and looks back as if he is waiting for someone and hence the name.

According to a Manipuri folklore, a legendary hero Kadeng Thangjahanba of Moirang once captured a gravid sangai from Torbung Lamjao for a gift to his beloved Tonu Laijinglembi during an animal hunting expedition. However, as fate would have it, he found his beloved married to the king on his return. The heartbroken hero released the deer

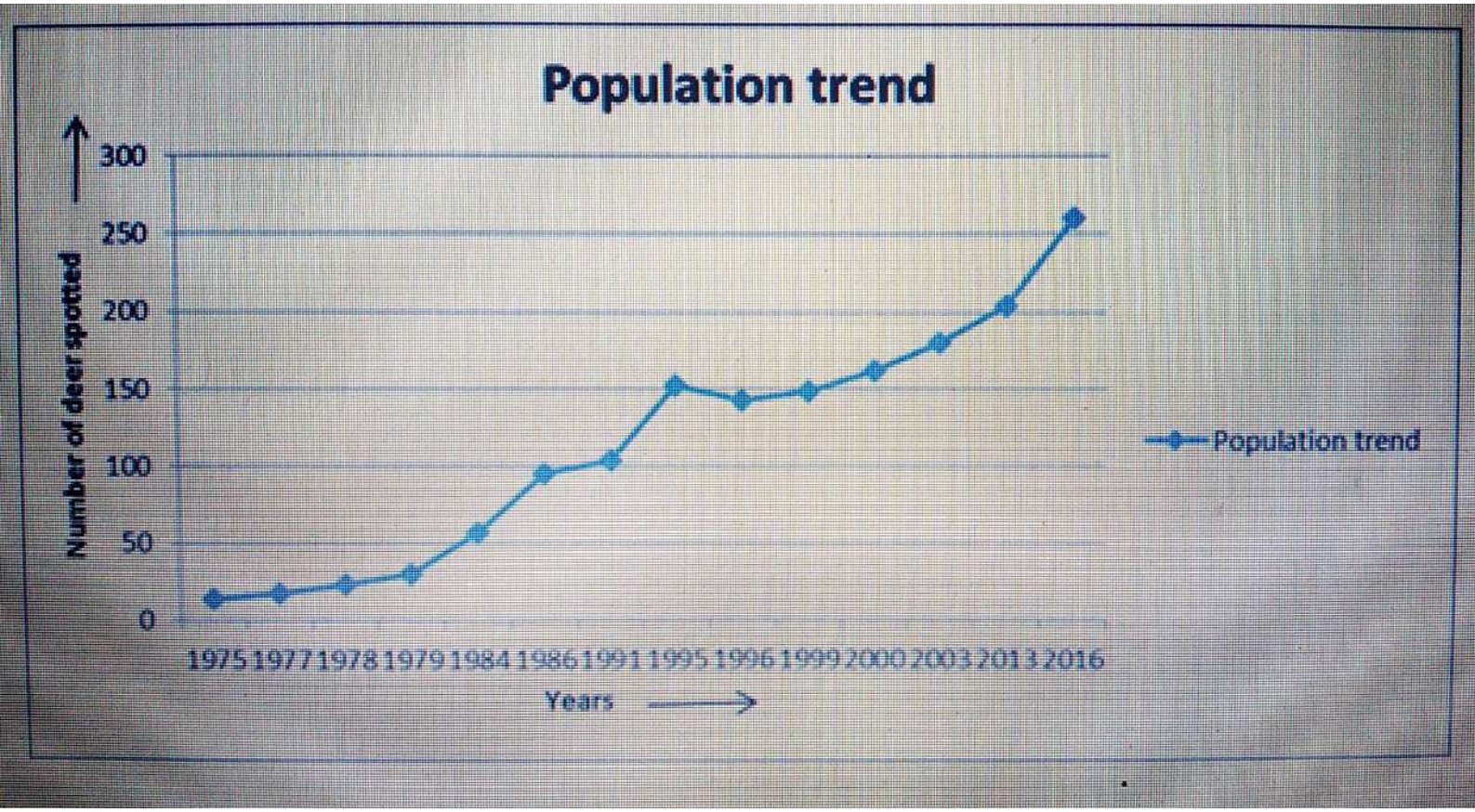
free in the wild of Keibul Lamjao. From that time onwards the place became the home of the Sangai.

In another folklore of Manipur, a prince called Pudangkoi of Luwang clan had by the grace of a divine entity, transformed himself into a deer which has later on called Sangai. Further, there were references of sangai head with crown of antlers, being decorated on the head of royal boat called Hijang Hiren.

DANGER OF EXTINCTION

The sangai was believed to be almost extinct by 1950. However in 1953 six heads of the sangai were found hovering at its natural habitat. Since then, the State Government has taken serious and positive measures for the protection of this rare and endangered species. The number of endangered deer sangai found in Manipur has increased from 204 in 2013 to 260 according to the latest census conducted in March 2016 jointly by Wildfire Wing, Forest department, State government, Manipur University and Wildfire Institute of India.

The sangai faces a two pronged danger to its life. Firstly, its habitat is steadily degenerating by reason of continuous inundation and flooding by high water caused as the result of artificial reservoir of the National Hydroelectric



Power Corporation Loktak. Secondly poachers are out there to trap and slay the deer at the slightest opportunity.

In 1983 the 103 megawatt capacity National Hydro-electric Power Corporation Loktak was commissioned with the objective of ensuring rapid development in the state. A maximum high water level of 168.5 m (553 ft) above mean sea level is maintained in the Loktak Lake to feed the reservoir for the hydel project. This high water level had wreaked havoc in the Keibul Lamjao National Park. The high water level, maintained continuously through the year had disturbed the natural life cycle of the vegetation growth, the phumdi, upon which the Sangai thrives.

The life cycle of the phumdi involves floating on the water surface during season of high water as in the monsoons. In the lean season when the water level reduces, the biomass comes into contact with the lake bed and they secure the required nutrient from there. When the rains come again and they become afloat, the biomass have enough food - the nutrients stored in their roots and their life continues.

What is happening now, according to local scientists who are studying the phenomena, is that with continuous high water in the lake throughout the year much of this process of 'feeding' on the nutrient in the lakebed had discontinued. The result - the biomass are losing weight and getting thinner by the year. Around January last week in 1999, it was reported that a large chunk of the biomass in the northern part of the National Park had broken up into pieces and had drifted freely from the park area. This was a bad sign for the Sangai habitat. It spelled out very clearly that the beginning of the end of the Sangai habitat had begun. There are reports of local people cutting up the phumdi into sizable pieces and then towing away these with dugout canoe for selling to fish culture owners. This is another potential danger to the Sangai habitat. It meant humans are now aiding the process of annihilating the habitat area supplementing to the rapid degeneration of the habitat.

Public Awareness Compaign
Initiated by NECER & YSN
In association with
Forest Department, Govt. of Manipur

DID YOU KNOW ?

Keibul Lamjao National Park

SANGAI

ON THE VERGE OF EXTINCTION

Endemic | Endangered | Only 200 left in wild

Stop poaching

Manipur Brow Antlered Deer
The dancing deer of Manipur

Songai is state animal of Manipur

Wildlife Conservation Campaign

CONCLUSION

Manipur's Sangai deer needs a new home.

The endangered species of brow-antlered deer 'Sangai' is in dire need of a second home as a epide-mic or a natural calamity at its current and only habitat at Keibul Lamjao National Park in Loktak Lake could spell doom for the entire race.

The Forest department has identified fresh water lake Pumlen Pat in Thoubal district as a suit-able site for shifting the 'dancing deer of Manipur' but the local fisherfolk have expressed their reservations to the idea as it could threaten their livelihood, Chief Conser-vator Forest (wildlife) Anurag Bajpai told PTI.

As of now, the census survey conducted in 2016 has spotted 260 Sangai deer in Loktak Lake. The species almost went extinct in the 1950s and only 14 deer were spotted in the area in 1975,.

At present 26 forest guards have been deployed at Keibul Lamjao National Park to check poachers and the state government has given its consent to increase manpower

in the area to check the menace.

The deer is considered sacred by the local population and the state government had been organising awareness campaigns for its preservation. The annual Sangai festival also derives its name from the species.

'A captive breeding centre has been set up near the Iroisemba locality in Imphal West district, where 14 of these species have been kept under controlled conditions," said Bajpai adding that measures are being taken to translocate the animals to its new ground at the earliest.

Sangai deer was declared 'protected animal' and its habitat 'protected sanctuary' by Manipur Wildlife Advisory Board in 1955. The endang-ered species has been listed under Schedule-I of Wildlife Protection Act, 1972.

College Roll No. – **BOTA20F096**

Calcutta University

Roll No. – **203223-11-0046**

Registration No. – **223-1211-0340-20**

Environmental Science Project

FLORA AND FAUNA IN LOCAL AREA

Study area: Nimta, Kolkata

Introduction

Environmental science and ecology are basically the study of the relation and interactions between organisms and their environment, comprising the floral and faunal communities of an area. With changes in environmental conditions, structure, density and composition of plants, animals (and other plants) also undergo vagaries.

Flora is essentially all the *plant life* present in a particular region or time, generally the naturally occurring (indigenous) native plants. The corresponding term for *animal life* is **fauna**. Both can include plant and animal life of a historic era, like fossil flora, for example – which are the basis of palaeontology.

Flora, fauna, and other forms of life, such as fungi, are collectively referred to as biota. In this project, our focus will be only on plant and animal life, i.e. flora and fauna.

Plants are sorted into floras based on region (specifically, floristic regions), period, special environment, or climate. Regions can be distinct habitats like mountain as opposed to flatland. Floras may be subdivided by special environments. It can be native flora (native and indigenous flora of an area), agricultural and horticultural flora (otherwise called garden flora, which refers to plants that are deliberately grown by humans) and weed flora. The term 'weed flora', traditionally applied to plants considered undesirable, has different connotations today. The designation includes three different types of plants now: weedy species, invasive species that may or may not be weedy, and native as well as introduced non-weedy species that are agriculturally undesirable. Many native plants previously considered weeds have been shown to be beneficial or even *necessary* to various ecosystems.

In this project, we will make a random observation of all three types of flora. As a student of the Botany department, my primary focus has been on the local flora, as compared to the fauna I have observed around my residence.

Dates of visitation: 24th, 25th and 30th of June, 2021

Flora

Name	Family	Characteristics/Comments/Observations
Jasminum sambac	Oleaceae (Dicot)	**Arabian jasmine** (*mogra, bel phul*), a species of evergreen jasmine vine or shrub native to Southeast Asia and Indian subcontinent. Ovate, glabrous (smooth) leaves except for a few hairs at the venation on the base, simple arrangement (instead of pinnate like in most other jasmines). Strongly scented flowers with white corolla having 5-9 petal lobes bloom all throughout the year, in clusters of 3-12 at the ends of branches, opening at the evening and closing in the morning. Has great cultural significance in many Asian countries, is mostly used for ornamentation purposes.
Jasminum officinale	Oleaceae (Dicot)	**Common jasmine**, native to the Indian subcontinent, northern Iran, Caucasus, Afghanistan, Tajikistan, and western China. Twining deciduous climber with sharply pointed pinnate leaves and clusters of starry, pure-white flowers in summer, which are the source of its heady scent released at dusk. Used in aromatherapy (essential oils) and herbal dermatology.
Curcuma longa	Zingiberaceae (Monocot)	**Turmeric** (*holud*), a perennial, rhizomatous, herbaceous plant native to the Indian subcontinent and Southeast Asia, gathered each year for their rhizomes. Leaves are alternate, arranged in two rows, divided into leaf sheath (from which a false stem is formed), petiole, leaf blade (oblong to elliptical, narrowing at the tip). At the top of the inflorescence, stem bracts which are white to green, sometimes tinged reddish-purple and with tapered upper ends are present. Hermaphrodite flowers are zygomorphic, have 3 long, fused and white sepals with fluffy hairs, 3 unequal calyx teeth, 3 bright-yellow petals fused into a corolla tube, 3 triangular corolla lobes with soft spiny upper ends.

		Turmeric has immense cultural significance and is extensively used in Asian culinary arts, dyes, other traditional uses, and as indicator (turmeric paper).  *Curcuma longa*
Murraya koenigii	Rutaceae (Dicot)	**Curry tree** (*kadi pata*), also called sweet neem, a small tropical to subtropical tree native to Indian subcontinent. Has aromatic pinnate leaves, and small white flowers which can self-pollinate to produce small shiny-black drupes containing a single, large viable seed. The berry pulp is sweet and edible. Fresh curry leaves are an essential part of Indian cuisine and traditional medicines, and also in the other cuisines of South and Southeast Asia. Dry curry leaves are also part of the culinary arts.  *Murraya koenigii*

Allamanda cathartica	Apocynaceae (Dicot)	**Golden Trumpet** (*alakananda, holud ghonti*, etc), a clambering or twining, much-branched, vine-like woody shrub considered an environmental weed, native to Brazil. Greyish, cylindrical, glabrous stem. Oblong or elliptical leaves in whorls of 3 or 4 with glabrous, dark green, shiny upper surface with a prominent mid-vein, yellowish green lower surface with the mid-vein thickened. Flowers have greenish calyx, 5 sepals, tube-shaped, with 5 bright yellow rounded petal lobes.  *Allamanda cathartica*
Ixora coccinea	Rubiaceae (Dicot)	**Jungle geranium** (*rangana*), a common evergreen flowering shrub native to the Indian subcontinent. Dense, multi-branched, has a rounded form with a spread that can exceed its height. Glossy, leathery, oblong leaves carried in opposite pairs or whorled on the stems. Small tubular, scarlet flowers in dense rounded clusters produced almost all year long. Has many cultivars with differently coloured flowers – yellow, pink, white, orange. Ornamental plant, and also has uses in traditional Indian medicine.

		 *Ixora coccinea*
Codiaeum variegatum	Euphorbiaceae (Dicot)	**Garden croton** or **variegated croton** (*pata bahar*), a tropical, evergreen, monoecious shrub. Has large, thick, leathery, shiny evergreen leaves, alternately arranged. Leaf blades can be different-shaped, for example, oblong, elliptic, lanceolate, ovate-inverted, ovate-spatulate, violin-shaped, and different-coloured, for example, green, yellow, or purple in various patterns, depending on the foliage variety of the particular cultivar.  
Tabernaemontana divaricata	Apocynaceae (Dicot)	**Crape jasmine** or **pinwheel flower** (*tagar*), an evergreen shrub native to South Asia. Dichotomously branched, has large, deep-green, shiny leaves. Waxy, white blossoms with

		characteristic 'pinwheel' shape of the family are found in small clusters on the stem tips, bearing a faint, pleasing fragrance. The plant blooms in spring but flowers appear sporadically throughout the year. More than 66 alkaloids are found in the shrub.  *Tabernaemontana divaricata*
Mangifera indica	Anacardiaceae (Dicot)	**Mango tree**, a large green monoecious fruit-tree, originating from the region between north-western Myanmar, Bangladesh, and north-eastern India. Mango fruit is an irregular, egg-shaped fleshy drupe, round, oval, heart, or kidney shaped, and greenish yellow in colour (green when they are unripe). Interior flesh is bright orange and soft with a large, flat pit in the middle. The plant is popular and commercially used for its fruits, rather than its timber.
Aegle marmelos	Rutaceae (Dicot)	**Bengal quince** (*bael*), a species of deciduous shrub or small to medium-sized tree native to the Indian subcontinent and Southeast Asia. Slender drooping branches, open irregular crown. pale brown or grayish, smooth or finely fissured and flaking bark, armed with long straight spines. Trifoliate, alternate, ovate leaves with tapering or pointed tip and rounded base, untoothed or with shallow rounded teeth. Young leaves are pale green or pinkish and finely hairy, mature leaves are dark green and smooth. Pale green or yellowish, sweetly scented, bisexual flowers in short drooping unbranched clusters at the end of twigs and leaf axils. Bael fruit is globose or slightly pear-shaped with a thick, hard rind – does not split upon ripening.

		Has culinary and medicinal uses, and is considered sacred to Hindus.
Psidium guajava	Myrtaceae (Dicot)	**Common guava** or **lemon guava** or **yellow guava** (*peyara*), an evergreen shrub or small tree widely cultivated in tropical and subtropical regions around the world. The fruit in various cultivars have different-coloured flesh (red, white, pink). Used for its fruit and in traditional medicine, smoking of meat (wood being resistant to insect and fungal attacks), fodder.
Dypsis lutescens	Arecaceae (Monocot)	**Areca palm**, native to Madagascar but cultivated widely. Multiple stems emerging from base, arched and pinnate fronds with 40-60 pairs of leaflets. Bears yellow flowers in summer. Offsets can be cut off for propagation when mature enough. Grown as an ornamental plant.  *Dypsis lutescens*
Cocos nucifera	Arecaceae (Monocot)	**Coconut tree** (*narkel*), the only living species of the genus Cocos. Large monoecious palm with pinnate leaves and pinnae 60–90 cm (2–3 ft) long. Old leaves break away cleanly to leave the trunk smooth. One of the most useful trees in the world, provides food, fuel, cosmetics, folk medicine and building materials, among many other uses. Inner flesh of the mature seed and the coconut milk extracted

		from it form a regular part of the diet of many people in the tropics and subtropics. Mature, ripe coconuts (a drupe, not a true nut) can be used as edible seeds, or processed for oil and plant milk from the flesh, charcoal from the hard shell, and coir from the fibrous husk. Dried coconut flesh is called copra, and the oil and milk derived from it are commonly used in cooking as well as in soaps and cosmetics. Sweet coconut sap can be made into drinks or fermented into palm wine or coconut vinegar. The hard shells, fibrous husks and long pinnate leaves can be used as material to make a variety of products for furnishing and decoration.
Ocimum tenuiflorum	Lamiaceae (Dicot)	**Holy basil** (*tulsi*), an erect, aromatic, many-branched perennial dwarf shrub native to the Indian subcontinent. Ovate, simple, petioled leaves are green or purple in colour, usually have a slightly toothed margin and are strongly scented. The purplish flowers are placed in close whorls on elongated racemes. Tulsi is cultivated for religious, culinary and traditional medicine purposes, and also for its essential oil.  *Ocimum tenuiflorum*
Hibiscus rosa-sinensis	Malvaceae (Dicot)	**China rose** (*joba*), a bushy evergreen shrub or small tree, widely cultivated in tropical and sub-tropical regions. Has glossy leaves, bloom in summer and autumn. 5-petaled, large,

		conspicuous, trumpet-shaped red flowers with prominent orange-tipped red anthers. Depending on cultivar, their colours can be white to pink, red, orange, peach, yellow or purple.
Cascabela thevetia (also called *Thevetia peruviana*)	Apocynaceae (Dicot)	**Yellow oleander** (*korobi*), an evergreen poisonous tropical shrub or small tree native to Mexico and Central America. Willow-like, linear-lanceolate, and glossy green leaves covered in waxy coating to reduce water loss (characteristic of oleanders). Green stems which turn silver/grey with age. Flowers bloom from summer to fall. Long, funnel-shaped, sometimes-fragrant yellow (less commonly apricot, sometimes white) flowers are in small-numbered terminal clusters. Mostly ornamental plants which are useful in biological pest control.  *Cascabela thevetia*
Nerium oleander	Apocynaceae (Dicot)	**Oleander** or **nerium** (*rokto korobi*), the only species currently classified in the genus *Nerium*, a shrub or small tree cultivated worldwide in temperate and subtropical areas. Erect stems splay outward as they mature, first-year having a glaucous bloom, while mature stems have a greyish bark. Leaves are in pairs or whorls of 3, thick and leathery, dull dark-green (light green and very glossy when young), narrow-lanceolate, an entire margin filled with minute reticulate

		venation web. Flowers grow in clusters at the end of each branch, colours ranging from white, pink to red, with a 5-lobed fringed corolla round the central corolla tube.
Clitoria ternatea	Fabaceae (Dicot)	**Butterfly pea** or **Asian pigeonwings** (*oporajita*), a perennial herbaceous plant growing as a vine or creeper, with elliptic, obtuse leaves. The flowers of this vine were imagined to have the shape of human female genitals, hence the Latin name of the genus Clitoria, from "clitoris". The most striking feature about this plant is the colour of its flowers, a vivid deep blue with light yellow markings. Some varieties may yield white flowers.
Thunbergia erecta	Acanthaceae (Dicot)	**Bush clockvine** (*nilakantha*), a herbaceous upright perennial shrub, native to western Africa but commonly cultivated in India. Ovate-elliptic, oppositely arranged leaves, wavy or occasionally broad triangular toothed leaf margin. Flowers occurring in leaf axils, either singly or in pairs. Short bowl-shaped sepals' cup. Flower tube slightly conical at the base, swelling above, distinctly curved. Flower tube flares open into 5 dark purple, roundish petals, whitish-yellow at the base, blooming in the colder season.  *Thunbergia erecta*
Artocarpus heterophyllus	Moraceae (Dicot)	**Jackfruit tree** (*kanthal*), an evergreen monoecious species of the same family as fig, mulberry and breadfruit, originating in the region between Western Ghats of southern India, Sri Lanka and rainforests of Malaysia, bearing the largest fruit of all trees. Comparatively short trunk with reddish-

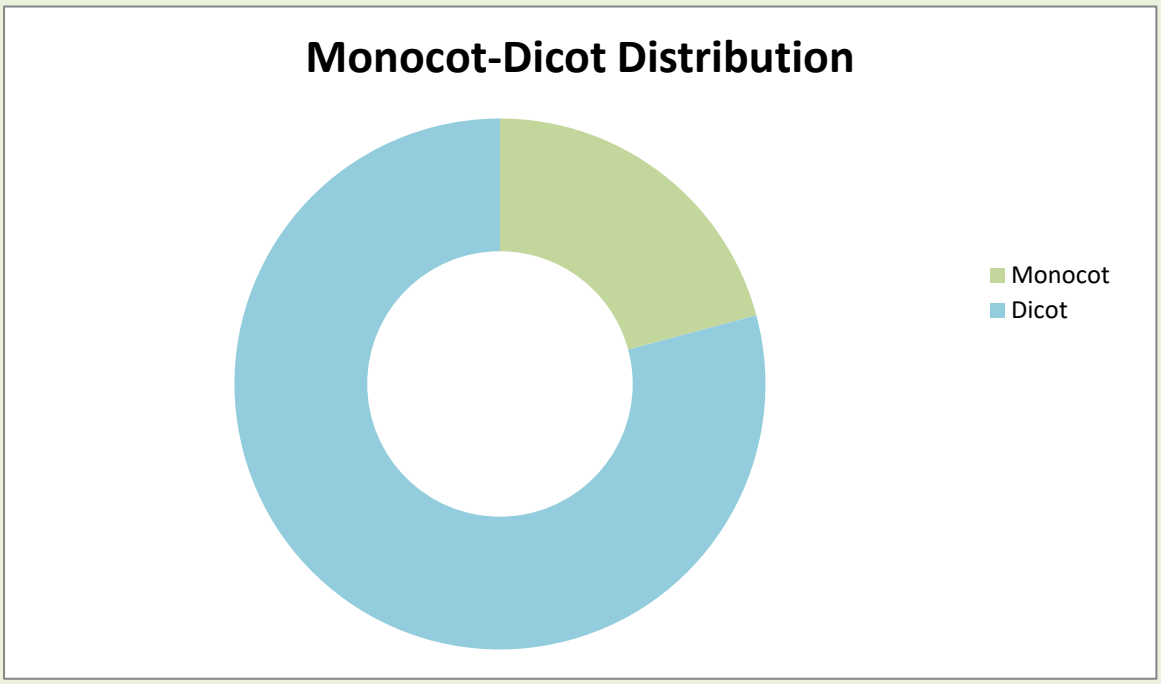
		brown bark and dense treetop. Leathery, gummy, thick leaves are alternate and spirally arranged. Inflorescence gives rise to jackfruit, which is a multiple fruit composed of thousands of individual flowers. Edible pulp is rich in nutritional value, and is part of culinary cuisines of many countries, with specific cultural significance in India. The golden-yellow jackfruit timber is widely used in building furniture and house construction.
Catharanthus roseus	Apocynaceae (Dicot)	**Pink periwinkle** (*nayantara*), an evergreen dwarf herbaceous shrub. Bear oval or oblong, broad, glossy green, hairless leaves arranged in opposite pairs, with a pale midrib and a short petiole. Flowers vary in colour from white to dark pink with a darker red centre, with basal tube, corolla and 5 petal lobes. Has a long history of medicinal use in Mesopotamia, India, China. The drugs vinblastine and vincristine used to treat several types of cancers via chemotherapy are naturally found in pink periwinkle. Used in plant pathology as an experimental host for phytoplasmas.  *Catharanthus roseus*
Aloe vera	Asphodelaceae (Monocot)	**Aloe vera**, a succulent evergreen perennial species, originating from Arabian Peninsula but growing wild in arid, tropical and semi-tropical climates around the world. Stem-less or very short-stemmed plant spreading via offsets. Green to grey-green, thick, fleshy leaves, with some

		varieties showing white flecks on their upper and lower stem surfaces. Serrated leaf margin having small white teeth. Pendulous flowers with yellow tubular corolla produced in summer on 90-cm-tall spikes. Like other Aloe sp., forms arbuscular mycorrhiza.  *Aloe vera*
Musa acuminata	Musaceae (Monocot)	**Banana tree**, an evergreen perennial monoecious species of banana native to Southern Asia (the Indian Subcontinent and Southeast Asia) – many of the modern edible dessert bananas are from this species. Trunk (pseudo-stem) made of tightly packed layers of leaf sheaths emerge from completely or partially buried corms. Inflorescence grows horizontally or obliquely from pseudo-stem. Individual flowers are white to yellowish-white in colour and negatively geotropic. Both male and female flowers are present in a single inflorescence. Female flowers are located near the base and develop into fruit, whilst the male flowers are located at the topmost bud in between leathery bracts. The particular cultivar observed in this project was Lady Finger Banana, a diploid cultivar of *M. acuminata*.

