

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years (10)

Sr. No.	Program name	Name of the Course that include experiential learning through project work/field work/internship	Course code	Number of students studying the courses that include experiential learning through project work/field work/internship	Actual number of students (without repeat of same student)
1	B.Sc. (Hons.) in Botany	Archaeogniate	BOT-A-CC2-4-P	2	2
2		Plant Geography, Ecology and Evolution	BOT-A-CC4-8-P	5	5*
3		Economic Botany	BOT-A-CC4-9-P		
4	B.Sc. (Hons.) in Computer Science	Project Work	CMS-A-CC-6-14-P	22	22
5	B.Sc. (Hons.) in Geography	Research methodology and Field work Lab	GEO-A-CC-5-11-P	29	29*
6		Hazard Management	GEO-A-CC-6-14P		
7	B.Sc. (Hons.) in Zoology	Animal behavior and Chronobiology Lab. Topic: Study of Circadian Rhythms in humans	ZOOA-DSE(B)-6-1-P	20	20*
8		Animal Cloning and Application and Its Ethical issues	ZOOA-DSE(A)-6-2-P	20	
9		Animal behavior and Chronobiology Lab. Topic: Excursion to Kaziranga National Park, Assam	ZOOA-DSE(B)-6-1-P	10 (10 students out of 20 Sem VI students actually went for the visit)	
10	BBA (Hons.)	Research Project	BBAA604DSE1/2/3	51	51
11	B. Com (Hons.)	Project Work	CC6.1 Ch	661	661*
		Computerized Accounting and e-filing of Tax Returns	SEC 6.1Chg	661	
12	B. Com (General)	Computerized Accounting and e-filing of Tax Returns	SEC 6.1Chg	56	56
13	All Semester II students of B.Sc./B.A./B. Com. (Hons. and General)	Environmental Studies	AECC2	953	943 (10 students did not submit)

* Same students did multiple Project/field work (counted once).

Total = 1789

Screen shots of Courses (from the curriculum) that include experiential learning through project work/field work/internship:

Department of Botany:

- 1. BOT-A-CC2-4-P**
- 2. BOT-A-CC4-8-P**
- 3. BOT-A-CC4-9-P**

Following are the syllabus screenshots of the courses having project work/field work:

1. PRACTICAL- ARCHAEGONIATE (BOT-A-CC-2-4-P)
(Credits 2)

- 
1. Workout on Pteridophytes
 2. Identification with reasons (Bryophytes, Pteridophytes and Gymnosperms)
 3. Classroom performance: (Lab records, slides)
 4. Field report
 5. Viva

BRYOPHYTES

1. Morphological study of the plant body: Genera as mentioned in theoretical syllabus and *Riccia*, *Porella*.
2. Study from permanent slides : *Riccia* (V.S. of thallus with sporophyte), *Marchantia* (L.S. through gemma cup, antheridiophore , archegoniophore) , *Anthoceros* (L.S. of sporophyte) , *Funaria* (L.S. of capsule).

PTERIDOPHYTES

1. Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and *Lycopodium*, *Ophioglossum* and *Marsilea*.
2. Workout of the reproductive structures: *Selaginella*, *Equisetum*, *Pteris*.
3. Study from permanent slides: *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus), *Ophioglossum* (L.S. of spike), *Dryopteris* (gametophyte), *Marsilea* (L.S. of sporocarp).

GYMNOSPERMS

1. Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone).
2. Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Ginkgo* (L.S. of female strobilus), *Gnetum* (L.S. of male cone and ovule).

FIELD STUDY

Botanical excursion to familiarize the students with the natural habitats of these groups is desirable. No individual collection should be allowed. Students should submit only photographs in their field report.

Indian hotspots, 4.3. *In-situ* and *ex-situ* conservation, 4.4. Seed-banks, 4.5. Cryopreservation
.....16 lectures

EVOLUTION

1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis
.....6 lectures

2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation
.....4 lectures

3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.
.....6 lectures

2. PRACTICAL- PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION (BOT-A-CC-4-8-P) (Credits 2)

1. Workout on ecological parameters
2. Classroom performance: (Lab records)
-  3. Field Records (Field note book of phytogeographical study and ecological study)
4. Viva

PLANT GEOGRAPHY

-  1. Field visit- at least one long excursion at different phytogeographical region of India.
2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region.