Chrysanthemum indicum	Asteraceae (Dicot)	**Indian chrysanthemum** (*chandramallika*), a herbaceous perennial plant or dwarf shrub. Alternately arranged leaves divided into leaflets with toothed or occasionally smooth edges. Compound inflorescence is an array of several flower heads, or sometimes a solitary head. The head has a base covered in layers of phyllaries. Flowers are usually yellow or white in this species, but can vary with cultivar. *Chrysanthemum indicum* 

Monocot-Dicot Distribution

In this random assessment of 24 local plant species, 5 are monocotyledonous and the rest 19 are dicotyledonous plants. Ratio – 5:19.



Fauna

Name	Family	Characteristics/Comments/Observations
Canis lupus familiaris or simply *Canis familiaris*	Canidae	**Indian pariah dog**. Ancient autochthonous landrace with a possible ancestry dating back to 4,500 years – one of the oldest dog breeds in existence today. A sighthound, with a medium-sized, wedge-shaped head, pointed muzzle, ears erect and pointed at the tips, bearing two coats (a coarse upper and a soft undercoat), a short digitigrade trot and hindquarters angled slightly. Serve as guard dogs and police dogs, being easily trainable. Are very social dogs and can provide better company as pets than many pedigreed dogs, being tough and intelligent.  *Canis lupus familiaris*
Bos taurus indicus or simply *Bos indicus*	Bovidae	**Zebu**. Species or subspecies of ancient domestic autochthonous cattle (Indian aurochs). Even-toed ungulates (characteristic of order Artiodactyla), having cloven hooves (distinctive of Bovidae) are hollow-horned ruminants. Zebu cattle have a fatty hump on their shoulders and a large dewlap, and sometimes drooping ears – well adapted to withstanding high temperatures. Serve as draught and riding animals, dairy cattle and beef cattle, plus they provide hides, dung (for fuel and manure) and horns. Also kept as pets.
Felis catus	Felidae	**Domestic cat**. Only domesticated species in the family. Digitigrade mammals characterised by unusual skull due to large eye sockets and powerful

		specialised jaw, keen night vision, protractible and retractable claws, great balance and flexibility with a strong righting reflex, vibrissae (whiskers) for navigation and sensation and papillae (backward-facing spines) on their tongue for cleaning fur. Very helpful in pest control, and are good pets.
Funambulus pennantii	Sciuridae	**Northern palm squirrel**. Semi-arboreal species of Order Rodentia found even in urban areas, having a bushy tail that is slightly longer than its body, a grizzled brown back having five conspicuous stripes running from head to tail.  *Funambulus pennantii*
Herpestes edwardsi	Herpestidae	**Indian grey mongoose**, having tawny grey or iron grey fur, which is more grizzled, stiffer and coarser than other mongooses, brown legs that are darker than the body, and a bushy tail. Very helpful in pest control, especially against venomous snakes.
Columba livia domestica	Columbidae	**Domestic pigeon** (*payra*), a subspecies derived from rock pigeon, the oldest domesticated bird in the world. Characterised by a dark bluish-grey head, neck and chest with greenish and reddish-violet iridescence around the neck and wing feathers, red 

		iris with pale inner ring, red feet and legs. *Columba livia domestica*
Spilopelia chinensis	Columbidae	**Spotted dove** (*ghughu*), a small pigeon common in the Indian subcontinent. Long-tailed buff brown with a white-spotted black collar patch on the back and sides of the neck, reddish eyes, white tail tips, pink-brown underside. Found in light forests and gardens as well as urban areas. Fly from the ground with an explosive flutter and sometimes glide down to a perch. *Spilopelia chinensis* 

Pycnonotus jocosus	Pycnonotidae	**Red-whiskered bulbul**, a passerine frugivore (that feeds on nectar, insects too) native to Asia. Brown upper-parts, whitish underparts, dark spur running onto the breast at shoulder level, tall pointed black crest, red face patch behind the eye (lacking in juveniles). Thin black moustachial line, long and brown tail with white terminal feather tips, but the vent area is red (rufous-orange in juveniles). *Pycnonotus jocosus* 
Passer domesticus	Passeridae	**House sparrow**, passerine bird native to Asia. Sexes exhibit strong sexual dimorphism. Stating very briefly, females and young ones are coloured pale brown and grey, whilst males have brighter black, white and brown markings. There are greater details to their plumage which changes during breeding seasons. Females usually are slightly smaller than males. Males are larger during the winter whilst females are larger during breeding season.
Acridotheres tristis	Sturnidae	**Common Indian mynah**, passerine omnivorous bird native to Asia, adapted extremely well to urban environments. Brown body, black hooded head, bare yellow patch behind the eye, bright yellow bill and legs. Have a white patch on the outer primaries, and on the wing lining on the underside. Sexes are similar, found in pairs, and are believed to pair for life.

		 *Acridotheres tristis*
Corvus splendens	Corvidae	**Indian house crow**. Forehead, crown, throat and upper breast are glossed black, wings, tail and legs are black, and the neck and breast are a light grey in colour. Highly opportunistic omnivorous birds that can survive on nearly anything that is edible. Can be seen near marketplaces and garbage dumps, foraging for scraps.
Gallus gallus domesticus	Phasianidae	**Chicken**, a subspecies of red junglefowl. Males (rooster) usually differentiated from females (hen) by striking plumage of long flowing tails and shiny, pointed feathers on their necks and backs, typically of brighter, bolder colours than those of females of same breed. Associated colours differ with breed. Primary use for humans is that they are a source of meat and eggs.  Female *Gallus gallus domesticus*
Capra aegagrus hircus	Bovidae	**Domestic goat**. Usually have two hollow horns, their size and shape being dependent on breed. Conspicuous horizontal, slit-shaped pupils with usually pale irises, most have beards. Coats can be of varying colour. Agile and having great balance, only ruminant known to regularly climb trees.

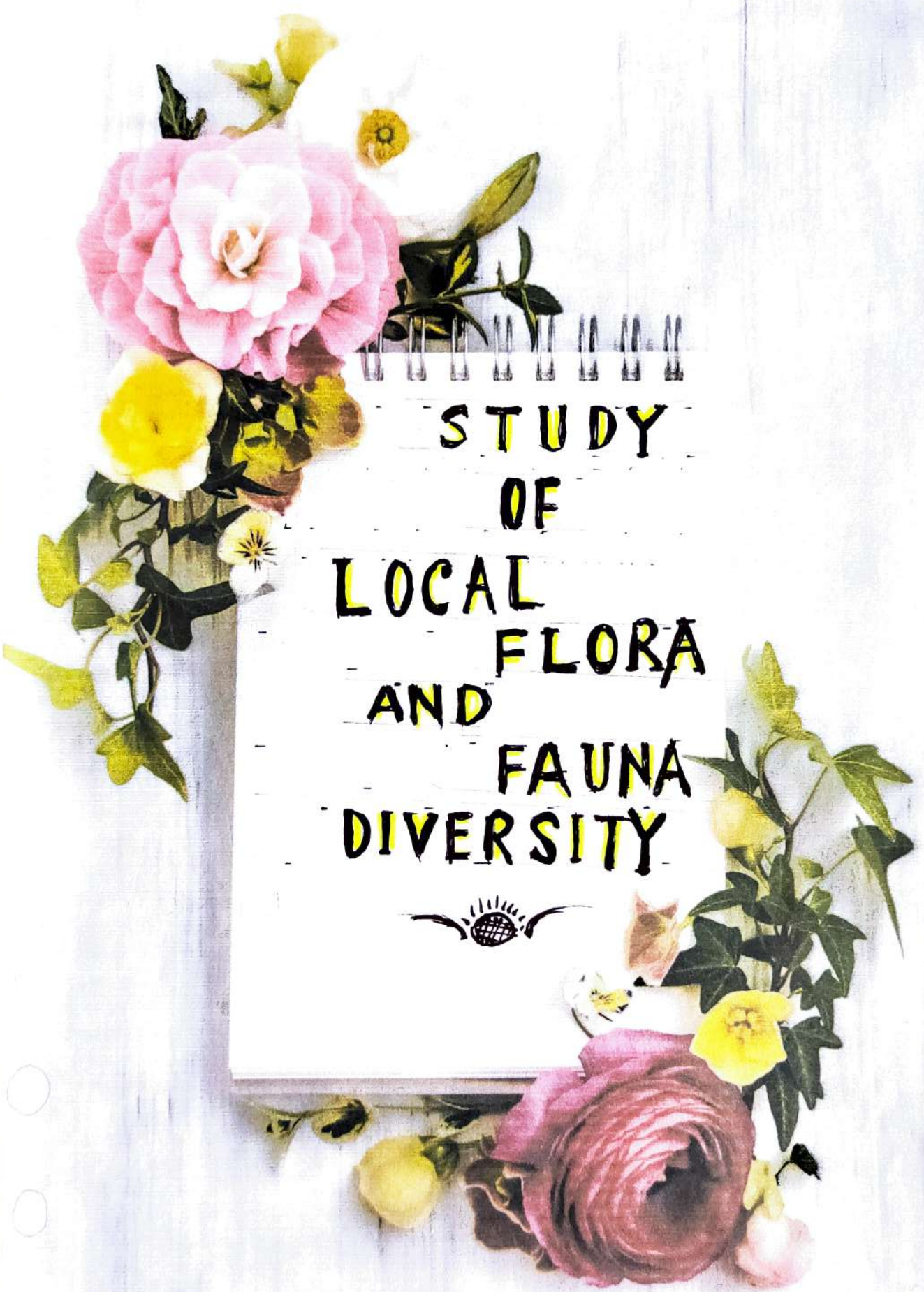
		Used for milk (and its products, like goat cheese), manure, fibre, meat, fur and skins.
Pipistrellus coromandra	Vespertilionidae	**Indian pipistrelle** or **little Indian bat** (*chamchika*). Usually brown-coloured on the dorsum (ranging from dark chestnut to dark clove brown). Found in moist, shady places, like crevices, ceilings, chimneys, tree-holes etc.
Hemidactylus frenatus	Gekkonidae	**Common house gecko** (*tiktiki*), usually nocturnal, exhibit preference for urban environments, can be seen climbing walls of houses and other buildings in search of insects, immediately recognisable by their characteristic chirping.
Rattus rattus	Muridae	**Black rat**, probably originated in Indian subcontinent, is a generalist (i.e. not specific in their food preferences) omnivorous rodent which is black to brown in colour with a lighter underside. Pointed snout, big eyes and ears, slender in shape and a tail that is longer than the rest of the body. Their foraging behaviour is flexible and well-developed, often meting and foraging together in a group, tending to forage post-sunset. They're very adaptable and a highly invasive species, and the hypothesized cause of devastations like the Plague of Justinian and the Black Death.
Rattus norvegicus	Muridae	**Brown rat**, larger than and can weigh twice as much as black rat. Slanted snout, small eyes and ears, sturdy in shape and a tail that is shorter than the rest of the body. Usually has dark grey or brown fur, while the underside is lighter grey or brown. Nocturnal in behaviour, they're good swimmers, climbers and diggers.

Conclusion

Confined within my residence in these pandemic times, subjected to home isolation, it was a surprise to find that my own home is surrounded by so many plants and animals – it just took three days of keen observation. I deliberately chose this small urban area for my study to get an estimate of how flora and fauna are distributed in these pockets of brick-and-concrete civilisation. It has been a pleasant surprise to find a good amount of vegetation surrounding my residence.

Keeping that in mind, as students of Biology, we should do our utmost to preserve our environments, no matter how congested an area we live in, because only with these little drops of water do we get the ocean.

SCOTTISHCHURCH
COLLEGE
ENVS PROJECT
SUB- BOTANY (HONS)
SEMESTER-2
UNIVERSITY
OF
CALCUTTA
CU-ROLL NO-203223-11-0100
CU-REG :NO-223-1211-0593-20
COLLEGE ROLL NO-
BOTA20F097


STUDY
OF
LOCAL
FLORA
AND
FAUNA
DIVERSITY

INTRODUCTION

Ecology is the study of the relation and interactions between organisms and their environment. It comprise the floral and faunal communities of an area.

[What is Ecosystem?]

An Ecosystem includes all of the living things (plants, animals and organism) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere). Ecosystems are the foundations of the Biosphere and they determine the health of the entire earth system.

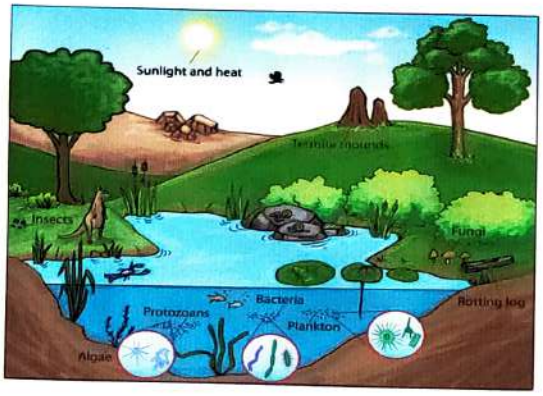
Ecosystem simply means —
"Ecological system"

Ecology is the study of Ecosystem

In an ecosystem, each organism has its own niche or role to play.

Thus, Plants, flowers and animals are two very important aspects of any eco-system. Flora and fauna are words originating from Latin. Flora

P.T.O



Ecosystem

P.T.O

in Latin means goddess of the flowers. Flora is also derived from the word floral, which means relating to flowers. On the flip side, Fauna refers to the goddess of fertility. Fauna is sometimes referred to as Faun, meaning forest spirits. By definition fauna is a group of indigenous animals of any geographical region

[What is Flora?]

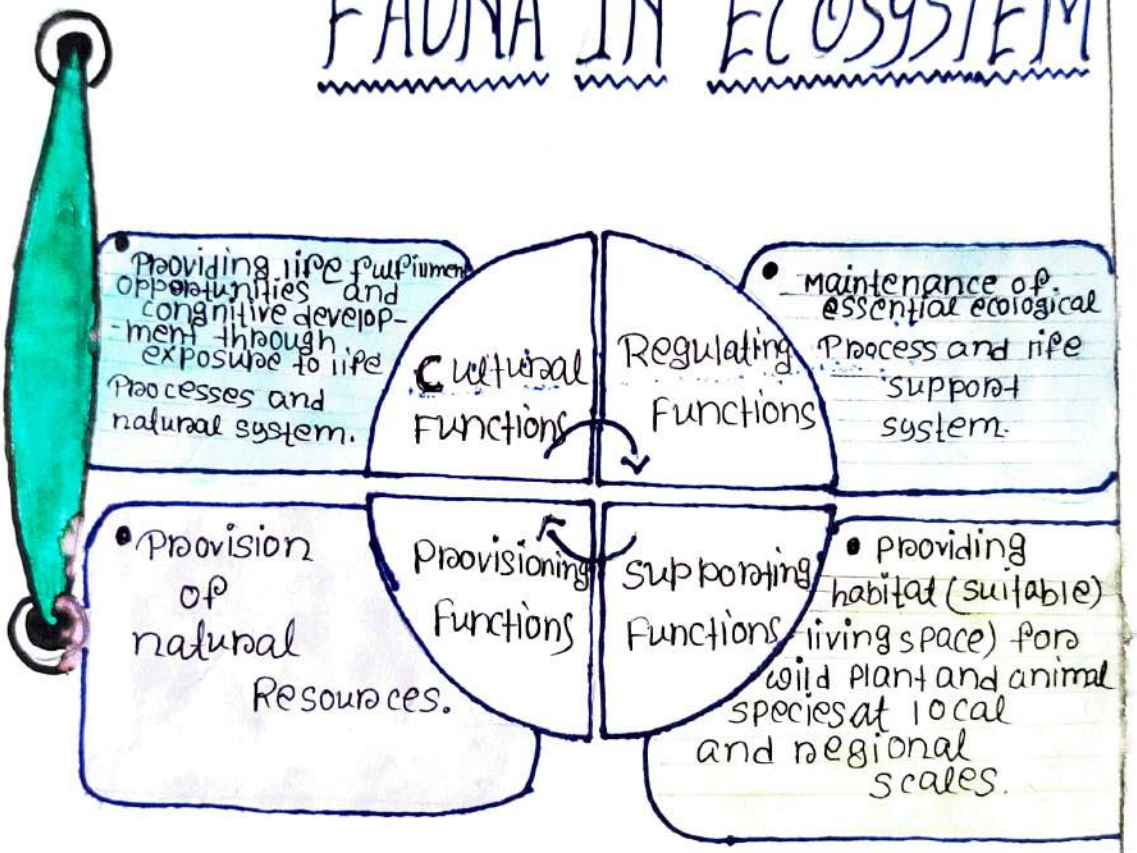
Flora is the name given to the collective plant life that grows or once grew in a certain area or during a given time period. It usually refers to the native plant life present but does include new species that have been introduced as well.

[What is Fauna?]

Fauna on the other hand, is the name given to collective animal life that lives or was once found in a certain area or time period.

P.T.O

FUNCTION OF FLORA AND FAUNA IN ECOSYSTEM



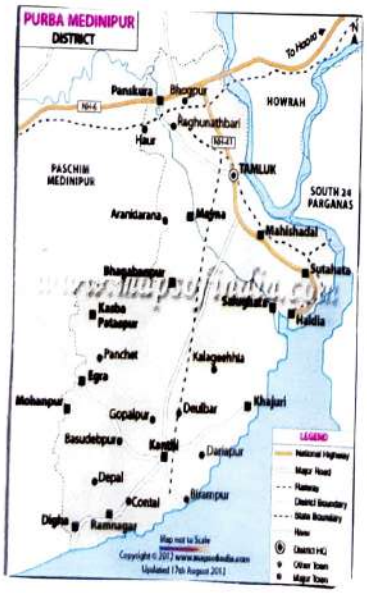
P.T.O

STUDY AREA

Purba Medinipur District has been categorized under 3 Agro-Ecological situations (AES). The geographical co-ordinate of the district headquarter is 21°56'14.24" N latitude and 87°46'35" E longitude and altitude is 6 m.

The proposed mine area is situated in Kolaghat region, Purba Medinipur. (Kolaghat - Jashara Rd, Jashara, west bengal) Lat N22°29'51.7272", Long E87°51'58.7808". The soil type of my area is textile and vast expanse of younger alluvial soils. Average annual temperature of this area is ~29°C and average annual rainfall is 1746.6 mm. My area is full of floral and faunal diversity. I am trying to explore those things under the Project work.

Location



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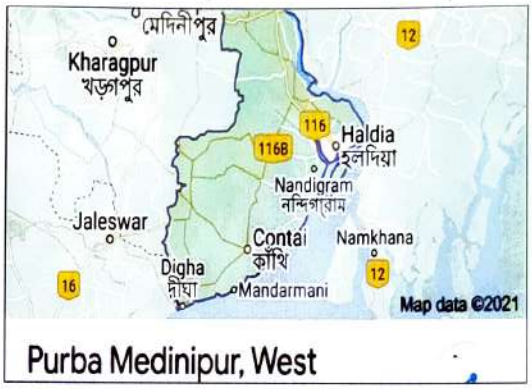
Kolaghat



Purba Medinipur, West

STUDY AREA IN MAP

P.T.O

OBJECTIVE OF THE STUDY

For Sustainable and eco-friendly mining project development biological environment is studied: In the present study area all the species (both herbs and trees) play here a significant role to stabilize habitat and species both flora and fauna rich to richer. Therefore, study and research is essential to come in to a point of following kinds

(1) To study the vegetation types in Kologhat Block.
(2) To study the pattern of Ecosystem dynamics persist in the area.
(3) To study the types of vegetation in natural, degraded and plantation sites.
(4) To study the flow of fuel wood and related materials collected by the local people.
(5) Study of illegal collection pattern of plant and similar products and their impact on local vegetation.
(6) To study ecological status and vegetation, role of institutions to conserve the environment sound and healthy.
(7) To Prepare parallel guideline to sustain local vegetation more better through better management of resources.

P.T.O

METHODS AND MATERIALS

Methods:

Making this project I use internet to collect information about the local area. There climate, the local floral and faunal diversity, and asked the local people about the local flora and fauna; their local name how can they use those plants e.t.c.

- Date:- 2-4 July, 2021
- Time:- 3 days

Material:

(1) I'm using internet to collect the local area's map and the map of Purba Medinipur.
(2) Camera.
(3) Pen (Blue/Black), Pencil, Erasers.
(4) Sketch and Marker Pen.
(5) A4 size white sheet.
(6) Scale, Geometry box.
(7) Book of ENVS e.t.c.

P.T.O

RESULTS

Flora: Plant species of common occurrence in local area studied under Kolaghat block, Purba Medinipura.

Table-1

S. No.	Plant species	Local Name	Family	Part used by local people	Ecological and Economical importance and How to used by local People
1.	Mangifera indica	Aam	Anacardiaceae	Fruit, leaves	Boiled green mango used as syrup to drink in summer season, Mango is low in calories yet high in nutrients – particularly vitamin -C, which aids immunity, iron absorption and hair growth and repair.
2.	Andrographis paniculata	Kalmegh	Acanthaceae	Leaves	Leaf juice is taken to control liver function, blood filtration. Paste soup is drank to relief from cough. as well as a discussion of health benefit and usage in clinical practice.
3.	Centella asiatica	Thankuni	Apiaceae	Leaf	Fresh young leaves are chewed at early morning in empty stomach to control chronic dysentery and blood stool. it may help treat Alzheimer's disease.

P.T.O

⇒ Centella asiatica

(Thankuni)

Cocos nucifera

(Narkel)

Mangifera indica

(Aam)

Carica Papaya

(Pepe)

Cynodon dactylon

(Durba)

P.T.O

4.	Cynodon dactylon	Dubba	Poaceae	Whole plant	Fresh juice applied to cuts and wounds to stop bleeding from colon. Paste applied to stop fodder plant and sacred plant for Hindu
5.	Justicia adhatoda	Bagak	Acanthaceae	Leaves	Leaves are boiled with water and is used to bath to cure chronic cough and cold
6.	Hibiscus rosa-sinensis	Jaba	Malvaceae	Leaves, Flowers	Leaf juice is drank to treat inflammation of colon, abdominal cure.
7.	Curcuma longa	Halud	Zingiberaceae	Rhizome	Rhizome paste is applied on skin to cure from skin infection and freshness. Rhizome powder with warm milk is taken at bed time for relief from cough, cold and weakness
8.	Carica papaya	Pempe	Caricaceae	Fruit Latex	Fruit latex mixed with water taken orally to increase appetite. Boiled fruit taken in constipation jaundice and indigestion.
9.	Cocos nucifera	Narkel	Arecaceae	Green coconut, water, oil	Green coconut water drank in dehydration. oil is applied over scalp hair to promote hair growth
10.	Emblica officinalis	Amlaki	Euphorbia-ceae	Fruit	Fruit juice taken in acidity and also juice boiled with coconut oil to promotes hair growth
11.	Musca paradisiaca	Kola (Banana)	Musaceae	Stem, Fruits leaf, Flowers	Inner portion of stem is used as vegetable as a source of iron and fibers. Ripped fruit is taken for energy source.

P.T.O

12.	Acanthus ilicifolius	Kanta Jhulai	Acanthaceae	Leaves, stem, Root	Whole plant is used for treatment of temporary senseless of organ, respiration trouble and Blood sugar control. Root decoction is used to relief cough.
13.	Grendarussa vulgaris Burm. f.	Bisallaka-roni	Acanthaceae	Leaves	Fresh juice of leaves is used in ear to cure pain, used to stop bleeding. Warm juice vapor is taken to cure headache, cough.
14.	~~Kutel~~ Hygrophila spinosa	Kulekhara	Acanthaceae	Leaf and stem	Juice of fresh leaves and warm juice is taken for increasing haemoglobin as well as to treated anemia.
15.	Puellia tuberosa	Chotpot	Acanthaceae	Leaves stem, Root	Leaves decoction is taken to treat joint pain. fresh juice of leaves is taken of relief from whooping cough, blood cleaning and weakness.
16.	Thevetia Peruviana	Karabari	Apocynaceae	Leaf, Root, seed	Leaf paste is applied to remedy skin disease. paste of Root bark is used to treat loss of pigmentation of skin. seeds are used to relief from inflammation of joints.
17.	Tridax procumbens	Choto Ganda	Asteraceae	Leaf, stem	Juice is applied to stop bleeding of wounds. Stem juice is used to stop diarrhoea.
18.	Barleria prionitis	Kanta Jhinti	Acanthaceae	Leaves, Root	Leaf juice is given for eye disease, melted root infusion is used cough, tooth pain. Root juice is used to treat Pimples.
19.	Aegle marmelos	Bel	Rutaceae	stem, Root, Bark, Leaf, Fruit	Leaves are taken orally to relief from common cold, respiratory trouble, fever, inflammation of lining of bronchial tubes.
20.	Cascabela thevetia	Kolke	Apocynaceae	Flower	Flower juice is taken to treat oral infection.

P.T.O

21.	Ipomoea aquatica	Kolmi sak	convolvulace-ae	Leaf, stem	Leaves and stem are used as vegetables. (10) Juice is applied on wounds.
22.	Ocimum tenuiflorum	Tulsi	Lamiaceae	Leaves	Leaves are taken orally to relief from common cold, respiratory trouble, fever and inflammation of lining of bronchial tubes.
23.	Terminalia arjuna	Arjun	combretaceae	Bark	wet stem bark is taken at morning in empty stomach to cure gastrointestinal troubles and cardiac problems.
24.	Azadirachta indica	Nim	Meliaceae	young Leaves, Bark, seed	water decoction of fresh and fried leaves eat for skin infection and allergy. Bark decoction is used for malaria. seed oil is used for skin disease.
25.	Barleria lupulina	Kanta bisallakarani	Acanthaceae	Leaves	Leaves paste is applied on freshcut and wounds to stop bleeding.
26.	Phoenix sylvestris	Khejur	Arecaceae	Fruit	Ripped fruit is taken to increase iron level in blood.
27.	Catharanthus roseus	Nayontara	Apocynaceae	Leaves Roots Buds.	Fresh leaves paste is applied on cuts to help in quich healing and to stop nosebleed.
28.	Citrus maxima	Batabi-lebu	Rutaceae	Fruit, Leaves	Leaves with warm water is used to bath to relief from dry cough. Fruits are eat for good digestion.
29.	Asparagus racemosus	satamuli	Asparagaceae	Root	Roots are chewed to relief from abdominal trouble and inflammation of colon

P.T.O

Tabernaemontana coronaria

(Tagar)

Ocimum tenuiforum

(Tulsi)

Mirabilis jalapa

(Sandhamaloti)

Azadirachta indica

(Nim)

30.	Enydra fluctuans	Hinche	Asteraceae.	Leaves, stem	Leaves and stem are used as vegetables for blood purification and weakness.
31.	Oxalis corniculata	Amlaulsak	Oxalidaceae	whole Plant	Plant decoction is used for muscular associated pain or stiffness and inflammation of colon.
32.	Nyctanthes arbor-tristis	Sewli	Nyctaginaceae	Leaves, stem	Juice of leaves is used for abdominal cure. Bark decoction is taken to remittent fever and control blood sugar level.
33.	Echbolium viridae	Nilkantha	Acanthaceae	Leaves, Root	Warm juice of leaves is used to relief from severe pain of joints, crushed roots with water is taken to treat jaundice.
34.	Ricinus communis	Kedhi	Euphorbiaceae	Branch	Luke warm oil message over abdomen for abdominal flatulence with pain especially for children. Branches used as tooth brush in bleeding gum.
35.	Alstonia scholaris	Chatim	Apocynaceae	Leaves, Root, latex Bark	Warm latex is used to cure chest pain and dental caries. Bark paste is applied on snake bite area
36.	Aganosma dichotoma	Malatilata	Apocynaceae	Leaves, stem	Whole plant decoction is used as antiseptic and respiratory trouble. Leaves decoction is used for eye problem.
37.	Tabernaemontana coronaria	Jagan	Apocynaceae	Leaves, latex	Milky latex is used on the wounds of snake bite, eye drop and skin infection.
38.	Pleumeria rubra	Kathmali	Apocynaceae	Leaves, Root, Bark	Leaves decoction is used to control high fever. bark paste is applied on swelling and inflammated area.
39.	Barleria cristata	Swet Jhinti	Acanthaceae	Leaf, Root	Leaves juice is drank to relief from cough. Root and leaves paste is applied on swelling.

P.T.O

40.	Amaranthus caudatus	Marshisak	Amarathaceae	Leaves, Root	Used as vegetables. Leaves decoction is taken for Pulmonary trouble, ulcer. Root juice is taken to control headaches.
41.	Ananas comosus	Anaras	Bromeliaceae	Leaves, Fruit	Leaves decoction is taken to treat hiccough and constipation. Fruit is eaten to control gastric irritability and jaundice.
42.	cyperus scariosus	Muthaghas	Cyperaceae	Tuber	Tuber decoction is taken at early morning in empty stomach to relief from indigestion and chronic dysentery.
43.	Borassus flabellifer	Tal	Palmae	Fruit, Spadices	Leaves juice and fruit is eaten for hiccough and gastric inflammation. Spadices is useful in ulcers. Ash of dry spadices used as antacid and liver function.
44.	calamus viminalis	Bet	Palmae	Leaves, Root	Leaves juice is taken to treat chronic fevers and gynae problem. Root decoction is used in treatment of jaundice and blood disease.
45.	Hemigraphis hirta	Baghua	Acanthaceae	Leaves, Root	Leaves and root paste is applied to the snake bite region. Leaves juice is used to cure dysentery.
46.	Piper bethe	Pan	Piperaceae	Leaf	Leaves juice is drank to relief from acidity and indigestion.
47.	Saccharum Spontaneum	Kash	Poaceae	Root	Root decoction is used in respiratory and gynecological problem.
48.	Syzygium cumini	Jumrul/ Jam	Myrtaceae	Fruit, seed, Bark	Fruit directly taken. Seed powder taken for sugar control. Bark juice is taken for inflammation of colon.
49.	Abutilon indicum	Petrol phol	Malvaceae	Leaves, Root, seed	Leaves juice is applied on fore head to reduce headache crushed root is to cure insect bite and fungal infection.

P.T.O

50.	Alocasia indica	Mankachu	Araceae	stem	A piece of stem with bitted banana is used to reduce blood secretion from colon.
51.	calotropis gigantean	Arak	Asclepiadaceae	Leaf, Latex	Leaves juice and latex mixed with ghee applied on abdomen to relief from pain and to treat wounds by poisonous insect.
52.	Dillenia indica	Chalta	Dilleniaceae	Leaf, Fruit, Bark	Leaves paste is applied on carbuncle. Fruit is taken for indigestion Bark juice is used to reduce food poisoning.
53.	Clerodendrum viscosum	Ghetu	verbenaceae	Leaf, Root	Fresh young leaves juice is taken at early morning to cure intestinal worm and skin infection
54.	Merremia gangetia	Musakani	convolvulaceae	Leaves	Leaves paste and juice is applied on cut and wounds to stop bleeding.
55.	Eclipta alba	Keshunt	Asteraceae	Leaves	Fresh juice applies over scalp to promote hair growth to treat scorpion sting.
56.	Foeniculum vulgare	Mouri	Apiaceae	Fruits, seeds	Seeds soaked in water overnight and drank the next morning for acidity, burning micturition and amoeboisis.
57.	Holarrhena dysenterica	Kurchi	Apocynaceae	stem, Bark	Fresh bark juice is used in amoeboisis and dysentery.
58.	Moringa oleifera	Sajina	Moringaceae	Leave, Root, Bark, Fruit	Tender leaves & fruits used as vegetables to Prevent chicken pox. Root bark paste is applied locally in injuries.
59.	saraca indica	Ashok	Caesalpiniaceae	stem, Bark, Flower, seed	stem and bark decoction is used for menstrual disorders. Flowers decoction is taken for sugar control.

P.T.O

60.	Tinospora cordifolia	Gulancha	Menispermaceae	stem, Tender	stem juice with boiled water is taken in early morning to control sugar and Cholesterol
61.	Ficus bengalensis	Bat	Moraceae	Latex	3-4 drops latex added with sugar candy is taken in chronic amoebiosis.
62.	Terminalia chebula	Haritaki	Combretaceae	Fruits	Fruits powder taken at bed time also soaked in water overnight is drank at next morning for acidity, constipation.
63.	vitex negundo	Nisinda	verbenaceae	Leaves	Fresh leaves used as hot poultice in swelling and joint pain.
64.	Momordica Charantia	Karala	cucurbitaceae	Fruits	Fruit juice drank in empty stomach especially for diabetes. Fruit is used as vegetables for skin itching.
65.	Piper nigrum	Marich	piperaceae	seed	seed chewed with common salt and then swallowed in sore throat, cough tonsilitis and pharyngitis.
66.	Cinnamomum tamala	Tejpata	Lauraceae	Leaf, Bark	used as vegetable. Bark decoction is taken to relief from cough. inhaling of smoke of dried leaves cure choked voice.
67.	Puncia granatum	Darim	Punicaceae	Leaves, Fruit	Tender leaves juice mixed with honey taken in diarrhea dysentery, especially in neonates. Fruit cover juice is also used in diarrhea, dysentery of adults.
68.	Sacchabum officinarum	Aakh	Poaceae	Stem	stem juice taken in jaundice, burning Micturition and dehydration.

P.T.O

69.	Coccinia indica	Telakucha	Cucurbitaceae	Leaves, Fruit	Leaves juice drank in empty stomach in diabetes. Leaves paste is bound on head to relief headache. Fruit is used as vegetable for sugar control.
70.	Paederia foetida	Gandal	Rubiaceae	Leaves	Leaves used as vegetables in diarrhea, Amoebasis, dysentery and stomach problem. Leaves juice is boiled used in joing pain.
71.	Allium cepa	Paianz	Liliaceae	Bulb	Crushed onion paste used locally in insect sting and eye vision.
72.	Carum carvi	Kalojira	Apiaceae	Seeds	Seeds covered by cloth, rubbed and then inhaled in common cold.
73.	Bacopa monnieri	Brahmi	Scrophulariaceae	Leaves	Leaves juice and fried in ghee are then eaten to promote memory.
74.	Mimusops elengi	Bakul	Sapotaceae	Stem, Bark	Stem bark decoction used as gurgling in spongy gum, bleeding gum etc.
75.	Tagetes erecta	Ganda	Asteraceae	Leaves	Leaves juice applied over cut injury to stop bleeding and juice is drank to cure abdominal pain.
76.	Psidium guava	Peyara	Myrtaceae	Fruit, Leaf	Fruit is eat to relief from indigestion Leaf juice is taken to control blood sugar, mouth bleeding.
77.	Tamarindus indica	Tentul	Caesalpinaceae	Leaf, Fruit	Warm paste of leaf is applied on joint or injured bone.

P.T.O

78.	Rungia pectinata	Choto sibjota	Acanthaceae	Leaves	Leaves are used as cooling agent crushed leaves is applied to lower swelling. (16)
79.	Citrus limon	Jamir Lebu	Rutaceae	Fruits, Leaves	Fresh juice of leaves and fruits are taken to treat mouth bleeding, skin infection, digestion and dandruff.
80.	Marsilea minuta	Shushni shak	Marsileaceae	Whole Plant	The leaf juice of marsilea is used to stop nose bleeding; indigestion is treated by eating the pounded leaves cooked with rice, and swelling of the gums is reduced by applying leaves.

P.T.O

Clerodendrum viscosum
(Ghetu)

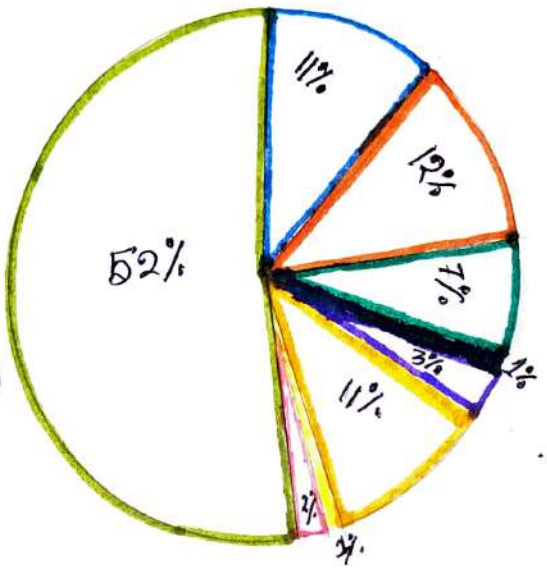
Aloe vera
(ghritkumari)

Marsilea minuta
(Shushni Shak)

P.T.O

Parts used (%)

- Stem (11%)
- Root (12%)
- Bark (7%)
- Rhizome (1%)
- Latex (3%)
- Fruit (11%)
- Bulb (1%)
- Whole plant (2%)
- Leaves (52%)



PERCENTAGE (%) OF PLANT PARTS USED

P.T.O

Calculation

Different disease treated with plants Parts—

1) Digestive disorder

Total plant = 80

Number of plants used for digestive disorder = 20

∴ Percentage

$= \frac{20}{80} \times 100$

$= 25\%$

2) Skin ifection and stop bleeding

$= \frac{10}{80} \times 100$

$= 12.5\%$

3) Sugar control

$= \frac{8}{80} \times 100$

$= 10\%$

4) Muscular and joint Pain.

$= \frac{7}{80} \times 100$

$= 8.75\%$

6) Respiratory trouble

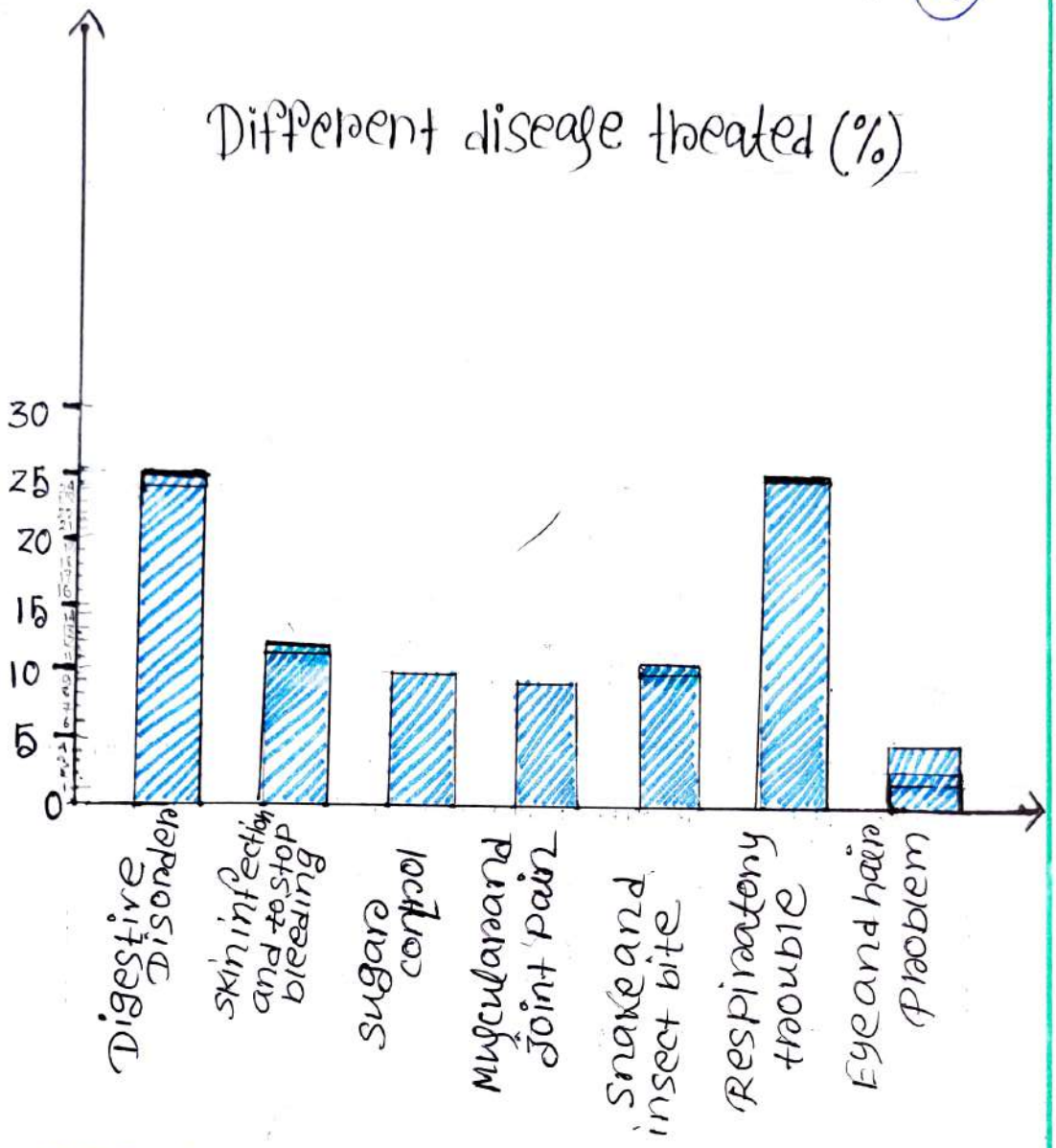
$= \frac{20}{80} \times 100$

$= 25\%$

7) Eye and hair problem

$= \frac{4}{80} \times 100 = 5\%$

P.T.O



PERCENTAGE (%) OF DIFFERENT DISEASE TREATED WITH PLANT PARTS

P.T.O

Discussion: From the present study, 80 sp. of plants belong to 42 families were recorded. The major plant families were used by the rural people for their health care sare Acanthaceae, Apocynaceae, Asteraceae (12, 7 and 4 species of each), Apiacea, Palmae and Rutaceae (3 species of each). The information documented in this study is completely based on the primary source and the uses of locally ~~people~~ available plants by the rural people as their household remedies. To treat various disease the rural people were using leaves (52%), most commonly and followed by Root (12%), Stem (11%), Fruit (11%), Bark (7%), latex (3%), Whole plant (2%), Rhizome (1%) and Bulb (1%).

The plants were used for the treatment of Digestive disorder (25%), to stop bleeding and skin infection (12.5%), Respiratory trouble (25 %), snake and insect bite (11.2%), sugar control (10 %), Muscular and joint pain (8.75%), Eye and hair problem (5%), Fever and sexual disease.