ECOLOGY

1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components (to be done during excursion/ field visit).
2. Comparative anatomical studies of leaves from polluted and less polluted areas.
3. Measurement of dissolved O₂ by azide modification of Winkler's method.
4. Comparison of free CO₂ from different sources.

3.

PRACTICAL- ECONOMIC BOTANY (BOT-A-CC-4-9-P)

(Credits 2)

1. Workout, micro-chemical tests
2. Identification- T.S./L.S. of permanent slides
3. Classroom performance: (Lab records, permanent slides)
4. Field visit desirable to give an idea about cultivation of any crop (viz. rice, jute, mustard, tea, potato)
5. Field record of the visit, properly authenticated by escorting teacher

ECONOMIC BOTANY

1. Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)
2. Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests)
3. Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch grains, micro-chemical tests.
4. Tea- tea leaves, tests for tannin
5. Mustard- plant specimen, seeds, tests for fat in crushed seeds
6. Habit sketch of *Digitalis*, *Papaver* and *Cannabis*.
7. Sal, Teak- section of young stem.
8. Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique.

Pictures of excursion visit to “Sunderban Biosphere Reserve-Bali Island:

Organized by Department of Botany

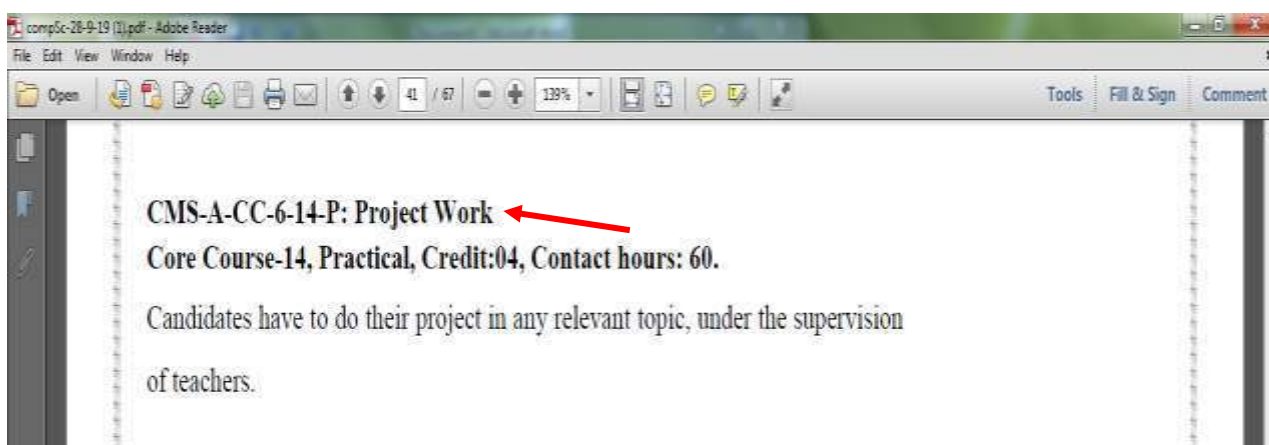
24th-27th March, 2022



Department of Computer Science:

4. CMS-A-CC-6-14-P -Project Work:

Semester - VI				
Course	Type	Course Code	Course Name	Credit
Core Course -13	Theory	CMS-A-CC-6-13-TH	Software Engineering	4
	Theory	CMS-A-CC-6-14-TH	Theory of Computation	4
Core Course -14	Practical	CMS-A-CC-6-14-P	Project	4



CMS-A-CC-6-14-P: Project Work

Core Course-14, Practical, Credit:04, Contact hours: 60.

Candidates have to do their project in any relevant topic, under the supervision of teachers.

Department of Geography:

5. GEO-A-CC-5-11-P – Research Methodology

2.22 **GEO-A-CC-5-11-P – Research Methodology and Fieldwork Lab** ✧ 30 Marks / 2 Credits

Every student needs to participate in fieldwork and prepare a field report according to the following guideline, failing which he/she will not be evaluated for GEO-A-CC-5-11-P.