P.T.O

Fauna:

The information of important animals groups such as birds, reptiles, Fishes and mammals were collected by along the road side, nearby village areas in the impact zone. An inventory of the animals has been prepared separately for mammals, reptiles birds e.t.c. some primary fauna observed during the field survey presented in the below table —

Table-2

List of Mammals studied in study Area

S. No.	Scientific Name	Local Name	Family
1.	Canis lupus familiaris	Kukur (Dog)	Canidae
2.	Felis catus	Bidal (Cat)	Felidae
3.	Cavia Porcellus	Guineapig	Caviidae
4.	Pteropus medius	Badur (Flying fox)	Pteropodidae
5.	Bandicota bengalensis	idur (rat)	Muridae

P.T.O

6.	Bos taurus	goru (cow)	Bovidae
7.	Marmota monax	kathbirali (squirrel)	sciuridae
8.	oryctolagus cuniculus	Khorgos	Leporidae
9.	Vulpes vulpes	fox	Canidae
10	Macaca mulatta	monkey	cercopithecidae
11	Capra hircus	goat	Bovidae
12	Bubalus bubalis	Buffalo	Bovidae
13	Sus domesticus	sukara	suidae
14	Viverra zibetha	bhambiral or khatas	viverridae
15	Rattus rattus	common house rat	Muridae

P.T.O

Table-3

List of Reptiles studied in study Area

S. NO.	Scientific Name	Local Name	Family
1	Calotes versicolor	Girgiti	Agamidae
2	Hemidactylus flaviviridis	tiktiki	Gekkonidae
3	Chamaeleon zeylanicus	Bohurupi	Chamaeleonidae
4	Varanus bengalensis	Goshap	Varanidae
5	Naja naja	Gokhra	Elapidae

Table-4

List of Amphibians in study Area

S. NO.	Scientific Name	Local Name	Family
1	Bufo melanostictus	Kuno bang	Bufonidae
2	Rana tigrina	Sonabang	Ranidae
3	Rhacophorus pengusonii	gechobang	Rhacophoridae

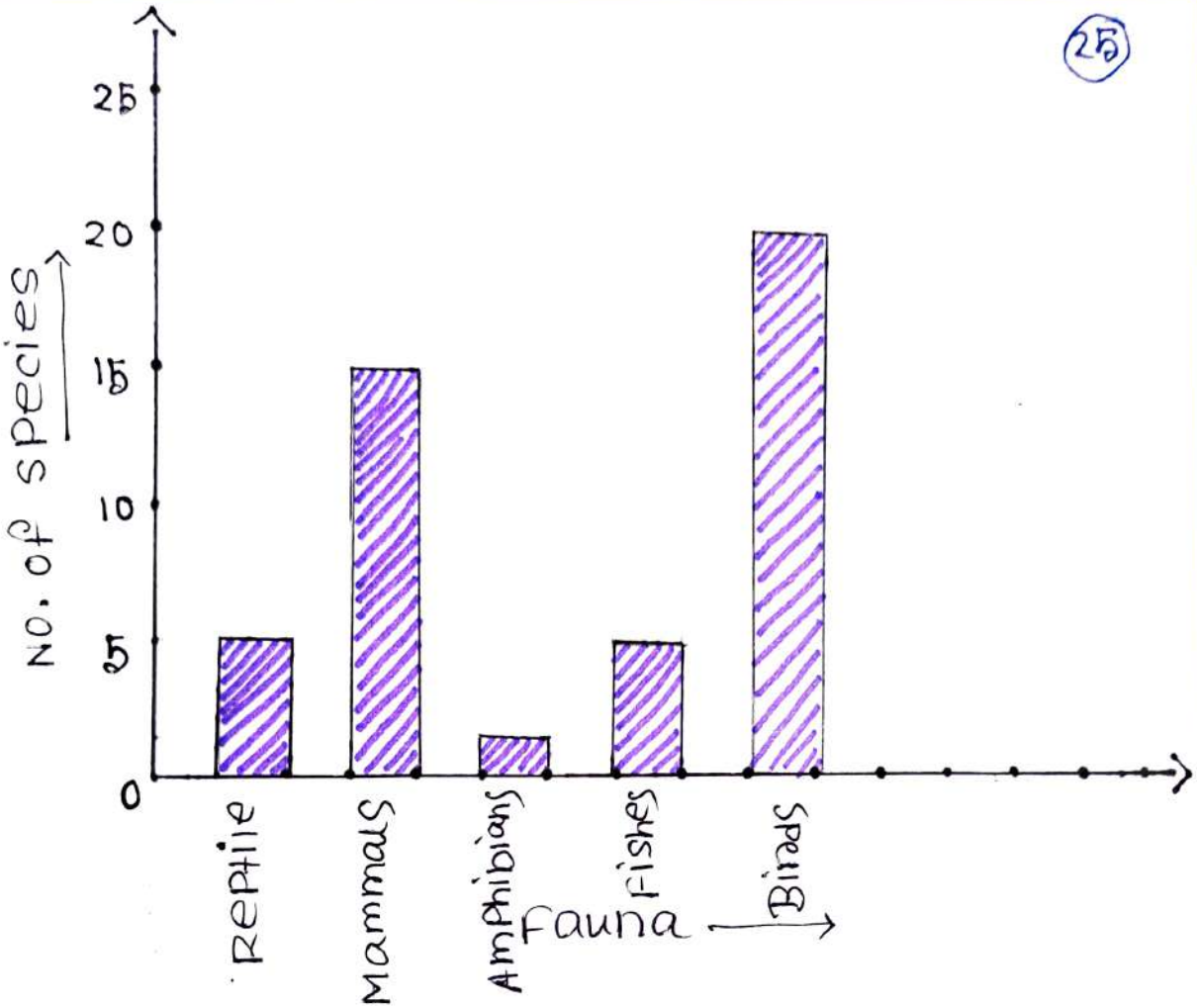
Table-5 List of Fishes

S. NO.	Scientific Name	Local Name	Family
1	Labeorohita	Rohu	cyprinidae
2	catla catla	catla	cyprinidae
3	Clarias batrachus	Mangur	Clariidae
4	Lates calcarifer	Bhetki	Latidae
5	Macrobrachium rosenbergii	Chingri	Palaemonidae

Table-6 List of Birds in study Area

S. No	Scientific Name	Local Name	Family
1.	Columba livia	Payra	Columbidae
2	Corvus splendens	Kak	Corvidae
3.	Ploceus philippinus	Babui	Ploceidae
4	Pycnonotus cafer	Bulbuli	Pycnonotidae
5	Copsychus saularis	Doyel	Muscicapidae
6	Psittacula krameri manillensis	Tiya	Psittacidae.
7	Passer domesticus	Chorui	Passeridae
8	Bubulcus ibis	bok	Ardeidae
9	Gallus gallus	murgi	Phasianidae
10	Anser anser	Rajhans	Anatidae
11	Picoides sp.	Kaththokra	Picidae
12	Eudynamys scolopacea	Kokil/Kokila	Cuculidae
13	Acridotheres tristis	Shalik	Sturnidae
14	Athene brama	Spotted owlet	Strigidae
15	Alcedo atthis	Machranga	Alcedinidae
16	Orthotomus sutorius	tuntunipakhi	Cisticolidae
17	Fulica atra	coot	Rallidae
18.	Cacatua vieillot	Cacatua	Cacatuidae
19	Spilopelia chinensis	Ghughu	Columbidae
20	Phalacrocorax fuscicollis	Pankouri	Phalacrocoraci-dae

P.T.O



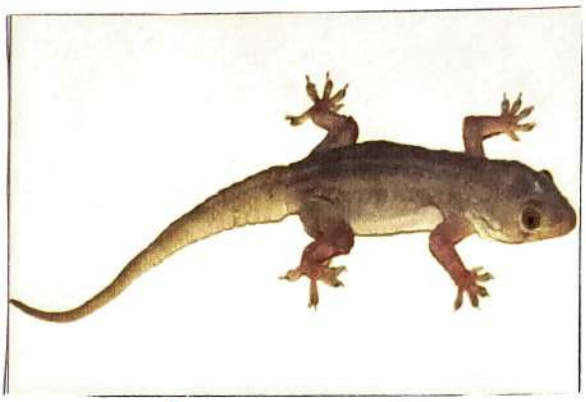
CLASS-WISE STATUS OF FAUNA SPECIES

Discussion:

15 species of mammals, 20 species of birds, 5 species of reptiles, 3 species of amphibians, 5 species of fishes were recorded.

P.T.O

Marmota monax
(squirrel / kathbirali)



Hemidactylus
flaviviridis
(tiktiki)

Rana tigrina
(sona bang)

~~Lab~~ Labeo rohita
(Rohu)

Columba livia
(Payra)

P.T.O

CONCLUSION

This project is my little effort to open the basic science. Hence, I have come to the end of the EVS project on the topic study of Local Flora and Fauna diversity.

I tried my best to include all the necessary point that are required related to the given topic.

It was a wonderful and learning experience of me while working on this project. I learned many things about my local area's Flora and Fauna.

The area is an important source of traditionaly used medicinal plants with indigenous in nature. I learn about their Economic and Ecological value.

As a conclusion ; fauna and flora constitute our environment. The Human being is the main responsible of the destruction of fauna and flora. so, people can do many efforts to respect law of protection of fauna and flora.

It is important, because we must live in a health environment and to conserve our animal and tree species.

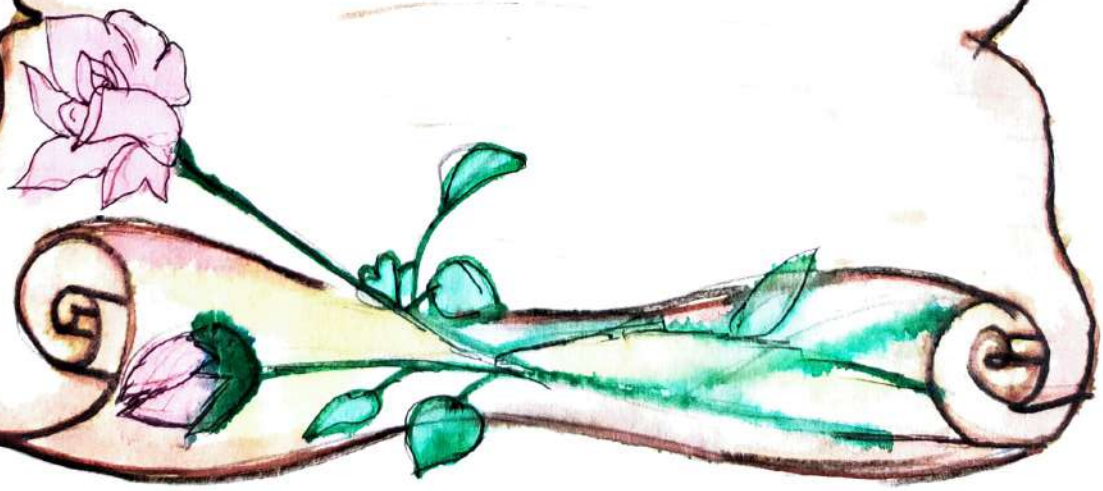
P.T.O

ACKNOWLEDGEMENT

I would like to express my profound gratitude and deep regards to our teacher Prof. Dr. Nilanjan Chakraborty for his exemplary guidance, monitoring and constant encouragement throughout the course of this project.

I would also like to thank my parents and friends who helped me to complete this project within the deadline.

Lastly, I would like to thanks each and every person who directly or indirectly helped me in the completion of the project.



ENVIRONMENTAL SCIENCE PROJECT

COLLEGE ROLL NUMBER: BOTA20F100

C.U. REGISTRATION NUMBER: 223-1211-0397-20

C.U. ROLL NUMBER: 203223-11-0061

STUDY OF LOCAL FLORA AND FAUNA DIVERSITY

Our planet is full of living and non-living things .The two basic scientific terms used for these things are Abiotic and Biotic .the term Abiotic relates to all physical objects such as mountains and rivers. Biotic, on the other hand, is about life on earth known as “flora and fauna”. Flora and fauna each have their differences between each other. They are obviously very important components of the environment and ecosystem.

The word “flora” means plant life. Flora is a Latin word, which relates to the collective plant life. It refers to all the plant species that exist in the world. It includes plants that once grew in the world and those, which are cultivated at present.

The fauna is about animal life. Avifauna is the terms given to birds and Piscifauna includes all types of fishes. Moreover, microorganisms also have a distinctive name to represent them, which is Microfauna. These two and similar other forms of life create a Biota.

The classification of flora and fauna depends on region, climate, period, and environments. We can distinguish the plant life on our earth in different ways. The simplest method used is to divide them depending on the basis of their respective regions. Plants growing in the desert are quite different from those that grow in the mountains. The unique form of flora includes those plants, which have adapted themselves to deep waters. The classification of the animal kingdom includes different divisions and subdivisions. The phylum is the first division, which breaks down into various groups known as classes. Classes further divided into orders, families, and genera. When you break down the genus, you get the species. These are individual groups of animals that have similar characteristics.

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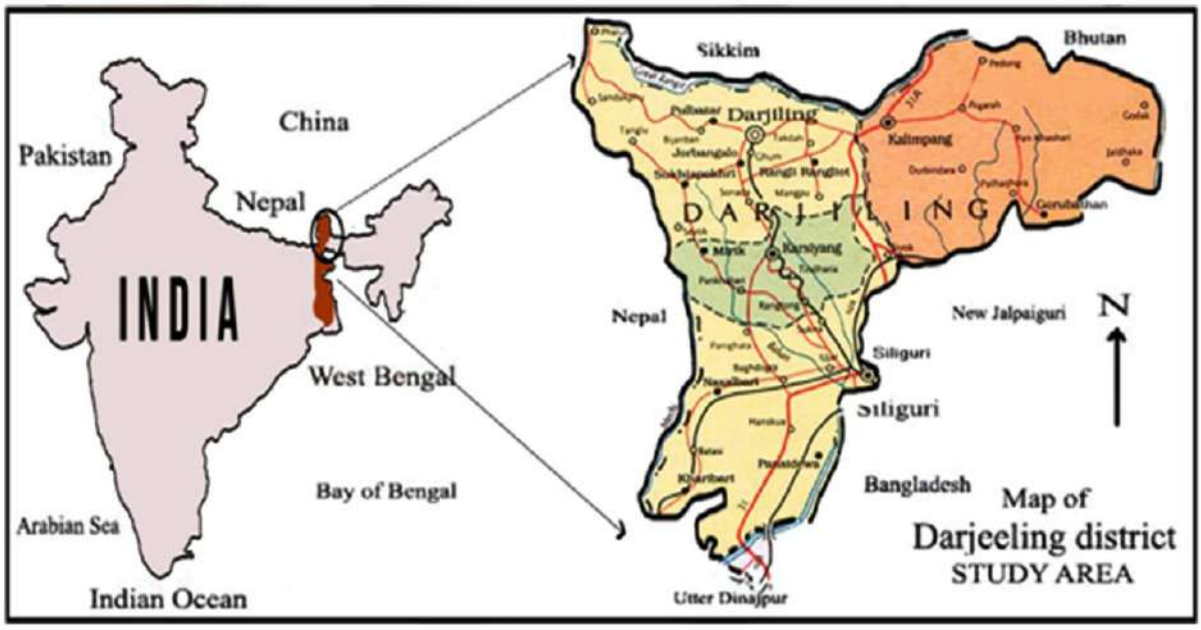
FLORA AND FAUNA OF KALIMPONG AND DARJEELING DISTRICT


Of the sixteen hotspot zones in the world, two of them fall in India – the Western Ghats and the Eastern Himalayas. Kalimpong is a precious part of the Eastern Himalayas and boasts a rich bio-diversity. The Neora Valley National Park (88 sq. km), on the north-eastern face of the district with its dense subtropical and impenetrable temperate forest, is a national asset. There are six natural subtropical forests beginning at different zones:

Mongpong (from Tiger Bridge), continuing to Lish, Guling and Nazoke

Chunabhatti, Samsing to Nimbong.
Pubung-Mangzing stretching to Gitdabling,
Dalimkot-Gourbathan, extending to Samsing and above
Kumai, taking its route to Rongo and above and
Jholung Paren to Todey, via Godak.



DARJEELING DISTRICT LOCATION

The Tarkhola and the forests along the eastern flank of river Teesta are connected to Neora Valley through Munsong, Damsang-Algarah and Paktham-Lahba. The second connectivity of forests begin at Chunabhatti (Bagrakote)-Pubung and continues through Nimbong, Pemling, Lolaygaon and Lahba to join Neora Valley. The forests of Ambiok-Dalimkot (Gourbathan), Samsing, Kumai, Rongo, Paaren- Godak and Todey Tangta skirt the national park on the south-eastern flank. At the foot of Kalimpong, along the river banks of Relli and Teesta, the rain forests can be observed containing the species Acacia (Khair), Meliosma Pinnata (Dabdabe), Albizia (Siris) and Dalbergia (sissoo). The lofty sal trees and the intermixed species of Terminalia, Largerstroemia parviflora, and Dillenia from the sal forest lie in the lower hills. The tropical mixed forests in this zone show the presence of Tetrameles (Maina), Beilschmiedia (Tarsing), Macarange (Malata), along with the undergrowths. The subtropical forests, mostly deciduous, extending to an altitude of 1800m, are home to species like Gynocardia odrata

(Gante), Callicarpa (Guenlo), Duabanga (Lampate), Terminalia (Saj), Phyllanthus (Amala), Cinamomum (Tejpat), Engelhardia (Mauwa) and Ficus (Khaniun). The beauty of these forests has been enhanced by the magnificent and lofty climbers like Entada (Pangra), Tinospora (Gurjo, Combretum (Thakauli), Mucuna (Kaoso & Baldengra), Cissus (Charchare).

NEORA VALLEY, LAVA, KALIMPONG

A WATERFALL IN NEORA VALLEY

FLORA OF KALIMPONG:

The popular bio-diversity and typical Himalayan flora is exhibited by the evergreen temperate forests. The temperate ranges cover the forests of Algarah, Charkhola- Lolaygaon, Damsang, Thosum, Todey Tangta and continue above to the Rachela peak, the tri-junction of Sikkim, Bhutan and Kalimpong. Floristically, this climatic border is marked by the presence of certain species like Leucoceptrum canum (Ghurpis), Edgeworthia gardneri (Argeli), Rapidophora (Kanchirno), Thunbergia, Agapetes, etc. There are about seven species of Rhododendrons in the Neora Valley, some of them forming a pure (monoculture) forest at the peak of Rachela. Species like

Rhododendron arboreum, Magnolia campbellii, Alcimandra cathcartii, Abutilon indicum, Mussaenda treutlerii and others can be seen along the ridges of Labha, Gumbadara, Jhandi, Damsang, Todey Tangta and above and they are popular with explorers. About 300 species of orchids have been reported in this part of the Himalayas. Some of the popular orchids available here are Paphiopedilium, Pleone, Orchis, Herminium, Oberonia, Liparis, Coelogyne, Dendrobium, Cymbidium, etc. along with the common ground orchids like Habenaria, Satyrium, etc. The only medicinal plant garden of the nation that cultivates the precious Cinchona (and has its headquarters at Mungpoo) has a major stretch of cultivation in Kalimpong – at Munsong and Rongo – Gairibas. The commercial cultivation of Cinchona spp, Dioscorea spp, Cephaelis ipecacuanha, and other herbal plants such as Digitalis, Solanum, Rauwolfia, Mentha etc. have been carried here since its inception in the 60s

SOME FLORA OF KALIMPONG\DARJEELING DISTRICT AND THEIR IMPORTANCE:

Sl. No.	Botanical Name:	Local name	Families:	Important:
1.	*Amomum subulatum*	Black cardamom	Zingiberaceae	Helps in various digestive disorders and also helps in fighting stomach ulcers. Improves appetite and helps in maintaining good heart health and keeps issues of gas and bloating at bay.

2.	*Rhododendron arboreum*	Tree rhododendron	Ericaceae	Flower petals when chewed treats dysentery, tonsillitis, mouth sores.
3.	Zanthoxylum nitidum	Shiny-leaf prickly-ash	Rutaceae	It helps to cure liver disorders.
4.	*Dioscorea alata*	Purple yam	Dioscoreales	Good source of carbohydrate,and controls stomach problems.
5.	*Choerospondi-as axillaris*	Nepali hog plum	Anacardiace-ae	Effective against blood dysentery and good appetizer.
6.	*Diplazium esculentum*	Vegetable fern	Athyriaceae	Good source of dietary fibre and protein, effective on constipation

7.	*Albizia lebbeck*	Lebbek tree	Fabaceae	It is used to produce timber and fuel, for forage, environmen t-al manageme nt and medicine.
8.	*Allium hookeri*	Hooker chives	Amaryllidac e-ae	Beneficial for circulatory system.
9.	*Baccaurea ramiflora*	Burmese grape	Phyllanthac-eae	Helps in constipatio n, high source of vitamin C.
10.	Calamus erectus	Viagra palm	Arecaceae	Anti-dibetic.
11.	Dendrocala-mus hamiltonii	Hamlinton's bamboo	Poaceae	Good source of dietary fibre.
12.	Betula alnoids	Himalayan birch	Betulaceae	It is used to make medicine.
13.	Cryptomeria japonica	Japanese cedar	Cupressacea e	Used for ornamental purposes and for

				making furniture, etc.
14.	Gladiolus grandiflora	Gladiolus	Iridaceae	Ornamental purposes.
15.	Cinchona officinalis	Quinine	Rubiaceae	Used in the treatment of malaria.
16.	Alnus nepalensis	Nepalese alder	Betulaceae	It controls erosion on hillsides and the nodules on its root helps in fixing oxygen.
17.	Musa sikkimensis	Darjeeling banana	Musaceae	Controls diarrhoea.
18.	Cymbidium devonianum	Boat orchid	Orchidaceae	Ornamental purposes.
19.	Citrus reticulata	Mandarin orange	Rutaceae	Enhances digestion.
20.	Camellia sinensis	Tea plant	Theaceae	Enhances immunity.

Amomum subulatum (Black cardamom)

Rhododendron arboretum
(Tree rhododendron)

Zanthoxylum nitidium
(Prickly-ash)

Dioscorea alata
(Purple yam)

Choerospondias axillaris
(Nepali hog plum)

Diplazium esculentum
(Vegetable fern)

Allium hookeri
(Hooker chives)

Baccaurea ramiflora
(Burmese grape)

Calamus erectus
(Viagra palm)

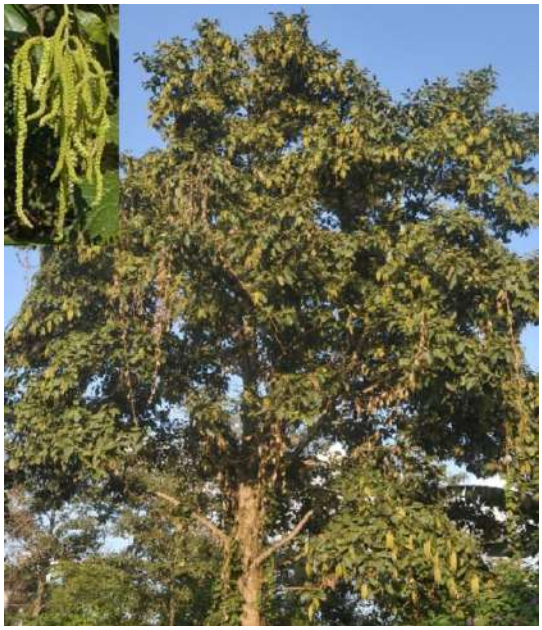
Albizia lebbeck
(Lebbeck tree)

Dendrocalamus hamiltonii
(Hamilton's bamboo)

Betula alnoids
(Himalayan birch tree)

Cryptomeria japonica
(Japanese cedar)

Gladiolus grandiflora



Alnus neplanlensis
(Nepalese alder)

Musa sikkimensis
(Darjeeling banana)

Cymbidium devoniaum
(Boat orchid)

Cinchona officinalis (Quinine)

Citrus reticulata
(Mandarin orange)

Camellia sinensis
(Tea plant)

FAUNA OF KALIMPONG AND DARJEELING DISTRICT:

The faunal diversity of this region is another interesting asset. There is record of about 130 mammals, 550 birds, 125 freshwater fish, 51 reptiles, 25 amphibians, 43 moths and 24 butterflies in the district of Darjeeling. The wildlife of Kalimpong is enriched by the presence of endangered species like the red panda and munal pheasant, Himalayan black bear, clouded leopard tiger, Himalayan tahr, goral, gaur and pangolin at widely different altitudes. The forest belts host the Siberian weasel, today cat, Asiatic black bear, common India leopard, barking bear, Indian bison, moupan hare and Himalayan squirrels. Some of the many birds found here are sparrow hawks, Indian besra, griffon vulture, kaleej pheasant, a variety of hornbills, woodpeckers, owls, Indian black-crested baza, etc. The dominant genera in the amphibian species are Rana, Loepa and butterflies like Pieris, Poutia, Apollo, Papilio etc. can be spotted. A good number of studies have been condu region, yet a lot is left for the naturalists

and nature enthusiasts to explorected on the flora and fauna of this region, yet a lot is left for the naturalists and nature enthusiasts to explore.

Accipiter nisus (Sparrow Hawk)

Mustela sibirica (Siberian weasel)

FAUNA OF KALIMPONG:

Sl. No.	Scientific name:	Common name:	Families:	Status as per IUCN Red List:
1.	*Ailurus fulgens*	Red panda	Ailuridae	Endangered
2.	*Pardofelis marmorata*	Marbled cat	Felidae	Vulnerable
3.	*Manis pentadactyla*	Chinese pangolin	Manidae	Critically Endangered
4.	*Amblonyx cinereus*	Asian small-clawed otter	Mustelidae	Vulnerable
5.	*Lutrogale perspicillata*	Smooth coated otter	Mustelidae	Vulnerable
6.	*Muntjac*	Barking deer	Cervidae	Least Concern
7.	*Dendrocopos darjellensis*	Darjeeling woodpecker	Picidae	Least Concern
8.	*Rucervus duvaucelii*	Barasingha	Cervidae	Vulnerable
9.	*Capricornis sumatraensis*	Sumatran serow	Bovidae	Vulnerable
10.	*Hystrix brachyura*	Malayan porcupine	Hystricidae	Least Concern
11.	*Rattus nitidus nitidus*	Himalayan field rat	Muridae	Least Concern
12.	*Ursus thibetanus*	Asiatic black bear	Ursidae	Endangered
13.	*Neofelis nebulosa*	Clouded leopard	Felidae	Vulnerable
14.	*Moschus*	Musk deer	Moschidae	Threatened
15.	*Tylototriton verrucosus*	Himalyan salamander	Salamandridae	Endangered

Ailurus fulgens
(Red panda)

Lutrogale perspicillata(Smooth coated otter)

Muntjac
(Barking deer)

Manis pentadactyla
(Chinese pangolin)

Pardofelis marmorata
(Marbled cat)

Amblonyx cinereus
(Asian small clawed otter)

Dendrocopos darjellensis
(Darjeeling woodpeker)

Rucervus duvaucelii
(Barasingha)

Capricornis sumatraensis
(Sumatran serow)

Hystrix brachyura
(Malayan procupine)

Ratus nitidus nitidus
(Himalayan field rat)

Tylototriton verrucosus
(Himlayan salamander)

Neofelis nebulosa (Clouded leopard)

Moschus (Musk deer)

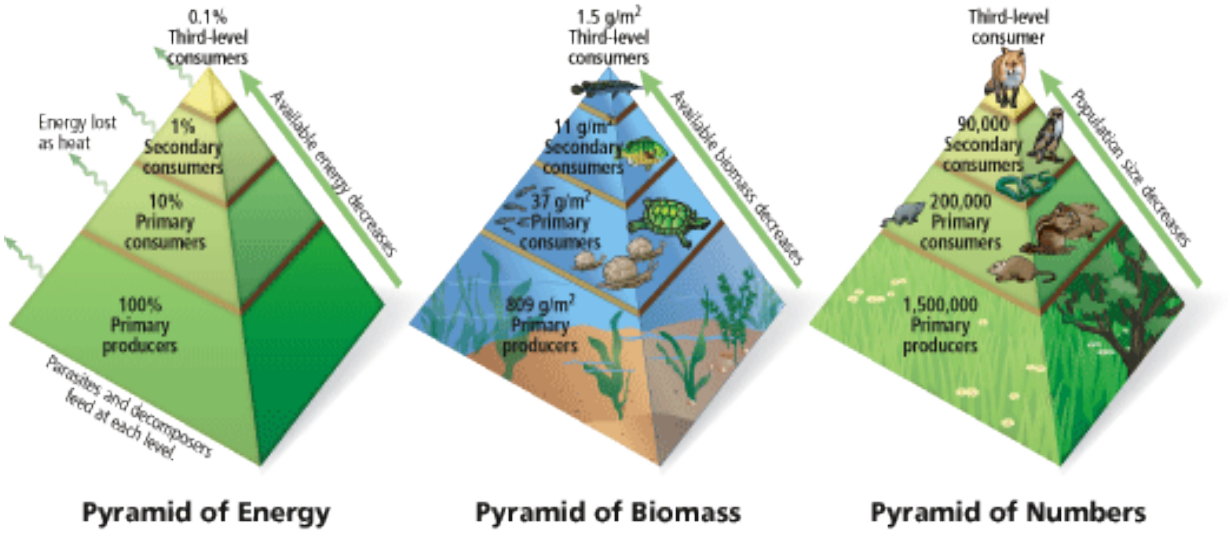
Ursus thibetanus(Asiatic black bear)

CONCLUSION:

Flora and Fauna is important because:-

- Maintains ecological balance

Human life needs flora and fauna to survive on this planet. Flora helps in the generation of oxygen into the environment. Whereas Fauna that is Animal, they produce carbon dioxide in large amounts. Plants absorb carbon dioxide. Carbon dioxide helps plants in carrying out the photosynthesis process. This relation between plants and animals follows a symbiotic relation. In the same way, humans also take oxygen from plants and exhale carbon dioxide. Thus ecological balance is maintained by flora and fauna and are essential for humans. Humans get food, medicinal elements, from plants and animals. Fauna provides food and fills the surplus population. Flora also provides ideal conditions for rain. Therefore one cannot neglect the importance of Flora and Fauna in keeping nature in balanced form. Animals do have a vital role in eco-balance. Animals feed on other plants and small animals and control their populationand growth. Animal waste products act as a fertilizer and manure for plants and soil respectively. Dead and decayed animals also refill the minerals of soil and increase the fertility of the soil. Animal waste also provides an ideal condition for various essential microorganisms to grow. This is how animals maintain balance in nature



ECOLOCICAL PYRAMIDS

- Natural Beauty and rejuvenation

Human beings love to spend their time in and around nature. It is no surprise that nature helps us to recover and act as an anti-depressant for us. This is the reason why we use to go to some hill station or coastal areas whenever we get free time. Flora and Fauna both act as a rejuvenating agent for us. Billions of people every year love to go to a place where they can connect with nature. In this way, Flora and Fauna both are important for us. They have a positive impact on our psychological health. This makes us understand the significance of flora and fauna in our lives.

- Expands local economies

Flora and Fauna also help in the economic development of a country or area. For example, many people visit wildlife sanctuaries and forests every year. This generates a lot of revenue for the native people. Exotic locations like Indonesia, Bahamas etc. have a great crowd turnover.

SAVE YOUR FLORA AMD FAUNA!

COLLEGE ROLL NUMBER :- BOTA20F101

C.U ROLL NUMBER :- 203223-11-0063

C.U REG. NUMBER :- 223-1211-0408-20

SUBJECT :- E.N.V.S

STUDY OF THE FOREST ECOSYSTEM

INTRODUCTION :-

An **ecosystem** is a geographic area where plants, animals, and other organism, as well as weather and landscape, work together to form a bubble of life. Ecosystem contain biotic or living, parts, as well as abiotic factors, or nonliving parts. Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in temperature of an ecosystem will often affect what plant will grow there. Animals that depends on plants for food and shelter will have to adapt to the changes, move to another ecosystem.

IMPORTANCE OF ECOSYSTEM :-

▫It provides habitat to wild plants and animals.

▫It promotes various food chains and food webs.

▫It controls essential ecological processes and promotes lives.

▫It provides and store clean fresh air.

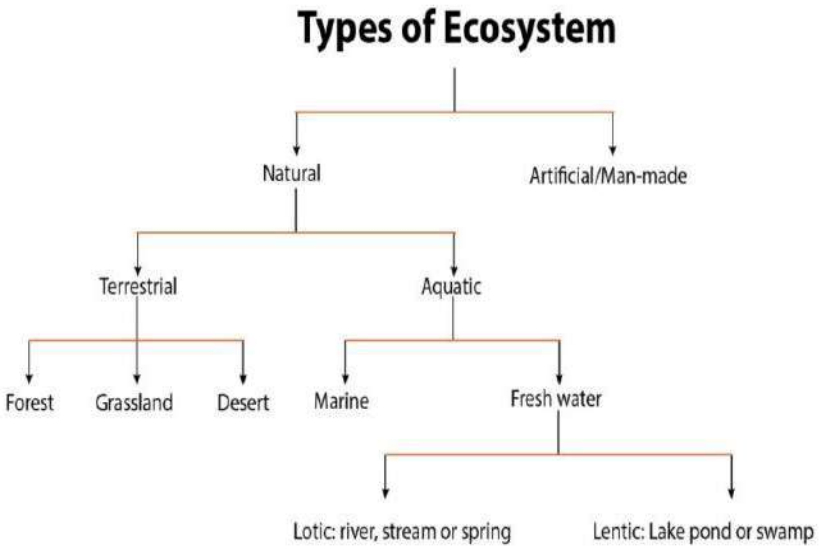
▫It recycles the nutrients between biotic and abiotic factors.

▫It maintains the flow of energy with the help of the carbon cycle, water cycle, nitrogen cycle and oxygen cycle.

TYPES OF ECOSYSTEM :-

There are different types of ecosystems based on different climates, habitats, and life forms. This means that ecosystems can typically be divided into hundreds and thousands of smaller systems. However, all such types generally fall into one of the following two categories:

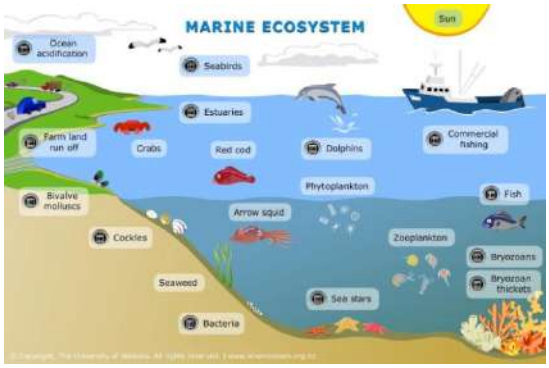
- Aquatic Ecosystem
- Terrestrial Ecosystem



Let us now understand in detail about both the above ecosystems.

⇨ Aquatic Ecosystem

An **aquatic ecosystem** is an ecosystem in a body of water. In this communities of organisms that are dependent each other and on their environment lives in aquatic ecosystems. The two main types of aquatic ecosystems are freshwater ecosytems and marine ecosystems. There are three basic types of freshwater ecosystems: Lentic (slow moving water, including pools, ponds, and lakes); Lotic (faster moving water, for example streams least part of the time).



Marine Ecosystem

Freshwater Ecosystem

⇨ Terrestrial Ecosystem

A **terrestrial ecosystem** is a land-based community of organisms and the interactions of biotic and abiotic

components in a given area. Examples of **terrestrial ecosystem** include the tundra/mountains, tropical rainforests, grasslands, and deserts.

A community of organisms and their environment that occurs on the land masses of continents and islands, terrestrial ecosystems are distinguished from aquatic ecosystems by the lower availability of water and the consequent importance of water as a limiting factor. Terrestrial ecosystems are characterized by greater temperature fluctuations on both a diurnal and seasonal basis that occur in aquatic ecosystems in similar climates.

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.

A Forest Ecosytem is large, uncultivated, uninhabited area covered with tress of different height, shrubs, and hurbs. It describes the community of plants, animals, microbes and all other organisms in interaction with the chemical and physical features of their environment. Specifically, a terrestrial environment dominated by trees growing in a closed canopy. The canopy layer is one of the most distinguishing characteristics of a forest ecosystem. The dense canopy layers act as a barrier against wind, rain, snow, etc.

FEATURES OF FOREST:-

- Only diffused light reaches the ground.
- Temperature is lower in summer and higher in winter.
- The floor of the forest is carpeted by thalloid plants, like lichen & mosses.

An ecosystem is composed of two main components: biotic and abiotic factors. Biotic factors are the living parts of the ecosystem, such as plants, animals, insects, fungi, and bacteria. Abiotic factors are the non-living parts

of the ecosystem, which influence the size and composition of the living parts: these are components like minerals, light, heat, rocks and water.

Abiotic Components:-

•These are the inorganic as well as organic substances present in the soil and atmosphere.

•Some trace elements are also present in soil.

Biotic components are typically sorted into three main categories:-

1.Producer:-

Teak tree

•There are mainly trees that show much species diversity
•The tress are of different kinds depending upon the kind of forest formation.
•There are also present shrubs and ground vegetation.
•The main producers are:- Flora
•Other producers (Tectona grandis(Teak), Butea frondosa etc).
•In temperature deciduous forest (Acer, Betula, Picea etc)

2.Consumer:-

•Primary consumers.
•These are herbivores that includes the animals feeding on tree leaves as (ants, beetles, leaf hoppers, spiders, etc).
•And large animals eats fruits of producers (Elephan, Nilgai, Deer, Flying Fox, etc).
•Tertiary consumers
•It consumes secondary consumers.

3.Decomposers:-

•These are wide variety of micro-organisms including:
Fungi (species of Aspergillus, Polyporus, Trichoderma, etc.

Bacteria (species of Bacillus, Clostridium, etc.)
Actinomycetes (species of Streptomyces.)

•Rate of decomposition in tropical and subtropical forest is more rapid than in the temperature.

Types of Forest

•Coniferous Forest

Broad Leaved Forests

- ▫Evergreen Forest
- ▫Deciduous Forests
- ▫Thorn Forests
- ▫Mangrove Forests

Coniferous Forests:-

Coniferous forest is a terrestrial biome defined by the world wide fund for nature. Temperate coniferous forests are found predominantly in areas with warm summers and cool winters, and vary in their kinds of plant life. In some, needle leaf tress dominate, while others are home primarily to broadleaf evergreen trees or a mix of both tree types. They occur in the northern part of North America, Europe, and Asia.

In these forest, winters are usually long and cold. The precipitation is often light in winter and heavy in summer. The soil is acidic and humus-rich and there is much litter.

Coniferous Forest

The main animals are large herbivores like mule deer, moose, elk, caribou; smaller herbivores like mice, hare, and red squirrels; and predators like lynx, foxes, and bears. They are often important nesting areas for many migratory birds like warbles and thrushes.

Evergreen Forests:-

An evergreen forest is a forest made up of evergreen trees. They occur across a wide range of climatic zones, and include tress such as coniferous and holly in cold climates, eucalyptus, live oak, acacias and banksias in more temperate zones, and rainforest trees in tropical zones.

In India, evergreen forests are primarily located in states such as Karnataka and even Kerala. The Western Ghats are the primary location of the evergreen forest. The trees looses their leaves continuously throughout the year, old leaves are shed at the same time new leaves are borne. There is not a particular season when trees loose all their leaves. Rainfall occurs throughout the year and temperature evergreen forest occurring at upper temperate latitude of

An evergreen forest in India

Evergreen Forest

Deciduous Forests:-

A deciduous forest is a type of forest dominated by trees that lose their foliage

at the end of the growing season. This is in contrast to an evergreen forest where a majority of the trees remain “green” throughout the year because they shed leaves not seasonally but at various periods of the year. They last for only months. They are found in the regions with a balanced amount of seasonal rainfall.

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 floor.

Thorn Forests:-

A thorn forest is a dense, scrubland with vegetation characteristic of dry subtropical and warm temperate areas with a seasonal rainfall averaging 250 to 500 mm. In India thorn forest are found in the semi-arid areas of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, and Haryana. These forests occur in the areas where annual rainfall is between 20 to 70 cm, the dry season is hot and very long.

The main animals found in thorn forests are:- wolf, rats and mice, rabbits, fox, tigers and lions, wild ass, horses, camels, spotted deer, wild sheep, etc.

Animals found in thorn forest

Dotted Deer

Mangroves Forests:-

A mangrove is a shrub or small tree that grows in coastal saline or brackish water. The term is also used for tropical coastal vegetation

consisting of such species. Mangroves are salt-tolerant trees, also called halophytes, and are dapted to live in harsh coastal conditions. They are adapted to the low-oxygen conditions of waterlogged mud.

Services provided by the forests

- Control flow of water
- Prevent soil erosion
- Watershed protection
- Control temperature
- Help increase ground
- Absorb CO_2
- Maintain water level

Uses of the Forest Ecosystem

A forest ecosystem helps in a various different ways. Some of them are:- They provides us Fruits, Flowers, Food, Medicines, Bamboo and cane for baskets, Wood, Gum, Raw material for variety of things- Industrial products and chemicals.

Fruits obtained from forest

Gum from bark of tree

Bamboos

ENVIRONMENTAL STUDIES (AECC-2)
PROJECT

C.U. ROLL NUMBER: 203223-11-0065

C.U. REGISTRATION NUMBER: 223-1211-0414-20

COLLEGE ROLL NUMBER: BOTA20F102

SUBJECT: BOTANY (HONS.)

SEMESTER: 2

STUDY OF ECOSYSTEM OF THE PART OF GANGA FLOWING NEAR KALYANI

INTRODUCTION

The "natual environment" encompasses all living and non-living things occuring natually. The term is most often applied to the Earth or some parts of Earth. Environment encompasses the interaction of all living species, climate, weather and natual resources that affect human survival and economic activity. The concept of natual environment can be distinguished as:

- Complete ecological units that function as natual systems without massive civilised human interactions, including all vegetation, micro-organisms, soil, rocks, atmosphere and natual phenomenon that occur within their boundaries and nature.
- Universal natual resources and physical phenomena that lack clear-cut boundaries; such as air, water and climate, as well as energy, radiation, electric charge and magnetism, not originating from civilized human actions.

Contamination of physical and biological components of the Earth to such an extent that normal environmental processes are adversely affected is environment pollution. Depending upon the nature of pollutants and also subsequent pollution of environmental components, the pollution may be categorized into: Air, Water, Soil, Noise and Radioactive pollution.

An ecosystem is a community of living organisms in conjunction with non-living components of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flows. There are mainly 2 components of an ecosystem:

i. Biotic factors are the living components of an ecosystem like producers, consumers, decomposers.
ii. Abiotic factors are the non-living components of an ecosystem like atmosphere, chemical elements, sunlight (temperature), wind, water.

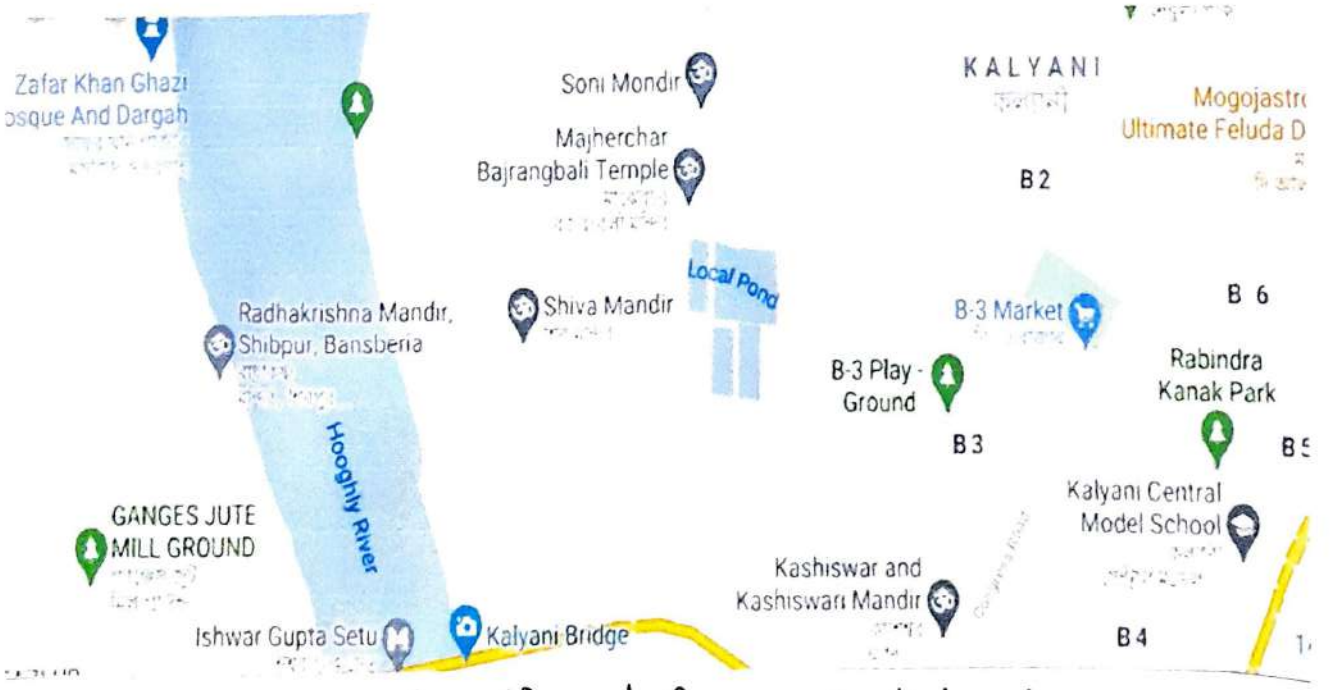
But currently, the assets of ecosystem are being misused. Due to excesive human intervention, the quality and quantity of the habitat is differed, various species are lost causing imbalance in the food chains. Heavy deforestation, pollution, global warming are some of the causes.

These damages can easily be checked by controlling over-exploitation of natural resources.

In this project, the topic dealt with is study of river ecosystem. The river chosen for the study is Ganges, the portion of it which is near Kalyani, Nadia of West Bengal state of India.

Date of visit: 24.06.2021
Place of visit: Kalyani, Nadia, West Bengal.

Ganges in Kalyani



Location of Ganges in Kalyani

GENERAL INFORMATION ABOUT GANGES

It is one of the most significant snow-fed rivers of India. This river is formed after the confluence at Devaprayag, Uttarakhand of the Alakananda and Bhagirathi rivers. The head waters of the river include Mandakini, Nandakini, Pindar and Dhauliganga - all are tributaries of Alakananda. The main tributaries of Ganga on its right bank are Yamuna, Tamsa, Kaiamnasa, Chandan, Ajoy, Damodar, Rupnarayan, etc. and on left bank are Ramganga, Gomti, Gandak, Burr Gandak, Koshi, etc. The river near Murshidabad of West Bengal divides into 2 parts: namely Padma which enters Bangladesh and Bhagirathi-Hooghly which continues to flow through West Bengal of India and finally converges with Bay of Bengal forming Sunderbans. The entire gangetic basin covers approximately an area of 1.2 million m^2.

- pH of Ganges: pH of Ganges water varies from 7.1 - 9.6. It is observed that the pH is higher mostly in monsoon season. The DO (dissolved oxygen) varies from 4.1 - 6.5 mg in monsoon and 5.4 - 8.2 mg in post monsoon season.
- Annual Rainfall: The average annual rainfall in the basin varies from 39 cm - 200 cm, with an average of 110 cm. 80% of the rainfall occurs during June - October.
- Average temperature: In summer, the average maximum is 30.3°C across the basin and average minimum is 21.5°C. In winter, the average maximum is 21.1°C and average minimum is 6.4°C.
- Rate of discharge: Averagely, Ganges discharges water at an approximate rate of 11,000 m^3/s.
- Soil: Various types of soils like sand, loam, clay, alluvium are found in the Ganges basin along with several combination soils like silty-clay, etc.
- Flora and fauna: Huge diversity of flora and fauna is observed across the basin.