1. Each student will prepare a report based on primary data collected from field survey and secondary data collected from different sources.
2. Students will select either one rural area (*mouza*) or an urban area (municipal ward) for the study, with the primary objective of evaluating the relation between physical and cultural landscape.
3. A specific problem or a special feature should be identified based on which, the study area will be selected.
4. The report should be handwritten in English on A4 size paper in candidate's own words within 5,000 words (Introductory Chapter: 1000 words; Physical Aspects: 1500 words; Socio-economic Aspects: 1500 words; Concluding Chapter: 500 words, approximately) excluding tables, photographs, maps, diagrams, references and appendices.
5. Photographs, maps and diagrams should not exceed 15 pages.
6. A copy of the bound report, duly signed by the concerned teacher, will be submitted during examination.
7. The field work and post-field work will include:
 - a. Collection of primary data on physical aspects (relief and soil) of the study area. Students should use survey instruments like prismatic compass, dumpy level, Abney level or clinometer wherever necessary.
 - b. Collection of soil samples from different land cover land use regions of the study area for determining pH and NPK values with help of a soil kit.
 - c. Collection of socio economic data, at the household level (with the help of a questionnaire) in the selected study area.
 - d. Plot to plot land use survey for preparation of a land use map, covering whole or part of the selected area.
 - e. Visit to different organisations and departments for collection of secondary data.
 - f. Any other survey relevant to the objective of the study.
8. The Field Report should contain the following sections (a–e).
 - a. Introduction: Study area extent and space relations, reasons for selection of the study area on the basis of a specific problem or special feature, objectives, methods of data collection, analyses and presentation, sources of information, etc.
 - b. Physical aspects: Lithology and geological structure, relief, slope, drainage, climate, soil, vegetation, environmental issues, proneness to natural hazards, etc.
 - c. Socio-economic aspects:
 - i. Population attributes: Number, sex ratio, literacy, occupational structure, ethnic and religious composition, language, per capita income, etc.
 - ii. Settlement characteristics: Number of houses, building materials, number and size of rooms, amenities, etc.
 - iii. Agriculture: General land use, crop-combination, use of fertiliser and irrigational facilities, production and marketing etc.
 - iv. Other economic activities: Fishing, horticulture, brick-making, household and other industries, etc.

6. GEO-A-CC-6-14-P-Hazard Management

2.28 **GEO-A-CC-6-14-P – Hazard Management Lab** ✧ 30 Marks / 2 Credits

A Group Project Report is to be prepared and submitted based on any one case study among the following hazards from West Bengal, incorporating a preparedness plan, preferably in the vicinity of the candidates' institution / district:

1. Earthquake
2. Landslide
3. Land subsidence
4. Thunderstorm
5. Flood
6. Riverbank / Coastal erosion
7. Fire
8. Industrial accident
9. Road / Railway accident
10. Structural collapse
11. Environmental pollution
12. Biohazard

One case study will be done by a group of five to ten students. Different groups may choose different case studies from any one or different types of disasters. The report should be prepared on secondary data and handwritten on A4 page in candidates' own words not exceeding 2,000 words excluding references. The report should contain a proper title. The report should incorporate relevant tables, maps, diagrams, and references, not exceeding ten pages. Photographs are optional and should not exceed three. A copy of the stapled / spiral-bound report in a transparent cover, duly signed by the concerned teacher, is to be submitted during examination. Without the report the candidates will not be evaluated for GEO-A-CC-6-14-P.

Marks division: 20 on report + 10 on viva-voce = 30

Department of Zoology:

7. ZOO-A-DSEB-6-1-P - Circadian Rhythm

Animal Behaviour and Chronobiology Lab, ZOOA-DSE(B)-6-1-P

Full Marks 50	60 Hours	2 Credits
List of Practical		
1. To study nests and nesting habits of the birds and social insects. 2. To study the behavioural responses of wood lice to dry and humid conditions(demonstration only). 3. To study geotaxis behaviour in earthworm. 4. To study the phototaxis behaviour in insect larvae. 5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report. 6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).		

8. ZOO-A-DSEA-6-2-P – Animal Cloning

Animal Biotechnology Lab, ZOOA-DSE(A)-6-2-P

Full Marks 30	60 Hours	2 Credits
List of Practical		
1. Genomic DNA isolation from <i>E. coli</i> and Plasmid DNA isolation (pUC 18/19) from <i>E. coli</i> 2. To study following techniques through photographs - Southern Blotting, Northern Blotting, Western Blotting, PCR, DNA fingerprinting ✓ Project report on animal cloning & Application & ethical Issues.		