INFORMATION ABOUT THE STUDIED PART OF THE GANGES

1. FLOW OF RIVER WATER:
   - The part of the river studied is of considerable depth.
   - The river water has a steady flow.
   - The natural flow is disrupted due to the several dams and barrages (940) it had crossed throughout its course. One of the significant one is Farakka Barrage of Murshidabad.
2. BIOTIC AND ABIOTIC ASPECTS:
   - Biotic factors like insects, molluscs, herbs, shrubs, trees, various fishes, and others were observed.
   - Abiotic factors like rocks, soil and others were present.
3. CHARACTERS OF RIVER COMPONENTS:
   - Banks: Here, formation of eroded concave bank and alluvium-deposited convex banks were observed. Kalyani lake, situated 4.6 km away from the Ganges is an ox-bow lake formed earlier due to this variation in bank formation.
   - Shallow area: Due to thick alluvium deposits, shallow areas were observed adjacent to the river banks.

Picture of Ganges in Kalyani.

4. FLORA AND FAUNA: Various species of flora and fauna were observed which are documented:

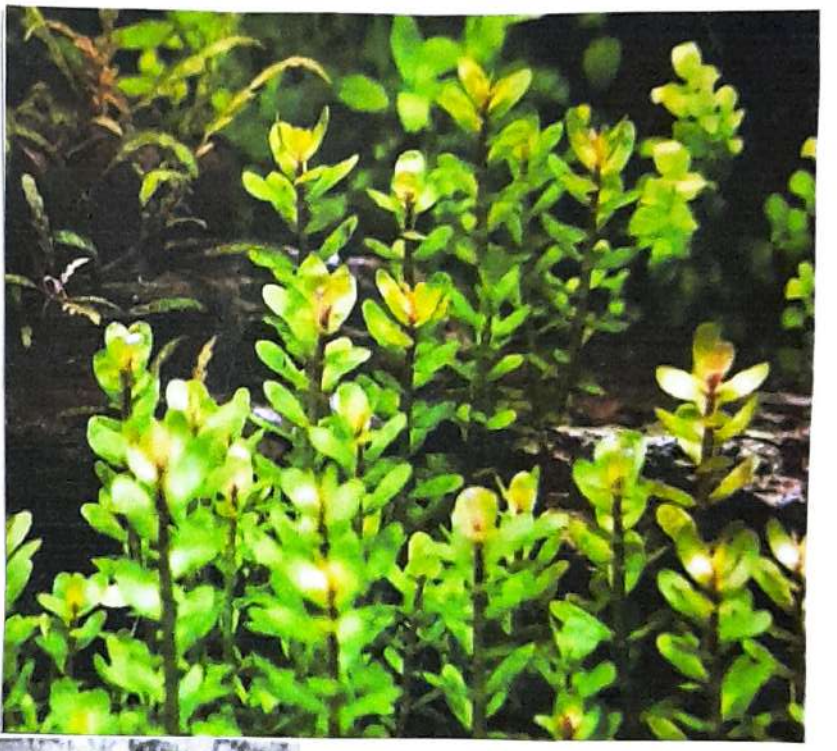
SCIENTIFIC NAME	COMMON NAME	TYPE	ECONOMIC VALUE
ALGAE			
Gloeocapsa pleurocapsoides			
Chlorogloean fritschii		Class-Cyano-phyceae	These species are the chief producers and also increase fertility of soil.
Anabaena ambigua			
Anabaena microscopia			
Calothrix bhaiadwajae			
Euglena viridis		Class-Eugleno-phyceae	
SEMI-AQUATIC / AQUATIC ANGIOSPERMS			
Rotala indica		Aquatic, indigenous	
Bergia capensis		Aquatic	
Phyla nodiflora	Frog fruit	Aquatic	
Hydrocera triflora		Semi-aquatic	
Ludwigia perennis		Semi-aquatic	
Ipomoea carnea	Pipe cane	Aquatic	
Oxalis latifolia	Garden pink-sorrel	Aquatic	
EXOTIC / INTRODUCED SPECIES			
Fimbristylis miliacea			
Eichhornia crassipes			
Saccharum spontaneum	Kash phul		
DICOTYLEDONS			
Nigella sativa	Kalojira	Herb of Ranunculaceae family.	Culinary and medicine.
Dillenia indica	Elephant apple	Tree of Dilleniaceae family.	Food and medicine.

Magnolia grandiflora	Champa	Tree of Magnoliaceae family.	Cosmetic and medicinal.
Annona reticulata	Nona	Tree of Annonaceae	Food and medicinal.
Annona squamosa	Custard apple		
Artabotrys hexapetalus	Kat champa	Shrub of Annonaceae	Ornamental and medicine.
Nelumbo nucifera	Padma	Herb of Nelumbonaceae	
Ficus benghalensis	Banyan	Tree of Moraceae	
MONOCOTYLEDONS			
Curcuma amada	Amada	Herb of Zingiberaceae	Culinary.
Curcuma aromatica	Ban haldi		Cosmetic and medicinal
Musa balbisiana	Banana	Herb of Musaceae	Food
Paspalum distichum	Knot grass	Grass of Poaceae.	

Cucuma amada

Oxalis latifolia

Phyla nodiflora



Rotala indica

Ipomoea carnea

Eichhornia crassipes

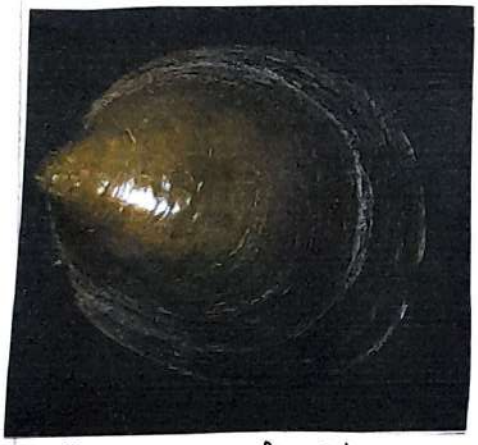
Artabotrys hexapetalus

Dillenia indica

Paspalum distichum

FAUNA:

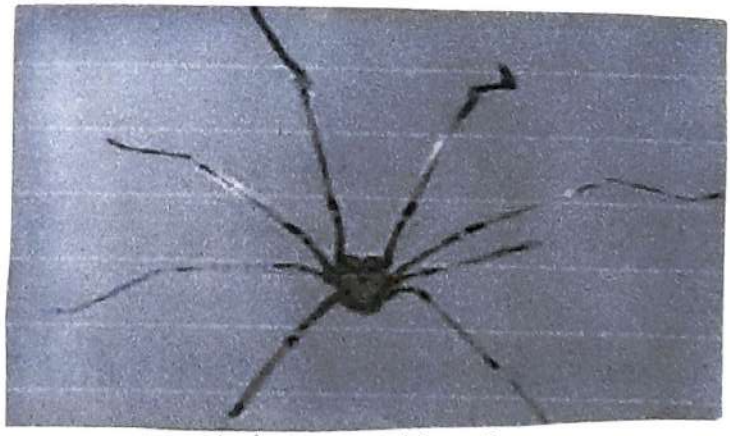
SCIENTIFIC NAME	PHYLUM	TYPE
Heliodiaptomus cinctus	Copepoda	Zooplanktons
Neodiaptomus madrasensis		
Aphis fabae	Arthropoda	Insects
Araneus dehaanii		
Artema atlanta		
Clubiona diassodes		
Crossopriza lyoni		
Nystus ceylonicus		
Oxyopes ratnae		
Bellamya dissimilis	Mollusca	Snails
Pareysia favidens.		



Pareysia favidens

Bellamya dissimilis

Aphis fabae



Artema atlanta

FISHES:

SCIENTIFIC NAME	COMMON NAME	DIET
Catla catla	Catla	Planktonivorous
Labeo rohita	Rohu	
Hilsa ilicha	Hilsa	
Cirrhinus mrigala	Mrigel	Detrivorous
Puntic sauana	Sorputi	
Eutropiichthys murius	Bacha	Omnivorous
Tilapia mossambicus	Tilapia	
Mystus vittatus	Tangra	
Labeo bata	Bata	
Notopterus chitala	Chital	
Ompok pabda	Pabda	Carnivorous/ Predators
Lates calcarifer	Vetki	
Mastacembelus armatus	Baan	

Hilsa ilisha

Labeo rohita

Labeo bata

5. USAGE OF WATER OF GANGES: There are various uses of Ganges water. Some of them are -

- Drinking water: Inhabitants of Kalyani use Ganges water as their only drinking water source after treating it in Kalyani Water Treatment Plant for purification.
- Power plants: Bandel Thermal Power Station (Hooghly), the sole source of electricity of Kalyani uses the river water for various purposes.

Bandel Thermal Power Station

- Industries: Kalyani has a prominent industrial belt which uses ganges water to serve the requirements. The industrial belt includes brick manufacturing factories, wire factories and others.

Brick manufacturing factory.

- The Ganges water is also used for domestic needs, irrigation, etc.
- Several transportations are also conducted via the Ganges.

POTABILITY OF WATER: The water is not fit for consumption without proper filtration and purification because of the presence of various pollutants present. Out of all the pollutants, industrial effluents cause the most destruction.

PROTECTIVE MEASURES: The industries have stated several experiments on the reduction of pollutant discharge directly to the Ganges after several protests of the locals. The residents are very cautious about the ecosystem and to conserve it, various drives are arranged time to time like cleaning of the river bank and vicinity, tree-planting, awareness camps and others.

The land area adjacent to the river bank is flood prone. Sometimes due to excessive rainfall or storms, deep flood conditions are observed which affects many families. Recently due to cyclone Yaash, a major part of the area was affected by flood.

To avoid this condition, some of the measures to be taken:

1. Proper drainage system must be planned. For heavy rainfall additional water drainage system has to be developed.
2. Man-made lakes, ponds must be built to control flood water.
3. Artificial levee can be made of soil, rocks or wood.
4. The sand and alluvium across the river bank must not be removed in excessive amount.

CONCLUSION

For maintaining the river ecosystem stable, the river and the banks must be kept pollutant-free. Being an inhabitant of Kalyani, Ganges is the prime source of water for our needs. Thus, conservation of it is important. For serving this purpose, inhabitants of the town conduct several cleanliness drives and tree-planting drives.

The only way to keep Ganges clean is by awareness. Some of the ways to spread awareness are-

- By celebrating several days dedicated to Nature like Earth Day, World Environment Day, etc.
- To make people aware, several educational camps can be organised where topics such as usage of less toxic substances, proper disposal of wastes, how various species of Nature are dependent on each other can be discussed.
- Inhabitants must check on the litters found on the banks.

I being a resident of Kalyani, am totally dependent on river ecosystem. From drinking water to food and electricity-for every necessary thing Ganges play a vital role in my life. So, to conserve it and its ecosystem is of immense necessity to me.

Scottish Church College

B.Sc. Semester II (Botany Honours)

CU ROLL NO : 203223-11-0131

CU REGISTRATION NO : 223-1213-0625-20

COLLEGE ROLL NO : BOTA20F104

SUBJECT : ENVS PROJECT

DATE : 05.07.2021(Monday)

A VISIT TO LOCAL POLLUTED SITE.

SITE : Mirik lake, Mirik, Darjeeling, West Bengal

DATE : 30th June, 2021.

CONTENTS

INTRODUCTION : POLLUTION AND ITS TYPES.

Pollution is the presence of harmful substances in the environment and these harmful substances are called pollutants. It is the introduction of contaminants into the natural environment that cause an adverse change and negatively affects whole ecology of the system. Pollutants, the components of pollution can be either foreign substances / energies or naturally occuring contaminants.

TYPES OF POLLUTION:-

There are different types of pollution that affect different sections of the environment.

- Air Pollution
- Water Pollution
- Noise Pollution
- Soil Pollution

1. Air Pollution :-

It is the presence of substances in the atmosphere that degrades its quality, damaging the environment. Air pollution is a major threat to human beings and all other living beings' health. Major contributors of air pollution are gases like ammonia, carbon monoxide, sulphur dioxide, nitrous oxide, methane, carbon dioxide and chlorofluorocarbons. Air pollution also causes other threats such as acid rain, global warming, etc.

2. Water Pollution :-

It is the addition of substances into the water bodies that degrades the quality of water. Water pollution is caused by discharges from domestic households, industries, agricultural farms, etc. Major water pollutants include chemicals, heavy metals, fertilizers, unwanted suspended particles, etc

water pollution is linked with many human diseases like typhoid, cholera, hepatitis, cancer, etc. The aquatic life forms and biodiversity is seriously affected by water pollution. Bio-magnification, eutrophication, etc are other consequence of water pollution.

3. Soil Pollution:-

Soil pollution is the contamination of the soil with toxic substances and removal of useful substances. Thus, this leads to decrease in quality of the soil. Soil pollution leads to degradation of soil fertility, water holding capacity, etc. The major causes of soil pollution are agriculture sources, industrial activities and inefficient disposal of waste. Soil pollution affects plants, animals, human and the ecosystem as whole. Decrease in availability of nutrients makes soil inhospitable for the growth of plant life.

The toxic chemicals in the soil can enter both humans and animals body through direct contact or uncleaned foods.

4. Noise Pollution.

Noise pollution is an unwanted and dangerous level of noise created in the environment. There are numerous sources of noise pollution. These includes noise from industry equipments, traffics, construction activities, fire crackers, low flying aircrafts, etc. Noise pollution primarily affects a person's hearing, leading to hearing impairment to even permanent loss of hearing. It causes an increase in blood pressure, hypertension, fatique and cardiovascular diseases. Noise pollution also affects wildlife and marine life. It can cause hearing impairments, changes in behaviour, problems in detecting migration routes, etc.

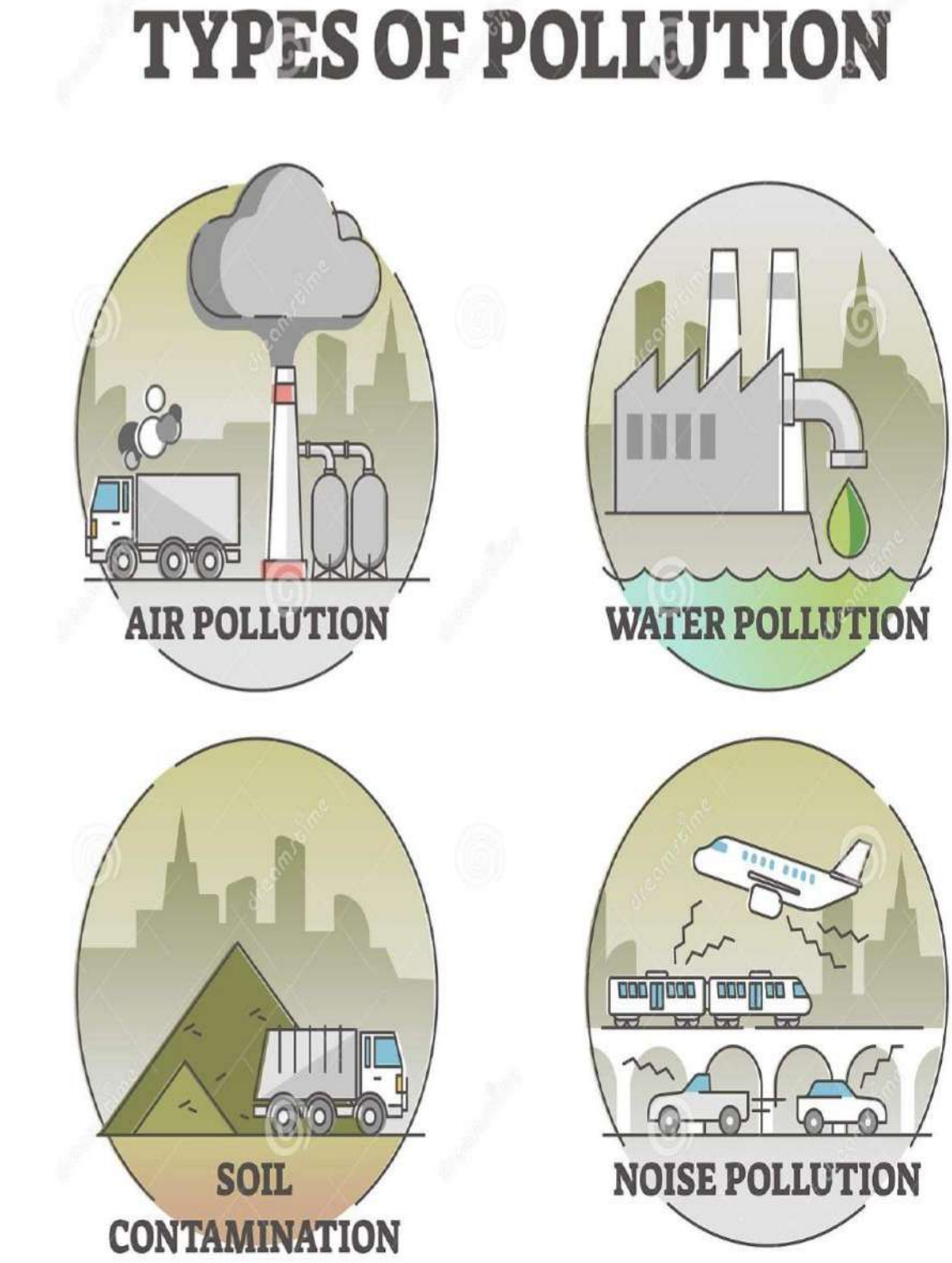


Figure: Major types of Pollution

VENUE: MIRIK LAKE, MIRIK.

DATE: 30th June, 2021.

I visited a famous lake in Mirik and the areas surrounding the lake to analyse the pollution in the site on 30th June, 2021. Mirik is a small town in the district Darjeeling of West Bengal, and an important spot for all tourists visiting Darjeeling.

MIRIK AND MIRIK LAKE : A Brief Introduction:-

Darjeeling is one of beautiful hill stations in India, popularly known by nickname "Queen of Hills" located in northern part of West Bengal. This famous hill station is famous for rich flora, fauna, chilling weather, beautiful tea gardens, magnificent views of snowcapped mountains of Himalayas (especially Kanchenjunga) and historical colonial charms.

One spot among many tourist spots in

Darjeeling is a Mirik town. Mirik is one of the famous hills resort in the Kurseong sub-division of Darjeeling district of West Bengal, at an altitude of 1767 meters. The word Mirik comes from the words 'Mir-Yok' meaning "place burnt by fire". The important attractant of Mirik is its lake, the tea gardens, orange orchards and hilly landscapes of pines and ferns surrounding the lake.

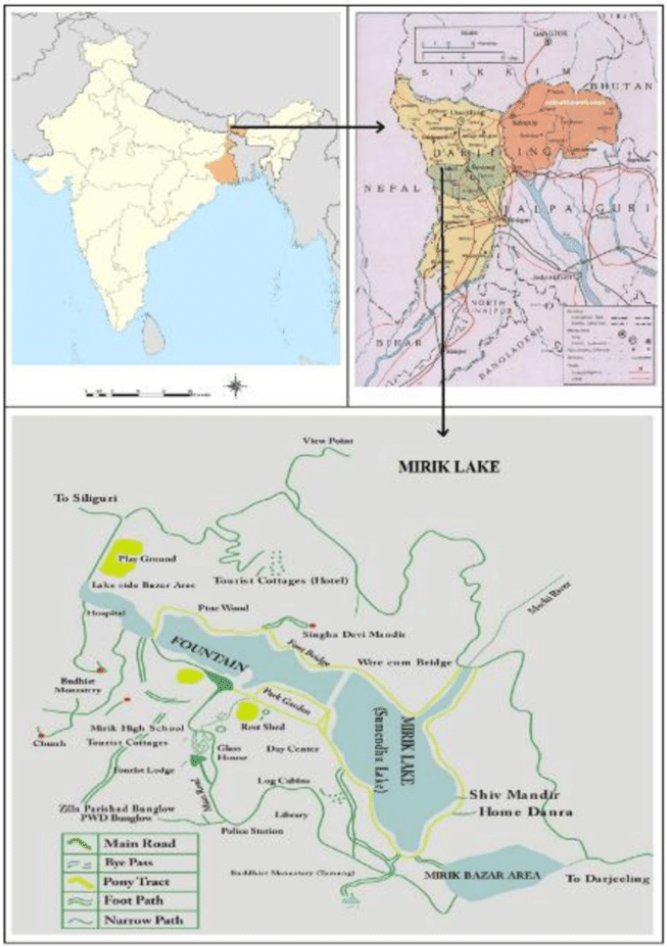
Mirik lake is popularly known as Sumendu lake." Mirik Tourist Project" in the year 1974 proposed the construction of the Mirik lake for the facilitation of commercial tourism. The total lake is about 1.25 km and the peripheral road is about 3.5 km. There is a 20 m long arch foot bridge across the lake called the "Indreni Pull." The depth of the lake varies with seasons and distribution with maximum depth

of 7.92m while minimum of 1.82m. The lake is fed by both perennial streams and rainwater.

Sumendu lake is a pride of the inhabitant among all the famous attractions in the Mirik. With shimmering reflection of the town in the lake, it offers the tourists with refreshing experience of boating and horse ridings with hill chills and surrounding hills and gardens famous for family picnics. It is the most beautiful lake of Darjeeling District where visitors come from different parts of the world.

Figure: View of Mirik Lake.

LOCATION OF MIRIK AND MIRIK LAKE:-



PRESENT SCENARIO :-

The Sumendu lake and garden in Mirik though still continues to be an important tourist spot yet, it do faces several modern challenges owing to environmental problems. Water in the lake and gardens surrounding the lake is severely vulnerable to pollution. The pollution in the area is in every passing year with increasing development and increase in influx of tourists.

While the visit did offer a sense of traditional breath and mountain chills to us and everyone visiting the lake with the beautiful views, yet there are several polluted unattractive site in and around the lake which were clearly noticeable. The area is filled with dumped garbage filths and the water of the lake certainly do not project characteristic of good quality.

POLLUTION IN AND AROUND MIRIK LAKE :-

The pollution in the area can be divided into two types. This includes soil pollution and water pollution.

WATER POLLUTION :-

There is no denial about the quality of the water in the lake being very polluted just by looking at the lake with naked eyes. The colour of the water seemed very turbid and muddy. The water indicated the presence of high quality of silt and other suspended pollutants.

The pollution and degradation of quality of Mirik lake water can be attributed to several factors. The primary source of water pollution in the lake is domestic and sewage disposal from nearby households. The lake provides a convenient place for dumping of the wastes. Also, people living around the lake uses the lake water for several purposes like washing, bathing, etc.

after which the same polluted water is discharged into the lake. It is noted that the local people do not depend on Mirik lake's water for drinking purpose, however 20% of the people rely on Mirik lake's water for household purposes. Eutrophication is also a serious consequence of these discharges.

Mirik lake, being a tourist place, is surrounded by many hotels and restaurants. Due to the large number of tourists inflow in mirik lake region, the demand for tourism and hotel industry has led to the deterioration of the water quality of Mirik lake. These hotels and restaurants uses the lake as area of disposal for all the sewage wastes and discharges. Tourism is an important contributing factor for water pollution. Majority of the tourists

visiting the place also lacks social awareness of pollution. Several tourism activities like boating often cause severe water pollution in lake.

These lack of consciousness among both the residents and tourists has aggravated the water pollution level in the lake.

Also, there are natural causes that contribute to pollution of lake water. Collection of debris from streams located on the upper fringes during rainfall. Deposition of large amount of silts and mud brought by streams makes the water dirty and murky.

These factors have significantly deteriorate the quality of water in the lake. This could trigger off a matter of concern and might cause health problem for local inhabitants who are dependent on lake water for daily uses.

According to local sources, the toxicity of the water of the lake in 2012 was 75%. This is a significant percentage and should be of high concern especially with respect to the aquatic ecology. The bio diversity of aquatic animals and plants are in serious threat due to water pollution. This is highly evident, now that the fishes have started to turn up dead in large numbers in the lake.