9. ZOOA-DSE(B)-6-1-P- Visit to Kaziranga National Park, Assam

Animal Behaviour and Chronobiology Lab, ZOOA-DSE(B)-6-1-P

Full Marks 50	60 Hours	2 Credits
List of Practical		
1. To study nests and nesting habits of the birds and social insects. 2. To study the behavioural responses of wood lice to dry and humid conditions(demonstration only). 3. To study geotaxis behaviour in earthworm. 4. To study the phototaxis behaviour in insect larvae. 5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report. 6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).		

Department of Business Administration:

10.BBA-BBAA604DSE4C-Research project

Semester V					
	Quantitative Techniques for Management	100	Core	6	BBAA501C11
	Legal Aspects of Business	100	Core	6	BBAA502C12
	Elective – I Discipline Specific Elective-paper a of 1/2/3/4	100	Disc. Specific Elective	6	BBAA503DSE 1/2/3/4(A)
	Elective – II Discipline Specific Elective-paper b of 1/2/3/4	100	Disc. Specific Elective	6	BBAA504DSE 1/2/3/4(B)
		400		24	
Semester VI					
	Business Policy & Strategy	100	Core	6	BBAA601C13
	Financial Institutions and Markets	100	Core	6	BBAA602C14
	Elective – III Discipline Specific Elective-paper c of 1/2/3/4	100	Disc. Specific Elective	6	BBAA603DSE 1/2/3/4(C)
	Research Project	100	Disc. Specific Elective (Applicable to all)	6	BBAA604DSE 1/2/3/4
		400		24	
	TOTAL	2600		144	

Department of Commerce:

11. CC6.1 Ch (B. Com Hons.)-Project Work

Year 3: Semester VI

		Marks	Credit Hours	
AECC 6.1Chg	Environmental Studies	100	2	
SEC 6.1Chg	Computerised Accounting and e-Filing of Tax Returns	100	4	
CC 6.1 Ch	Project Work	100	6	
DSE 6.1 A**	Financial Reporting and Financial Statement Analysis	100	6	
DSE 6.2 A**	Financial Management	100	6	

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Chg: Common for Honours and General; **Ch:** Core Course for Honours

12. SEC6.1Chg (B. Com Hons. and General)-Computerized Accounting and e-Filing of tax Returns

Year 3: Semester VI

		Marks	Credit Hours	
AECC 6.1Chg	Environmental Studies	100	2	
SEC 6.1Chg	Computerised Accounting and e-Filing of Tax Returns	100	4	
CC 6.1 Ch	Project Work	100	6	
DSE 6.1 A**	Financial Reporting and Financial Statement Analysis	100	6	
DSE 6.2 A**	Financial Management	100	6	

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Chg: Common for Honours and General; **Ch:** Core Course for Honours

13. Environmental Science-AECC2 (for Semester 2 students of BA/B.Sc./B. Com/BBA

• Concept of hazardous 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 studies on 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.

Following are the sample copies of some project reports from different programs:

Botanical Excursion

Preface

"Excursion" can be defined as educational tourism and their habitat of a phytogeographical region. As a part of the Botany Honours curriculum, the excursion have been of immense importance. This excursion to a different phytogeographical region in India, helped us to gain idea on a number of factors, viz, the habitat, the habit, the niche, the field conditions, the richness of species diversity, the ecology and soil chemistry and even more about which we learn in theory but understand in 'the field'

Examined
P. H. K. Jain Colleg.
Dept. of Botany

Aim and objectives of Field Excursion

- To explore the local flora in their respective natural habitats
- To study the vegetation
- To study the interaction of different biotic communities
- To study the species richness and diversity
- To observe the cultivation techniques and processing of economically important crops.
- To learn about the agroforestry and social implications, ethnobotanical aspects of the region.
- Holistic approaches to study the ecosystem itself
- To gather knowledge about the pollination mechanism, seed dispersal or fruit dispersal etc.



Group photo at
excursion

DATE

Pioneer Paper Co.
PAGE NO.

EXPT. NO.

Excursion Participated

Date	24 th to 27 th March 2022
Place	Sundarban Biosphere Reserve
Location	Bali Island, Sundarbans
Students	Semester 4
Guided by	1) Dr. Rimi Datta (Head, Department of Botany) 2) Dr. Sourav Bose 3) Dr. Anindita Singha Roy 4) Mr. Koushik Mondal
Expert	Dr. Suman Datta, Associate Professor, Serampore College.