The degradation of water quality in the lake can severely impact the tourism of the area. The beauty of the lake is the major attractant for the tourists. With increasing water pollution, the aesthetics of the Mirik is also at stake. This further will directly hamper the socio economic conditions of the residents whose lives directly or indirectly depends on the tourism.

A. Dead Fish in the lake.

B. Quality check by observation.

C. Solid wastes deposits in lake.

D. Leftovers of picnics by lake visitors.

SOIL POLLUTION :-

A short walk from Krishnanagar Road towards the Mirik lake immediately gave us a glimpse of soil pollution in the area. Presence of several spots that are turned into dumping grounds were easily visible. This spots housed huge piles of thrown away of domestic households and restaurants. The area looked ugly and unhygienic.

The area near the water body is filled with solid wastes collected from the streams and deposited at the shores. There are huge piles of dead fishes causing a strong odour at some places. These waste seems to be there for a long time and are usually house cockroachs, mosquito, flies and street dogs feeding on the dirt.

The uphills surrounding the lake is an

important tourist spot for all the visiting people to enjoy picnic and outdoor parties with loud music, bonfire and good foods. But there is severe mismanagement of such activities in the area with every visitors leaving the place dirty with plastic plates, bottles and thrown eateries. There is no regulations and rules in the area in any form and the area lacks presence of any disposal facilities for the visiting people. You can clearly see all the plastics in the all along the hills.

The garden near the lake is a beautiful area with numbers of flowers and plants. This area is also significant for the area as the garden is a venue for all the important events and functions in the Mirik. These events includes fairs, concerts, flower exhibitions, political and publics affairs, etc.

These events brings a lot of crowd in the garden with no proper waste management and regulations. By virtue of which, the area is filled with garbage, plastic bags, posters, holdings, etc which are left there to degrade by natural ways.

A

B

Figure A,B : A common sights of animals feeding on garbages.

C.

D.

E.

F.

Figure C,D,E,F : Solid waste dumping sites found at several spots around the lake.

DISCUSSION :-

Mirik is an important tourist site that requires utmost attention as soon as possible. The degradation of Mirik lake will affect the inflow of tourists in the area and whole North Bengal as well. The preservation of natural beauty of the area is significant as people visits the hills to heal from exhaustions of pollution and hectic city life. They visit hill stations in search of relaxations in the laps of the mountains. The activities such as pollutions has serious effects with minimizing pleasures to visiting people.

Several steps can be taken to mitigate the pollution in the lake. Mirik is a small town. So, tiny steps in the conservation of the aesthetics can bring about an enormous result. Awareness should definately be a primary strategy as the pollution in Mirik is largely due to lack

of consciousness among people, both the locals and the tourists.

The concerned authority should take important steps to analyze the level of pollution and accordingly carry out activities to minimize it. Significant effort should be taken for proper disposal of garbage and solid wastes. Authorities should develop a suitable sewage management system for both households and hotels.

Picnic spots should be taken care and cleaned frequently. laws and regulations should be established for both the vendors and visitors in order to ensure minimal pollution while enjoying picnics and parties. Frequent checks must be carried out to discouraged the law breakers. Sufficient quantity of waste bins should be placed all over the spot for people utilization. Eco friendly products must be promoted as much as

possible.

The organizers of the events should be held responsible for cleaning of gardens both during and after the events. They should frame a proper disposal and management rules to assure the minimal pollution during this events. Activities such as feeding fishes with unhealthy foods, throwing foods along with wrappers should be strongly discouraged.

NGOs can come up with campaigns on regular basis for creating awareness and on ground cleaning of the gardens and lakes. The students of the schools can be involved actively in the process.

As people flocks to hills for betterment of health and pleasure activities, we as a youth must ensure the beauty of the hills is well preserved with our efforts. It is our responsibility as a responsible citizen to take care of the

biodiversity for improving quality of humans, animals and plants lives. We must understand small efforts can go a long way in stabilizing the ecology of an area. Mirik requires immediate attention of all the residents and governing bodies. The pride of Mirik residents, The Mirik lake must not lose its days of charm in any future.

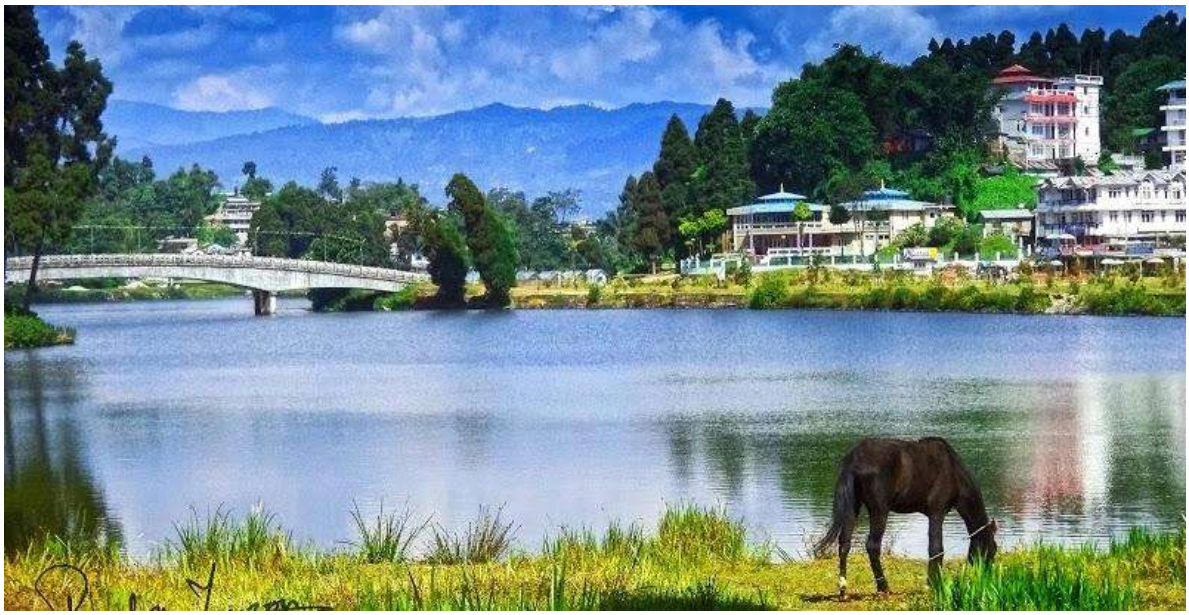


Figure : Beauty of Mirik Lake.

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I express my deep sense of gratitude to the local residents around the lake for their time and selfless cooperation. Without them, this project would not be possible.

Lastly, my special thanks and love to my parents for always being there for me through every path of my life.

ENVS Assignment

Scottish Church College

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223-1112-0373-20

CU Roll No-
203223-21-0166

College Roll No-

BOTA20M098

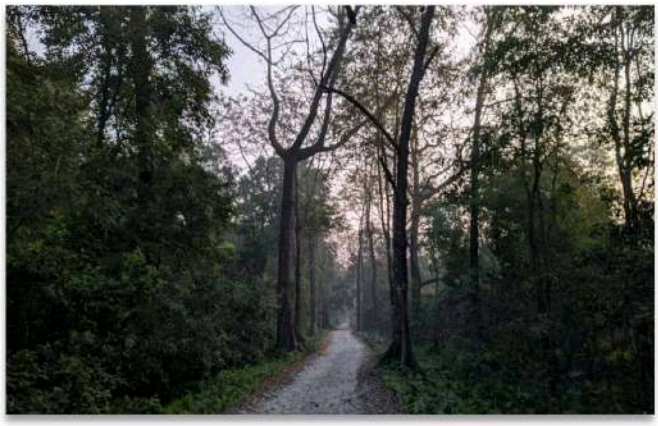
Study of Deforestation: Causes & Sollutions

CU ROLL NO- 203223210166

CU REG. NO- 2231112037320

Forest Resources

Forest is an area that is set aside for the production of timber and the forest produce that we are maintained under woody vegetation for certain indirect benefits. (climate or protective) which it provides.



Manas National Park, Assam, IN

The word `forest' is derived from the Latin word "foris" meaning outside. The reference being is a village boundary and it must have included all uncultivated and unhabited land. As per report of **Survey of India:** central and southern Indian states, while northeastern states witnessed a net loss in **forest cover** over 2010 to 2012. In 2018, the total **forest** and tree cover in **India** increased to 24.39% or 8,02,088 km. It increased further to 24.56 percent or 807,276 square kilometers in 2019. Unless India makes major, rapid and sustained effort to expand electricity generation and power plants, the rural and urban poor in India will continue to meet their energy needs through unsustainable destruction of forests and fuel wood consumption.

CLASS	AREA (SQ KM)	GRAPHICAL AREA PERCENTAGE
Very Dense Forest	99,278	3.02
Moderately Dense Forest	3,08,472	9.39
Total Forest Cover	7,12,249	21.67
Scrub	46,297	1.41
Open Forest	3,04,499	9.26
Non Forest	25,28,923	76.92
Total Graphical Area	**32,87,469**	100.00

Source: Forest Survey of India, Dehradun. State of Forest Report (2019). Volume 1.

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Importance of Forest

(i)Protective Function: Forests preserve the physical features of the earth, check soil erosion, prevent flood and drought.

(ii)Productive Function: Forest meet the need of timber, fuel, bamboo, gums, resins, dyes, tans and medicinal drugs.

(iii)Conservational Function: Forests provide shelter or the wild-life and help to maintain the ecological balance of nature.

(iv)Recreational Function: Recreational function of forest is important for human being.

DEFORESTATION

Deforestation is the purposeful clearing of forested land. Throughout history and into modern times, forests have been razed to make space for agriculture and animal grazing, and to obtain wood for fuel, manufacturing, and construction.

Deforestation has greatly altered landscapes around the world. About 2,000 years ago, 80 percent of Western Europe was forested; today the figure is 34 percent. In North America, about half of the forests in the eastern part of the continent were cut down from the 1600s to the 1870s for timber and agriculture. China has lost great expanses of its forests over the past 4,000 years and now just over 20 percent of it is forested. Much of Earth's farmland was once forests.

Today, the greatest amount of deforestation is occurring in tropical rainforests, aided by extensive road construction into regions that were once almost inaccessible. Building or upgrading roads into forests makes them more accessible for exploitation. Slash-and-burn agriculture is a big contributor to deforestation in the tropics tree plantations.

Source: Google

with this agricultural method, farmers burn large swaths of forest, allowing the ash to fertilize the land for crops. The land is only fertile for a few years, however, after which the farmers move on to repeat the process elsewhere. Tropical forests are also cleared to make way for logging, cattle ranching, and oil palm and rubber tree plantations.

Causes of Deforestation:

There is no single factor that is responsible for deforestation. Rather, it's a combination of forces that are devastating it.

1. **Encroachment of Forest Land or Agricultural Purposes:** The conversion of forests into agricultural plantations is a major cause of deforestation. The increase in global demand for commodities, such as palm oil and soybeans, are driving industrial-scale producers to clear forests at an alarming rate. Indonesia, the largest producer of palm oil, was named the "Fastest Forest Destroyer," in the 2008 Guinness World Records. Even when efforts are made to replenish barren plantations, the depleted soil is not able to produce the same biodiversity it once was.

Ex:1. Agricultural Deforestation, Source: Google

Ex:2. Agricultural Deforestation, Source: Google

2. **Livestock Ranching**: Forest clearing for livestock ranching is another contributor to deforestation. Since 1990, Brazil, a top exporter of beef, has lost an area of forest that is three-fourths the size of Texas. A strong global demand for beef, supported by governments such as in Brazil, is expanding this kind of deforestation.

3. **Logging:** Logging, including illegal logging, is a driver of deforestation. In Indonesia, illegal logging operations provide short-term income for people living on less than $1 a day. However, it destroys the livelihoods of those who depend on the forest. Indonesia is one of the largest exporters of timber, with about 80 percent of it being exported illegally. It is estimated that organized criminals get between $10-15 billion dollars from illegal logging per year.

Logging, Source: Google

4. **Infrastructure Expansion:** Road construction can lead to deforestation by providing an entryway to previously remote land. The 5,404-km Interoceanic Highway, which runs from Brazil to Peru, is a concern for conservationists as the road cuts a strip through the biodiverse Amazon rainforest. The road expansions often lead to logging and illegal logging, where opportunists slash down trees without permission from authorities. The cleared land then attracts an influx of settlers and disturbs the peace that once reigned in small villages.

DEFORESTATION PRESSURE

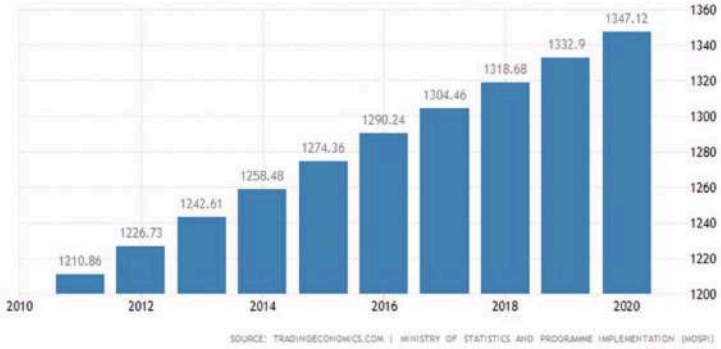
Primary cause of forest loss and/or severe degradation | Important secondary cause of forest loss and/or severe degradation | Less important cause of forest loss and/ or severe degradation | Not a cause of forest loss and/or severe degradation

	Livestock	Large-scale agriculture	Small-scale agriculture & colonization	Unsustainable logging	Pulp plantations	Fires	Charcoal and fuelwood	Mining	Infrastructure	Hydroelectric power
Amazon	Primary	Primary	Primary	Less important		Important		Important	Primary	Primary
Atlantic Forest/ Gran Chaco	Primary	Primary		Important	Important	Important	Important	Important	Primary	Less important
Borneo		Primary	Important	Important	Important	Important		Important	Less important	Important
Cerrado	Primary	Primary					Less important	Less important	Important	Less important
Chocó-Darién	Primary	Primary	Primary	Important				Primary	Primary	
Congo Basin	Less important	Important	Primary	Important			Important	Important	Important	
East Africa	Primary	Less important	Primary	Important		Primary	Primary	Important	Important	
Eastern Australia	Primary		Less important	Important				Less important		
Greater Mekong		Primary	Important	Important	Important		Less important		Less important	Less important
New Guinea		Primary	Important	Important	Less important	Less important				
Sumatra		Less important	Primary	Important	Important	Important			Primary	

Table 2: Summary of main pressures on forests in different deforestation fronts

5. **Overpopulation:** Our planet once housed an estimated maximum of 15 million people in prehistory. It now sustains a whopping 7 billion and counting. With overpopulation, there is an increase in global needs and wants, leading to expansion and deforestation. The planet's forests are being devastated at an even rate with population growth.

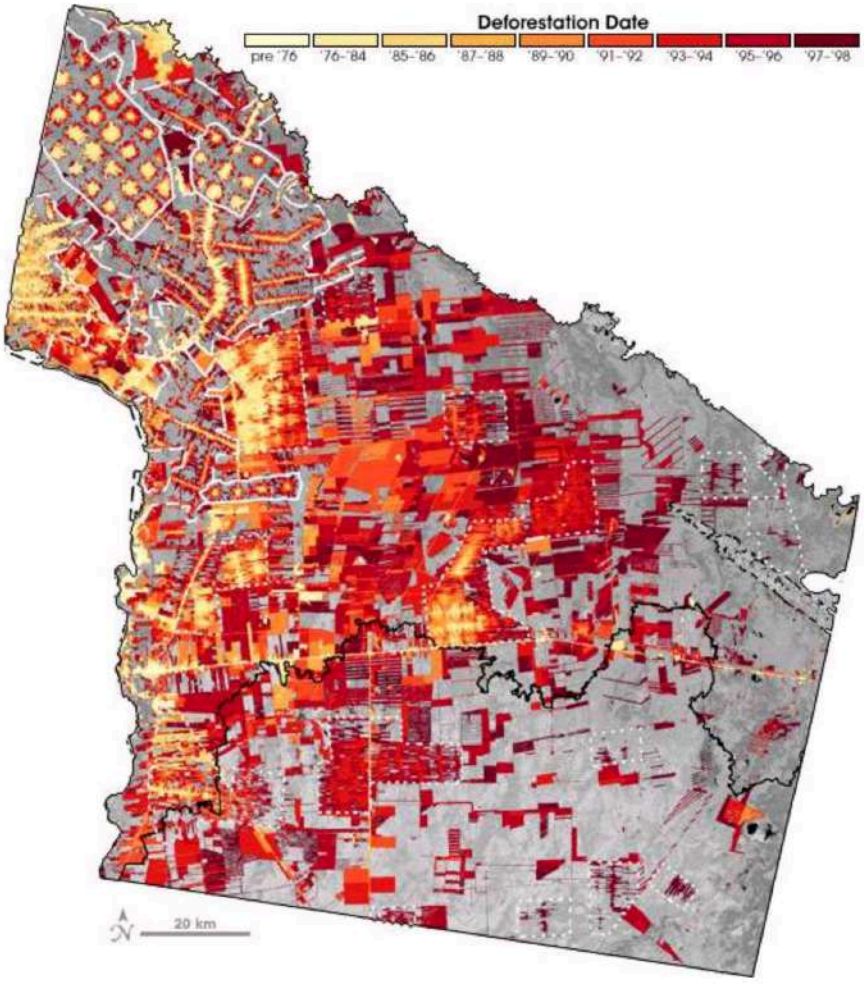
Every year at an average the population is growing by 17 million in India. Out of six people in the world one is Indian. More people mean more population of the environment. Therefore, the entire ecosystem is under stress.



Tropical Deforestation:

NASA remote-sensing technology has become the backbone of worldwide efforts to quickly, routinely, and reliably assess trends in tropical deforestation. Since the 1970s, the Landsat series of satellites has provided high-resolution imagery (resolution means "level of detail") of changes in tropical forests over time. The most comprehensive use of Landsat data to map tropical deforestation has been NASA's Landsat Pathfinder Humid Tropical Deforestation Project, a collaborative effort among scientists from the University of Maryland, the University of New Hampshire, and NASA's Goddard Space Flight Center. The project yielded deforestation maps for the Amazon Basin, Central Africa, and Southeast Asia for three periods in the 1970s, 1980s, and 1990s. Agencies and scientists across the globe continue to use Landsat data to monitor deforestation and to enforce environmental policies. For example, in 2003, the state of Mato Grosso, Brazil, piloted a successful timber licensing system in which property maps were combined with Landsat images to routinely document and issue fines for clearing that exceeded legally licensed limits. As part of a USAID (United States Agency for International Development) initiative called the Central African Regional Program for the Environment, scientists are drawing on experience from the Pathfinder project to improve methods for

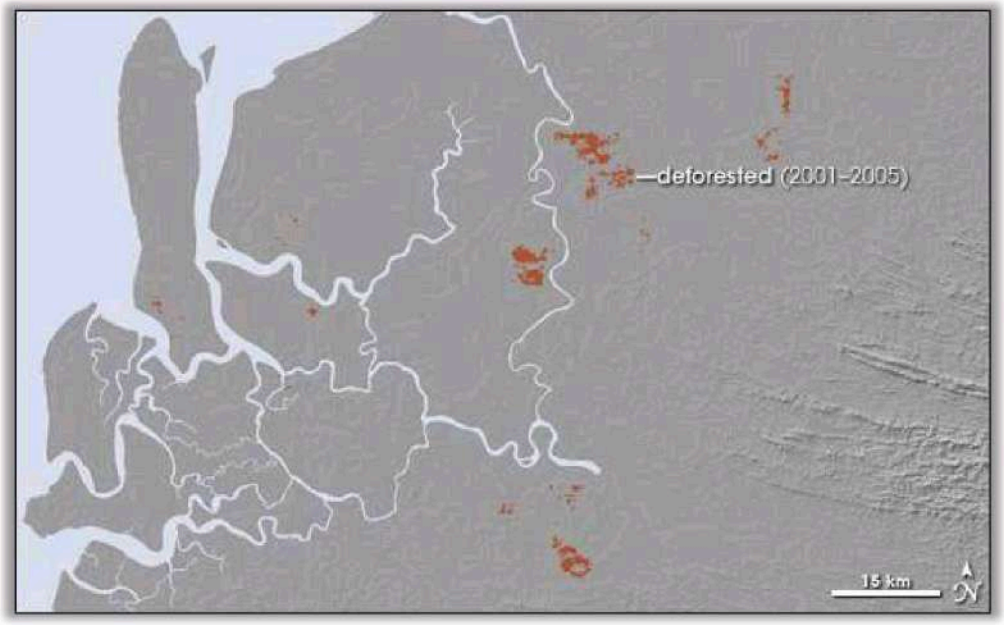
detecting deforestation and degradation in the Congo Basin. The initiative is producing new decadal forest change maps using Landsat data from the 1990s through 2005.



Source: NASA Earth Observatory.

High-resolution sensors such as Landsat, ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) and ALI (the Advanced Land Imager) provide a detailed picture of deforestation, but the detail comes at a price. The greater the surface detail a sensor can observe, the smaller the area it can view in a single image. This tradeoff between detail and coverage makes high-resolution sensors less suitable for routine deforestation mapping on a global scale. In addition to the problem of spatial coverage, high-resolution data generates large data files that require significant computer and internet resources to analyze, to combine into regional or global-scale maps, and to distribute to scientists and agencies that need them. Scientists at the University of Maryland have used MODIS data to develop an annual set of images showing where human-caused changed in vegetation—including deforestation and burning—have occurred in the previous year. The team refers to the product as an "alarm" product, which can draw

researchers' or natural resource managers' attention to areas undergoing rapid change. By combining the large-scale coverage of the MODIS change-detection "alarm" maps with the more detailed Landsat and ASTER images, scientists are developing automated forest-monitoring systems that can rapidly detect tropical deforestation.



Source: National Geographic

Deforestation Impacts:

However, deforestation incurs consequences as is widely known. India has witnessed flooding on a catastrophic scale in multiple instances in recent years, as was seen last year in Mumbai and the year before in Kerala. In addition to the heavy rainfall, deforestation contributes in part to the heightened damage as forest water retention is significantly higher than that of farmland. Food supply disruptions can also be a ramification because, as the article notes, "most of the area that has undergone deforestation is actually unsuitable for long-term agricultural use such as ranching and farming. Once deprived of their forest cover, the lands rapidly degrade in quality, losing their fertility and arability. The soil in many deforested areas is [sic] also unsuitable for supporting annual crops. Much of the grassy areas are also not as productive compared to more arable soils and are therefore not fit for long-term cattle grazing."

In addition, it notes, deforestation can adversely affect soil quality as "heavy rainfall and high sunlight quickly damage the topsoil in clearings of the tropical rain forests. In such [a] circumstance, the forest will take

much longer to regenerate and the land will not be suitable for agricultural use for quite some time."

Scenes of flooding in Mumbai. Image credit: News Measurements Network Live from New Delhi, IN

Loss of biodiversity is another consequence. This is especially true in the case of the Western Ghats. As an article published in *The Conversation* noted, "the mountains are teeming with life. Though they cover only a small part of India's total land area, the Ghats are home to more than thirty percent of the country's species of plants, fish, reptiles, birds and mammals, including both wild elephants and tigers. Its combination of unique species and habitat loss means UNESCO has recognized it as one of eight global "hottest hotspots" of biodiversity." Deforestation is a major threat to the Western Ghats retaining this status.

A view of the Western Ghats.

The impact of deforestation on public health may appear, on the surface, rudimentary. However, as *Health Issues India* has previously reported, "rates of zoonotic diseases – those spread by animals – have shown a correlation with those living in areas close to fragmented forests." That article spotlighted trends in countries such as the Democratic Republic of the Congo and the United States, where a link has been identified between deforestation and rates of diseases such as Lyme disease and Ebola, respectively.

India is not immune to this trend. As *Health Issues India* noted, "across the Western Ghats, deforestation is giving rise to higher rates of Kyasanur forest disease (KFD)...experts found through satellite imagery that areas prone to outbreaks coincided with those that were currently witnessing deforestation. This deforestation typically meant that human activity in the area increased, often bringing farm animals which could also potentially harbor the ticks."

Historical Movements:

- **CHIPKO MOVEMENT:** The Chipko Movement is the most well-known people movement in respect of environmental protection in India. It is a movement of those people who are living in and around. The forest that sustain their lives. The destruction of forests for the survival of the local people through commercial forestry created. The Chipko Movement first in the Himalayan area of U.P. Then the movement gradually spread to other mountain areas such as the Western Ghats, the Aravallis and the Vindhyas.

  Villagers have created an effective non-violent way to stop the devastation of forest by the industries. When the axeman come to the people, mainly the woman form circles around the trees-they embrace the trees. This have given the movement its name "Chipko Andolan".

Chipko Movement, Source: Google

  The movement was initiated for the protection of forest in India at the end of the year 1960. The main objective of the movement, how ever was to ensure survival of the tribal people. Notable among this movements are those of the people of the Singhbhum and the Baster regions. Later on Sundarlal Bahuguna joined in this

movements. These movements have sought to convert mixed natural forests into monoculture of commercial species like teak or tropical pine. It is because this process of conversion that leads to the destruction of the material base for the survival of a large portion of the tribal people. The movement was so intensified that P.M. of India declared that a single tree would not be touched for the next 15 years.

- **SILENT VALLEY MOVEMENT:** Silent valley is densely forested valley that is situated in Palghat district of North Kerala. The name is given as "Silent Valley" as the forest is very deep, dark & extremely peaceful. The river Kunithpara which is not navigable is flowing across this valley from north to south. The stage of government planned a dam along the slopes of the river. A British technical expert opined that hydroelectricity could be easily granted from his following stream and the Planning Commission approved the proposal.
  Later on, in 1976, a task force headed by the vice president of W.W.E (World Wildlife Fund) in their report advised not to implement the project. They advised that if the project was implemented then, it would cause ecological disbalance in that region.
  The popular sciences organization of Kerala (Kerala Shastra Sahitya Parishad, KSSP), started a movement to stop the project. They want for mass signature campaign. The resolution of the project was accepted in the assembly. KSSP wrote a book vehemently oppose the project. They forced the govt. to postpone the Moraji Desai, then the prime minister of India also supported the project along with the state govt. But many environmentalists like Salim Ali of IUCN rallied and protested against its implementation.
  Ultimately in December, 1980 the Kerala govt announced to rejected the project. The Silent Valley was declared as a National Park.

Source: silentvalley.gov.in

Solutions:

Solutions are needed. "There is an urgent need to focus on the mitigative measures in order to prevent the distressing effects of deforestation in the near future," read a paper published last year. "In order to alleviate the problem of deforestation, the strategies should be based on the underlying causes of the same. Also, the strategies for mitigating the problem of deforestation require its effective implementation that needs the recognition of the roles of national, state and municipal governments along with the pro-active role of the civil society and private society." It outlined a number of examples, whilst underscoring why such measures are imperative.

- ✓ **Tree Plantation:** Planting a tree is just like taking a step towards saving one life. Planting a tree is one of the best *deforestation solutions*. Every year for several uses, we cut the trees from especially forest areas. We don't even think of planting one instead. We become blind to fulfilling our instant needs and do not think for even a single second that will impact the near future. A tree means a lot to us. It provides us oxygen, fruits, and so many essential things for a living, not only that it absorbs carbon dioxide. It also prevents soil erosion, and the water cycle is also maintained. It also decreases global warming. Not only that, but animals also depend on a tree for shelter, they live in forests and depend on food and oxygen. It provides us a vast amount of oxygen for forest areas, and it is also responsible for rain. Now there are many articles available on the internet which will tell you all these. Still, in this article, I want to provide the readers with the causes of deforestation, but I will also tell all the fellow readers about the solution. Shortly, may a day come when there is a lack of food, oxygen, and shelter for animals that day, we all will understand the importance of a tree? And for which billion people will suffer. It's enough now; we should be concerned about this because it is a serious topic, and from today we should start planting a tree instead of cutting it down to fulfill our temporary needs.

✓ **Reduce Consumption of Paper:** In a year, a huge number of trees are cut down for commercial uses just, for example, making of paper? Lots of trees are cut down from the forest area and hence causes deforestation. We all know, but still, we go on using papers in a huge amount. Do you ever imagine that if the trees are cut down in a huge number, then one day, no tree will be left? Think it over and mark my words if we have not become serious and use some alternative instead of papers. Then, there will take a day soon on Earth when there will be no single tree left. Alternatives like using digital writings in MS Word is a good option. It will save many papers and, hence, save a huge number of trees years after years. Online examinations should also be a good idea because too much paper must conduct a single examination in schools and colleges. In this way, we should think and implement our ideas in this sector to reduce paper consumption. So reducing the consumption of paper is another and one of the best deforestation solutions.

✓ **Use Biodegradable Products:** Using biodegradable products is the best alternative and one of the best deforestation solutions. Biodegradable products are easily decomposed with the environment and also it can be recycled. Hence using biodegradable products results in less environmental pollution. After use, Biodegradable products can be easily recycled, and the waste can fill the compost heaps. This compost can further be used as manure or fertilizer for plants. While on the other hand, using non-biodegradable products not only harm Mother Nature but also harms the animals and us too. Non-biodegrade products like plastics and petroleum are very harmful and don't get

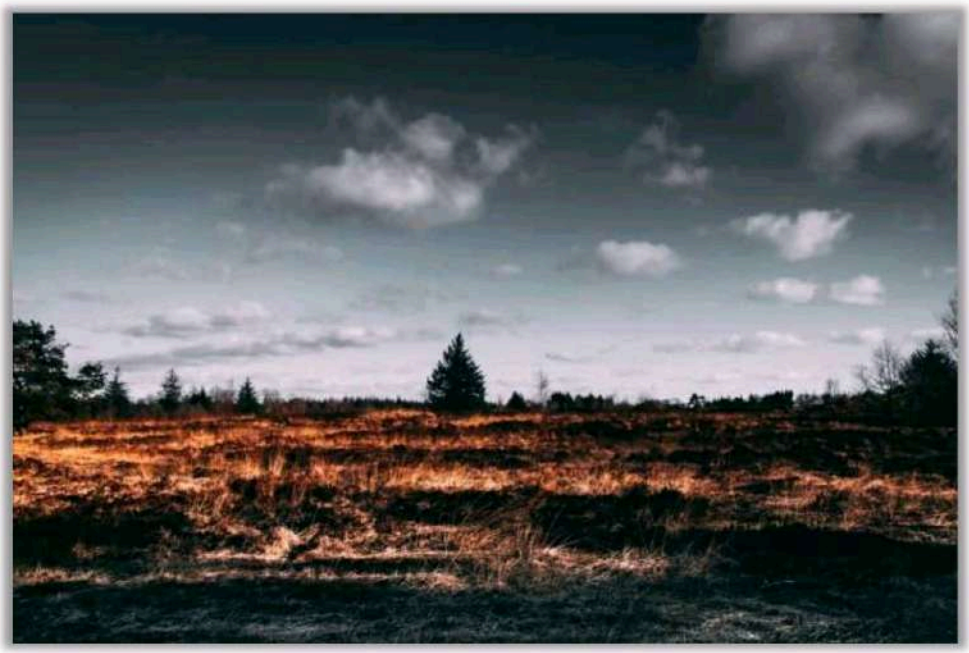
contaminated with the soil. It also spread many diseases later on. We all should know it and stop using plastics. Instead of plastics, we should use bags that comprise paper or jute. Bags that are made up of paper easily break down and decompose with the soil or be easily recycled. And bags which are made up of jute can be used repeatedly. Jute bags and paper bags are very nature-friendly. These types of materials can be used repetitively. We should be aware of the shops in our locality and request them to use paper bags instead of plastics bags. And here comes the terms reuse and recycle of products, which we will discuss in our next point.

- ✓ **Recycle & Reuse:** Recycling & reusing products is a smart way of using that product. Products which are made up of paper or wood, that products should be used in a repetitive manner or it can be used differently. We all should think differently but conclude that we all have to recycle or reuse the products as much as we can. For example, paper bags can be recycled and can be made other things made up of paper. We all should become more concerned about it and hence start a new recycling method in which every person in your locality should participate and come up with their own innovative ideas. Educating others is a good solution too. Many people don't know the harmfulness of plastics and use it and threw it here and there. First, we should give them a basic education about the disadvantages of using plastic and petroleum products and understand the advantages of using paper products that can be easily recycled and reused. Hence, we can consider recycling & reusing products is also one of the best deforestation solutions.

- ✓ **Strict Laws and Regulation:** Not everyone will listen to those who are concerned about deforestation and understand how serious it is. For such irresponsible people, we should start some strict laws and regulations. We should start appealing to the higher authorities for making more strict laws. We should appeal to pass some laws regarding fines. A huge fine will be charged if anyone cuts the trees, especially in the forest areas, without higher authorities' permission. If some laws are abiding this deforestation, everyone should respect this important issue. And if someone breaks the law, they will be punished and charged a huge amount of fine. Now that will make sense and increase the people's concerns and decrease the rate of deforestation. Introducing strict laws and regulation is one of the ultimate and best deforestation solutions.

- ✓ **Raise Awareness Programs:** We all should involve ourselves in social awareness programs and spread awareness in our locality. Not only that, we should spread awareness to people by social media posts. Aware more and more people through your post. You can also draw attention to the people by posting pictures and videos regarding deforestation. If possible, we can arrange some programs in our locality. We can invite some socialist or activists who can explain and make everyone understand the importance of planting more trees instead of cutting them down. Further, we can arrange a tree plantation program and request to take part in it and plant a tree. We can also make some posters and use them as hoarding on the roadside. We should start distributing leaflets and newspapers daily, which is also a step regarding waking people in a huge number. In the beginning, the message may be ignored, but when they receive messages regularly, some people may try to understand its purpose. Raising awareness programs is also smart and efficient, and one of the best deforestation solutions among the rest.

✓ **Help to Re-stored Degraded Forest:** From my perspective, restoring degraded forests is the most important and one of the best deforestation solutions. There are many forest areas which are already degraded. We should start restoring those forest areas by planting more and more trees. First, we should start searching for those degraded forest areas; then, we should plan after taking permission from the forest authorities. After planning how much land is fertile and how much is unfertile. We first make the entire land fertile using manures like cow dungs. After that, we should start planting trees and involving more people from your locality and friends. Then we should water the trees, if possible, regularly at the beginning. So restoring degraded forest is one of the best deforestation solutions. If deforestation is not stopped immediately and continued at such a high rate, then after 25 years hence, it can be expected that around half of the world's species of plants and animals will be surely extinct or severely threatened. While concluding the article, I want to remind again that mother earth has enough for our needs but not for our greed. We must try to understand it. So in this post is a curated list of the 10 best solutions for deforestation. If you know any better solution, please let us know through comments.



✓ **Support Organization:** There are many organizations those who are involved in saving the forest areas. Please support them by standing beside them and spreading their message to everyone. Many organizations like Amazon Watch, Conservation International, Forest Stewardship Council Canada (FSC), Rainforest Action Network (RAN), Rainforest Alliance, and Trees for the Future, and so on are some organizations that help prevent

deforestation. We should support them by helping them in restoring forests by planting trees. We can also take a stand when you see an illegal clearing of trees, especially in the forest areas, informing them or the forest department or higher authorities. We can also write some social media posts regarding those organizations, especially mentioning their aim in the quotation so that those unaware of those organizations will get to know them. So, supporting organizations who are fighting deforestation is also one of the best deforestation solutions.

Acknowledgement

I am really really grateful to my Professor Mr. Nilanjan Chakraborty) for advising me and introducing the project to me in a easy way to understand which has helped me complete my project and effectively on time.
I am thankful to our Principal Mrs. Madhumanjari Mandal for giving me an opportunity to work on this project which has provided me with valuable information about the different aspects of Deforestation.

Thank You.

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SEM – II

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I am thankful to our Principal Dr. Madhumanjari Mandal for giving me an opportunity to work on this project which has provided me with valuable information about the different aspects of WETLAND ECOSYSTEM in our life.

Thank you.

STUDY ON WETLAND ECOSYSTEM OF TEESTA RIVER

INTRODUCTION

The ecosystem is the structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words, an ecosystem is a chain of interaction between organisms and their environment. The term “Ecosystem” was first coined by **A.G.Tansly**, an English botanist, in 1935.

Types of Ecosystem

An ecosystem can be as small as an oasis in a desert, or as big as an ocean, spanning thousands of miles. There are two types of ecosystem:

- Terrestrial Ecosystem
- Aquatic Ecosystem

In this project a unique type of terrestrial ecosystem will be discussed which is named as WETLAND ECOSYSTEM.

WETLAND ECOSYSTEM

A **wetland** is a distinct **ecosystem** that is **flooded** by water, either permanently or seasonally, where oxygen-free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic **vegetation** of **aquatic plants**, adapted to the unique **hydric soil**. Wetlands play a number of functions, including water purification, water storage, processing of carbon and other nutrients, stabilization of shorelines, and support of plants and animals. Wetlands are also considered the most **biologically diverse** of all ecosystems, serving as home to a wide range of plant and animal life. Whether any individual wetland performs these functions, and the degree to which it performs them, depends on characteristics of that wetland and the lands and waters near it. Methods for rapidly assessing these functions, wetland **ecological health**, and general wetland condition have been developed in many regions and have contributed to **wetland conservation** partly by raising public awareness of the functions and the **ecosystem services** some wetlands provide.

Ecology & Characteristics

The most important factor producing wetlands is **flooding**. The duration of flooding or prolonged soil saturation by **groundwater** determines whether the resulting wetland has aquatic, **marsh** or **swamp** **vegetation**. Other important factors include fertility, natural disturbance, competition, herbivory, burial and salinity. When **peat** accumulates, **bogs** and **fens** arise.

Wetlands vary widely due to local and regional differences in **topography**, **hydrology**, **vegetation**, and other factors, including human involvement.

BIOTA OF WETLAND

The **biota** of a wetland system includes its flora and fauna. The most important factor affecting the biota is the duration of flooding. Other important factors include fertility and salinity. In **fens** (a type of wetland), species are highly dependent on water chemistry. The chemistry of water flowing into wetlands depends on the source of water and the geological material in which it flows through.

Flora

- Submerged
- Floating
- Trees
- Shrubs
- Planktons

Fauna

Fish are more dependent on wetland ecosystems than any other type of habitat. **Amphibians** such as **frogs** need both terrestrial and aquatic habitats in which to reproduce and feed. **Reptiles** such as **alligators** and **crocodiles** are common in wetlands of some regions. **Birds**, particularly **waterflow** and **wading birds**, use wetlands extensively. Wetlands attract many **mammals** due to abundant seeds, berries, and other vegetation components, as well as abundant populations of prey such as invertebrates, small reptiles and amphibians. **Insects** and **invertebrates** total more than half of the 100,000 known animal species in wetlands

CLIMATE OF WETLAND

Temperature

Because wetlands are indicative of the amount of water in soil, they are found all throughout the world in different climates .Temperatures vary greatly depending on the location of the wetland. Many of the world's wetlands are in **temperate zones**, midway between the North or South Pole and the equator. In these zones, summers are warm and winters are cold, but temperatures are not extreme. In a subtropical zone wetland, such as one along the **Gulf of Mexico**, a typical temperature might be 11 °C (52 °F). Wetlands in the tropics are much warmer for a larger portion of the year. Wetlands on the **Arabian Peninsula** can reach temperatures exceeding 50 °C (122 °F) and would therefore be subject to rapid evaporation. In northeastern **Siberia**, which has a polar climate, wetland temperatures can be as low as −50 °C (−58 °F). **Peatlands** insulate the **permafrost** in subarctic regions, thus delaying or preventing thawing of **permafrost** during summer, as well as inducing the formation of **permafrost**.

Precipitation

The amount of precipitation a wetland receives varies widely according to its area. Wetlands in **Wales**, **Scotland**, and western **Ireland** typically receive about 1,500 mm (59 in) per year. In some places in **Southeast Asia**, where heavy rains occur, they can receive up to 10,000 mm (390 in). In some drier regions, wetlands exist where as little as 180 mm (7.1 in) precipitation occurs each year

USES OF WETLANDS

Wetlands occur naturally on every continent. The water in wetlands is either **freshwater**, **brackish**, or **saltwater**. The main wetland types are **swamp**, **marsh**, **bog**, and **fen**; sub-types include **mangrove forest**, **carr**, **pocosin**, **floodplains**, **mire**, **vernal pool**, **sink**, and many others. Many **peatlands** are wetlands. Wetlands can be **tidal** (inundated by tides) or non-tidal. The largest wetlands include the **Amazon River basin**, the **West Siberian Plain**, the **Pantanal** in South America and the **Sundarbans** in the **Ganges-Brahmaputra** delta. A **bay gall** is another type of wetland found in the forest of the Gulf Coast states in the USA.

Depending partly on a wetland's geographic and topographic location, the functions it performs can support multiple **ecosystem services**, values, or benefits. **United Nations Millennium Ecosystem Assessment** and **Ramsar Convention** described wetlands as a whole to be of **biosphere** significance and societal importance in the following areas, for example:

- **Water storage (flood control)**
- **Groundwater replenishment**
- **Shoreline stabilization and storm protection**
- **Water purification**
- **Wastewater treatment (in constructed wetlands)**
- **Reservoirs of biodiversity**
- **Pollination**
- **Wetland products**
- **Cultural values**
- **Recreation and tourism**
- **Climate change mitigation and adaptation**

DATE AND TIME OF VISIT AT TEESTA WETLAND

For the detailed study of my project I have visited the **TEESTA WETLAND** which is in **Jalpaiguri**, nearby my locality, on **23rd June**, 2021, **Wednesday** around 12:00 p.m. in the noon. The temperature was around **32 degree Celsius**. I also have gathered few **information** from the people in the **neighborhood**. It helped in better understanding of my project.

In the upcoming slides I am going to present all the information that I have gathered about **TEESTA WETLAND**.

TEESTA WETLAND

Teesta River is a 315 km (196 mi) long river that rises in the eastern **Himalayas**, flows through the **Indian states** of **Sikkim** and **West Bengal** through **Bangladesh** and enters the **Bay of Bengal**. It drains an area of 12,370 km^2 (4,780 sq mi). In **India**, it flows through **North Sikkim**, **East Sikkim**, **Kalimpong district**, **Darjeeling District**, **Jalpaiguri District**, **Cooch Behar districts** and the cities of **Rangpo**, **Jalpaiguri** and **Mekhliganj**. It joins the **Jamuna River** at **Fulchhari** in Bangladesh.

During **rainy seasons** the flow of **Teesta River** increases and the water level rises **up-till the banks** of the river at Jalpaiguri. Due to the overflow, **small** and **scattered** wetlands are formed at the banks (but these are **not permanent**) , as a result a wide range of vegetation (**Flora**) is seen. These provide with a lot of food resources enough to sustain the **consumers**. Hence, an **ecosystem is formed**.

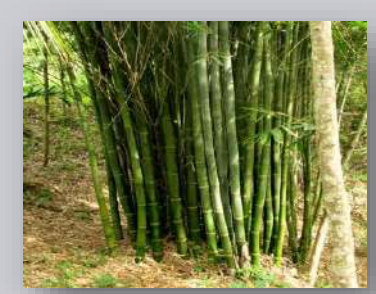

FLORA

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Common water hyacinth	*Eichhornia crassipes*	Pontederiaceae
	Taro	*Colocasia* sp.	Araceae
	Lotus	*Nelumbo nucifera*	Nelumbonaceae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Banana	*Musa acuminata*	Musaceae
	Ferns	*Dryopteris* sp.	Dryopteridaceae
	Golden Beardgrass	*Chrysopogon aciculatus*	Poaceae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Eucalyptus	*Eucalyptus* sp.	Myrtaceae
	Carpet Grass	*Stenotaphrum secundatum*	Poaceae
	Congress Grass Or, Parthenium	*Parthenium hysterophorus*	Asteraceae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Potato plant	*Solanum tuberosum*	Solanaceae
	Pumpkin plant	*Cucurbita moschata*	Cucurbitaceae
	Bottle gourd plant	*Lagenaria siceraria*	Cucurbitaceae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Onion plants	*Allium cepa*	Amaryllidaceae
	Water clover	*Marsilea* sp.	Marsileaceae
	Bamboo	*Bambusa* sp.	Poaceae

FAUNA

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	**Earth-worms**	***Lumbricus terrestris***	**Lumbricidae**
	**Mosquito**	***Anopheles*** sp.	**Culicidae**
	**Bettle**	***Megasoma*** sp.	**Scarabaeidae**

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Indian pipistrelle bat	*Pipistrellus coromandra*	Vespertilionidae
	Indian rat snake	*Ptyas mucosa*	Colubridae
	Indian greynecked crow	*Corvus splendens*	Corvidae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Rohu	*Labeo rohita*	Cypirinidae
	Catla	*Catla catla*	Cypirinidae
	Boroli	*Barilius barila*	Cypirinidae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Asian koel	*Eudynamys scolopaceus*	Cuculidae
	Ring-necked parakeet	*Psittacula krameri*	Psittaculidae
	Common myna	*Acridotheres tristis*	Sturnidae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Honey bee	*Apis dorsata*	Apidae
	Common tiger butterfly	*Danaus genutia*	Nymphalidae
	Cow	*Bos taurus*	Bovidae

PICTURE	COMMON NAME	SCIENTIFIC NAME	FAMILY
	Pig	*Sus*	Suidae
	Water buffalo	*Bubalus bubalis*	Bovidae
	Goat	*Capra aegagrus hircus*	Bovidae

CONCLUSION

We are not the only species in the biodiversity web. There are thousands of other species. Flora and Fauna are two of the most important groups of species that our planet provides to us. Flora and fauna serve as an integral part of our ecosystem. They are crucial for most of the life of our earth. Flora and Fauna provide humanity with precious resources which can be used in several important ways. Flora and Fauna include a huge variety of species which are estimated to range from 7,000,000 to over 11,000,000 species worldwide, depending on the respective study.

Since they are crucial for human life ,we have to make sure that we protect them accordingly. Many of the flora and fauna which were abundant have now become endangered and even extinct. Maintaining a natural balance is essential for the sustenance of the ecosystem. We need strict laws and high fines regarding the destruction of flora and fauna. By doing this, we can protect our ecosystem.

BIBLIOGRAPHY

For this project I have gathered the information from **Wikipedia** and some from the **people in the neighborhood**.

For the photos some have been clicked by me and the rest were taken from **Google** photos and **Shutterstock** (as some species are seasonal and are not seen during this time of the year).