Sundarbans as a spot for Excursion

The Sundarbans are an archipelago of 102 islands located in the State of West Bengal in eastern India in the Ganges Delta, stretching into southern Bangladesh.

Area

Around 4262 km sq. of the total forest area

Latitude and Longitude: $21^{\circ}43'2'' - 21^{\circ}55' N$ latitude;

$88^{\circ}42' - 89^{\circ}04' E$ longitude.

Altitude: 7.5 m above sea level.

Climate

The climate in the Sundarbans is generally soothing and pleasant.

- The temperature in Sundarbans ranges from $34^{\circ}C$ and $20^{\circ}C$
- The rainfall is extremely high
- The weather is almost always moist and laden with the humid air from Bay of Bengal blowing constantly carrying 80% humidity.

Soil

Soils of the Sundarbans mangrove forest differ from other inland soils in that they are subjected to the effects of salinity and waterlogging, which naturally affect the vegetation.

- In certain places soils are semi-solid and poorly consolidated
- pH ranges widely from 5.3 to 8.0
- Texture: soil is in general medium textured; sandy loam, silt loam or clay loam. The grain size distribution is highly variable. Silt loam is the dominant textural class. However, Ray et al. 2014 reported a 72-87% silt content in 0-60 cm depth for Indian part of Sundarbans.
- Porosity: 0.7 (Ray et al. 2014)
- Sodium and calcium contents of the soil vary from 5.7 to 29.8 meq/100g dry soil, respectively and are generally low in the eastern region and higher towards the west.
- Available potassium (K) content of the soil is low, 0.3-1.3 meq/100g dry soil.
- Organic matter content varies between 4% and 10% in dry soil.
- Soil salinity increases from 5 ppt in east (slight to moderate) to 30 ppt in west (highly saline), but the salinity is not uniform from north to south throughout the forest.

Sundarbans National Park.

- Around 2585 sq. km of the Indian Sundarbans region is occupied as the National Park and make it the largest National Park and Tiger Reserve in India.
- The forest of the Sundarbans is located in the world's largest delta formed by three rivers named Ganges, Brahmaputra and Meghna.
- Spans over around 10,000 sq km of area, the Sundarbans forest is shared between the two countries, India and Bangladesh. Around 4262 km sq of the total forest area is in India and the remaining part is in Bangladesh.
- Around 2125 sq. km of total area of 4262 sq. km of the Sundarbans is occupied by the mangrove forest and the rest area is occupied by water bodies across the 56 ~~inches~~ islands that constitute the forest. They form the largest estuarine mangrove forest in the world.
- The Indian part of the Sundarbans forest constitutes the Sundarbans National Park, which is also a designated tiger reserve and biosphere reserve.
- Declared as a UNESCO heritage site, this forest, classified as tropical moist forest has its own charm to attract tourists and ecologists round the year from all around the globe.



Special Lecture session
by honourable expert
Sir Dr. Suman Datla

Day Wise Activity

Day	Place	Itinerary
1	Sealdah - Canning - Godkhali - Bali Island	- Reached Sealdah at 6:30 am and boarded train to Canning. - Reached Canning and forwarded to Godkhali by magic car. - Boarded the launch for safari in the social forest - Explored the forest on foot • to study the vegetation, • collect samples for soil test, • collect water for TDS-TSS, • collect water sample for dissolved gases • collect plant specimens for herbarium - Reach Bali Island around 5 pm and night stay at resort. - Attended a special lecture session by our honourable expert sir, Dr. Suman Datta.



Rice cultivation field visit



Launch safari



Learning vegetation of sundarban



In magic car

Day	Place	Itinerary
4.	Godkhali- Canning- Sealdah.	- Village walk along with vegetation study - Study of community structure by Quadrat method. - From Godkhali to Sea Canning (by magic car) - From Canning to Sealdah (by train)



Utricularia



Euphorbia tithymeloides



Callistemon sp.

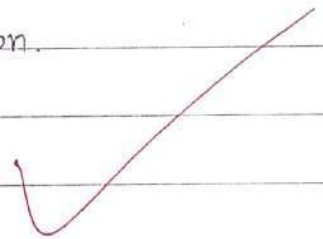


Sonneratia caseolaris

Flora in Sundarbans National Park.

The Sundarban forest is the largest mangrove forest in the world so undoubtably the mangrove tree is the prime fauna of the region. This tree has a unique ability to stand and stay alive in the inundated land for a long time.

The pneumatophores from their roots which help in respiration and support the Mangrove Plants. An exquisite variety of mangrove tree, one of a special kind, named 'Sundari' is found in abundance here, which also is the reason for naming the forest as Sundarbans. More than 300 species of plants are found in the entire Sundarbans region.





Heritiera Jones Buch-Ham



Acanthus ilicifolius L.

Local name	Scientific name	Family	Remark
Sundari	<u>Heritiera fomes</u> Buch.-Ham	Sterculiaceae	Back mangrove tree species of the Sundarbans. Sundarban forest is named after the once abundant Sundari tree. Once the species is distributed up to about 70 percent of the forest, but presently it is enlisted as Endangered in the IUCN Red Data List 3.1. It is threatened by, • over-harvesting for its high value wood, • rise in salinity - a fallout of water diversions in the Ganges Basin. • coastal encroachment. • top-dying disease.
Hargoja	<u>Acanthus ilicifolius</u> L.	Acanthaceae	Holy mangrove growing in the muddy river bank with spiny margined leaves. Fresh leaf paste is used to wash the wound or injury due to tiger attack.

Local name	Scientific name	Family	Remark.
Khalsi	<u>Aegiceras</u> <u>corniculatum</u> (L.) Blanco	Myrsinaceae	Bushy mangrove plant, common bee forage plant.
Tora	<u>Aegialitis</u> <u>retundifolia</u> Roxb.	Plumbaginaceae	The plant is ranked as near threatened (NT). Globally the plant is uncommon and the area of occupancy is less than 2000 sqkm. Sometimes table salts are used to be prepared after drying the leaves.
Kalo Baine	<u>Avicennia</u> <u>alba</u> Blume.	Avicenniaceae	Mangrove with blackish stem with numerous pneumatophores, one of the most dominant species at the lower part of the river bank, often facing inundation. Viviparous germination. Bark yields tannin, used as firewood.
Tat Baine	<u>Avicennia</u> <u>marina</u> (Forssk.) Vierh.	Avicenniaceae	Similar to <u>Avicennia alba</u> but leaves oblong lanceolate. Bark yields tannin, used as firewood.



Bruguiera gymnorhiza



Bruguiera parviflora

Local name	Scientific name	Family	Remark.
<u>Pera Baine</u>	<u>Avicennia</u> <u>officinalis</u> L.	Avicenniaceae	Similar to <u>Avicennia alba</u> but leaves wider, apex rounded. Bark yields tannin, used as firewood.
Kankra	<u>Bruguiera</u> <u>gymnorhiza</u> (L.) Savigny	Rhizophoraceae	Root buttress with pneumatophores Flowers solitary, calyx tube conical with striations, red-pink, petals bristle like at apex, 3-4 bristles. Viviparous germination. Timber used for pole, Bark used for extraction of tannin.
Bakul Kankra	<u>Bruguiera</u> <u>parviflora</u> (Roxb.) Wight and Arn.	Rhizophoraceae	Mangrove with numerous pneumatophores, flowers in clusters of 3-4, axillary cyme.
Thamti Garan/ Tele Garan	<u>Ceriops</u> <u>decandra</u> (Griff.) W. Throb	Rhizophoraceae	One of the dominant species along the river bank with orangish leaves. Mangrove with prominent root buttress and pneumatophores. Viviparous germination, hypocotyl upto 12 cm



Excoecaria agallocha L.



Kandelia candel (L.) Druce



Nypa fruticans Wurm.



Rhizophora apiculata Brume.

Local name	Scientific name	Family	Remark.
Gol Pata	<u>Nypa</u> <u>fruticans</u> Wurmb.	Areaceae	Unbranched palm mangrove, a highly valued food and source of materials for local people, providing edible seeds and sap plus an excellent material for thatching. It is also planted along swampy coastlines, often with mangroves, in order to protect the shore from erosion. Now-a-days become rare.
Dhani Ghas	<u>Porteresia</u> <u>coarctata</u> (Roxb.) Tateoka	Poaceae	A pioneer species of mangrove, which excretes salt crystals through its leaves. Wild relative of Cultivated Rice. Fodder for deer.
Garjan	<u>Rhizophora</u> <u>apiculata</u> Blume.	Rhizophoraceae	One of the dominant species with glossy deep green leaves. Stilt Mangrove; prominent arching stilt roots than can extend 5m up the stem. Viriparous germination Timber yielding.



Phoenix paludosa Roxb.



Xylocarpus mekongensis (Lam.)

Local name	Scientific name	Family	Remark
Hental	<u>Phoenix</u> <u>paludosa</u> Roxb.	Areaceae	Mangrove date palm is an excellent species which helps the tiger in camouflaging itself. The plant is classified as 'Near Threatened' in the IUCN Red List of Threatened Species (2008) The fruits are eaten in curries The fibrous leaves are used to make mats, ropes, umbrellas, and fences as well as for thatching roofs. The stems are used to make walking sticks (believed traditionally to repel snakes), as rafters and for flooring as well as pots.
Gazjan/ Bhara	<u>Rhizophora</u> <u>mucronata</u> Poir.	Rhizophoraceae	Plants with slender arched aerial roots, flowers mostly on bare stems. Timber yielding.
Pashur	<u>Xylocarpus</u> <u>mekongensis</u> (Lam.) M. Roem	Meliaceae	Fruit large globose, 12 cm diameter like wood apple, wood durable, used in furniture making.



Sonneratia apetala Buch.-Ham



Xylocarpus granatum J.

Local name	Scientific name	Family	Remark
Tak Keora	<u>Sonneratia</u> <u>apetala</u> Buch.-Ham.	Sonneratiaceae	The tree occurs in moderately to strongly saline areas and is considered as a pioneer species in ecological succession. Forms the upper storey of the vegetation. Flower apetalous with style consisting of a white, 2-3 cm long, curved, flat flattened umbrella like stigma. Fruit sour, consumed by villagers.
Ora/Chak Keora	<u>Sonneratia</u> <u>caseolaris (L.)</u> Engl.	Sonneratiaceae	Branches diffuse and spreading, petals dark pink. Other features like <u>S. apetala</u>
Dhundul	<u>Xylocarpus</u> <u>granatum J.</u> Koenig.	Meliaceae	Cannonball mangrove, fruit globose, 25 cm diameter, rustic brown, superficially fissured like wood apple. The wood is used in boat building, furniture and as fuel; bark for tanning.

Comment

From this field study we got ample scope to study the vegetation in nature. The forest of the studied area was quite luxuriant with different mangrove species of angiosperms along with a comparatively less diversity of gymnosperms, pteridophytes and bryophytes but a large number and variety of algal species. It is a rare occasion to get the opportunity to study the plants in their natural habitats, their distributional patterns, their adaptive features, their reproductive parts and processes in the cradle of nature which is quite different from studying the plants in books or other literature. Another important aspect is to learn about the various uses and their ethnobotanical features. Sundarbans is a treasure to not only India but to the world and hence declared a UNESCO World Heritage Site. We learnt about the importance of the Mangrove Vegetation but also came to know how devastatingly the vegetation is being destroyed for human inhabitation, tourism, recreation, poaching, logging etc. Even pollution of all sorts affect and cause thinning of the vegetation. Sundarbans calls for its conservation and it is already beyond time that we must have listened to this call. Conservation of the mangroves is very important for the sustainability of this Ramsar site of wetland ecology. We should take steps as much as is in our reach to conserve the vegetation of Sundarbans.



A field visit to Rice cultivation
in Bali Island.

A Field visit to Rice Cultivation In Bali Island, Sundarbans

Date

26th March, 2022

Location

Bali Island, Sundarbans

Altitude

7.5 m above sea-level

Latitude Longitude

21.9497°N, 89.1833°E

Temperature

30°C - 34°C

Climate

The climate in the Sundarbans is generally soothing and pleasant. The rainfall is extremely high. The weather is almost always moist and laden with the humid air from Bay of Bengal blowing constantly carrying 80% humidity.

Soils of the Sundarbans mangrove forest differ from other inland soils in that they are subjected to the effects of salinity and water logging, which naturally affect the vegetation.

- In certain places soils are semi-solid and poorly consolidated
- pH ranges widely from 5.3 to 8.0
- Texture: soil is in general medium textured; sandy loam, silt loam or clay loam. The grain size distribution is highly variable. Silt loam is the dominant textural class. However, Ray et al, 2014 reported a 72-87% silt content in 0-60 cm depth for Indian part of Sundarbans.
- Porosity: 0.7 (Ray et al. 2014)
- Sodium and calcium contents of the soil vary from 5.7 to 29.8 meq/100g dry soil respectively, and are generally low in the eastern region and higher towards the west.
- Available potassium (K) content of the soil is low, 0.3-1.3 meq/100g dry soil.
- Organic matter content varies between 4% and 10% in dry soil.
- Soil salinity increases from 5 ppt in east (slight to moderate) to 30 ppt in west (highly saline), but the salinity is not uniform from north to south throughout the forest.

Students

Semester 4

Guided by

Dr. Rimi Datta (HOD)

Dr. Sourav Bose

Dr. Anindita Singha Roy

Mr. Kousik Mondal.

Expert

Dr. Suman Datta, Associate Professor, Serampore College.

Examined
P. H. K. Jain College
Dept. of Botany

Description of the Journey:

As a part of the academic curriculum in Botany, we visited a Rice Cultivation Field in Bali Island, Sundarbans. Under the guidance of our teachers, we, the students of B.Sc Botany (Hons.) 4th Semester, went to a rice field of a village of Bali island on the third day of our Sundarban excursion. The day was sunny and suitable for the visit. We started our journey with a launch safari in the Sundarban Tiger Reserve (STR) area and studied the forest cover along with different algal and plant sample collections.

The process of cultivation of Rice:

The process of rice cultivation includes the following steps as mentioned below:

1. Land preparation

- For land preparation, sowing is necessary.
- Sowing depends upon whether the crop is to be grown under the 'dry', semi-dry, or 'wet' system.
- The soil of Bali island is 'dry soil' type.
- In this case, the land is ploughed immediately after harvest of the previous crop and then brought to tilth by repeated ploughing or harrowing when rains are available.
- Weeds and stubbles of the previous season are collected and burnt on the field.
- Manures, if applied, are added well in advance before sowing.

2. Sowing

- The seeds are sown directly by broadcasting, dibbling or drilling in lines.
- For broadcast sowing, seed rate varies from 80 kg - 100 kg per hectare and for line sowing from 60-70 kg per hectare.

3. Transplantation

- Seed-bed preparation : 1-2 m wide

Raised beds,

Length of the bed according to land area available.

- Irrigation channel : 0.3 m wide

10 cm deep

Interspersed in between seed beds.

- 2-3 seedlings of 3-5 weeks each are transplanted in each ridges.

- Early varieties are planted 20 cm from line to line and 10-15 cm from plant to plant.

- Medium and Late varieties are planted with 20 cm X 15 cm and 23 cm X 23 cm spacings respectively

4. Manuring

- Chemical fertilisers and organic manures are equally important for rice cultivation.

- Nitrogen, either organic or inorganic form, is however, the best manure for rice.

- Farmyard manure, compost, oil-cakes, fish manure, green twigs, leaves of leguminous plants like Indigofera, Tephrosia etc are in common use.



Harvesting of rice

5. After-care

- In the field, water is allowed to stand to a depth to 1-2-3.5 cm until the transplanted seedlings are well established.
- About 5.0 cm of water with frequent draining and re-irrigating is maintained in the field up to the dough stage of the crop.
- For quick and uniform maturation of grain, water is drained off from the field a week or two before harvesting.
- Weeding either by hand or with a 'rotary weeder' should be given upto the boot leaf stage of the crop.
- At the same time the soil near the roots of the plants should be stirred.

6. Harvesting,
Threshing and
Storage.

- The crop is harvested when the 'ears' are nearly ripe and the colour of the straw is still slightly green.
- Crop is cut with sickles by the farmers, dried in the field for few days (2-4)
- The crop is then stacked in the threshing yard for a week and threshed either with sticks, or by beating against a wooden log or treading the entire crop under feet of bullocks.
- Finally, the husk is removed by pounding method or by rice hullers
- Generally, the cleaned unhusked paddy is dried and stored in jute bags and granaries of different types.

Conclusion

From this field visit we got an ample scope to study about the different steps of rice cultivation. It is a great opportunity for us to study in details about these cultivation methods on field in person directly from the farmers along with the different irrigation techniques and harvesting of rice. We gained a lot of knowledge about the entire rice cultivation processes which includes land preparation, sowing of the seeds, transplantation of seedlings, manuring, aftercare, harvesting and storage. This study also provide us some sweet memories which will remain as a treasure for us throughout our life.

G. S. Ravi
2/5/2022

EXAMINED
G. H. K. J. in Coll
Date of exam