Sl. Instrument No. 17,299
Date 11/07/2024

5रु. कोर्ट फी COURT FEE भारत INDIA सत्यमेव जयते पाँच रुपये FIVE RUPEES

BEFORE THE NATIONAL GREEN TRIBUNAL

EASTERN ZONE BENCH, KOLKATA

APPEAL. NO. 04/2020/EZ

IN THE MATTER OF:

NOTARY GOVERNMENT OF ASSAM Saligram Chetri Kamrup Metro Regd No.KAM-14 Exp. Dt-16/01/2027 NOTARIAL

Bimal Gogoi & Anr...Appellant (s)

VERSUS

Union of India &Ors. ...Respondent(s)

-AND-

IN THE MATTER OF

Affidavit filed on behalf of the Respondent No. 4, the Assam State Biodiversity Board in compliance of the Order dated 06.05.2024

I, Shri Sandeep Kumar, son of (Lt.) Kameshwar Prasad, aged about 56 Years and a resident of 603, Gajendra Apartment, Vijaya Complex, Beltola ,Guwahati-781028, Assam, in the district of Kamrup (Metro) do hereby solemnly affirm and state as follows-

1. That I am the Principal Chief Conservator of Forests (Biodiversity) and Member Secretary, Assam State Biodiversity Board to the Government of Assam, in the office of the Principal Chief Conservator of Forest & Head of Forest Force, Assam, Aranya Bhawan, Panjabari, Guwahati-781037. I am fully conversant with the facts and

11/7/24 Saligram Chetri NOTAKY GOVT. OF ASSAM Kamrup (Metro) Guwahati Regd. No-KAM-14

Sandeep Kumar Member Secretary Assam State Biodiversity Board

circumstances of the case, I am also duly authorized to swear this affidavit on behalf of the State of Assam and Respondent No.4, i.e. the Assam State Biodiversity Board.

2. That as directed by the Hon'ble Tribunal and due adjudication of the case, the answering deponent take the opportunity to bring on record the Status Report/Final Technical Report on the Biodiversity Impact Assessment (BIA) Study for the proposed seven (7) Extended Reach Drilling Wells in Dibru-Saikhowa National Park (DSNP), in the district of Tinsukia, Assam prepared by the Assam State Biodiversity Board, Guwahati in collaboration with International Union for Conservation of Nature and Natural Resource (IUCN), New Delhi, India. As of date, the Biodiversity Impact Assessment (BIA) Study has been completed on 04.05.2024.

A copy of the status Report/Final Technical Report is annexed and marked as ***ANNEXURE-I***

NOTARY GOVERNMENT OF ASSAM
Saligram Chetri
Kamrup Metro
Regd. No.KAM-14
Exp. Dt-16/01/2027

3. That the statements made in paragraph 1 of this affidavit is true to my knowledge and belief and those contained in paragraph 2 is true to my information derived from records maintained in our office which I believe to be true and the rest are humble submission before this Hon'ble Court.

That the declarations made in the above paragraphs are true and it conceals nothing and that no part of it is false, so help me God.

11/7/24
Saligram Chetri
NOTARY GOVT. OF ASSAM
Kamrup (Metro) Guwahati
Regd. No-KAM-14

Sandeep Kumar
Member Secretary
Assam State Biodiversity Board

And I sign this affidavit on this the 11th day of July, 2024 at Guwahati.

Identified by me:

Chittaranjan Deb

Advocate

NOTARY GOVERNMENT OF ASSAM
Saligram Chetri
Kamrup Metro
Regd. No.KAM-14
Exp. Dt-16/01/2027

Sandeep Kumar

DEPONENT

Member Secretary
Assam State Biodiversity Board

Solemnly affirmed and declared before me by the deponent, who is identified by Chittaranjan Deb, Advocate on this the 11th day of July/2024 at Guwahati

11/7/24

Saligram Chetri
NOTAKY GOVT. OF ASSAM
Kamrup (Metro) Guwahati
Regd. No-KAM-14

FINAL TECHNICAL REPORT

BIODIVERSITY IMPACT ASSESSMENT STUDY FOR THE PROPOSED SEVEN (7) EXTENDED REACH DRILLING WELLS BENEATH DIBRU-SAIKHOWA NATIONAL PARK (DSNP), ASSAM

FOR

OIL INDIA LIMITED, DULIAJAN-786602

ASSAM, INDIA

PREPARED BY

ASSAM STATE BIODIVERSITY BOARD, GUWAHATI

IN COLLABORATION WITH

INTERNATIONAL UNION FOR CONSERVATION OF NATURE & NATURAL RESOURCES (IUCN), NEW-DELHI, INDIA

JULY 2023

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ACKNOWLEDGEMENTS

Acknowledgements

The **International Union for Conservation of Nature (IUCN)** is pleased to acknowledge the support of its technical partners and donor who are supporting in implementation of the project.

We would like to thank:

Dr. Amit Sahai (IFS), Principal Chief Conservator of Forest, Assam

Shri Sandeep Kumar (IFS), Principal Chief Conservator of Forests, Wildlife & Chief Wildlife Warden, Assam and Project Director, APFBC Society and current Member Secretary of Assam State Biodiversity Board

Sri. KSPV Pavan Kumar (IFS) Addl. PCCF (Biodiversity &CC) & ex-Member Secretary, Assam StateBiodiversity Board

Dr. Vivek Saxena (IFS), Managing Director HFDC & Ex-Country Head IUCN India

Sri. Prasanta Borkakoty, Resident Chief Executive, Oil India Limited Duliajan

Sri. Sanjay Kumar Rai, Executive Director, FHQ affairs Oil India Limited Duliajan

Dr. O. Sunanda Devi, Scientific Officer-Assam State Biodiversity Board

Sri K.K. Deori, AFS, Divisional Forest Officer, Tinsukia Wildlife

Dr. Prof Syed Ainul Hussain, Ph.D.; DSc (Wildlife Sciences), Wildlife Institute of India

IUCN Global Business and Biodiversity Unit, Gland, Switzerland

We would also thank the **Oil India Limited, Environment and Safety, Duliajan team** for the supportand on-site coordination.

And finally, we express our sincere appreciation for our on-ground implementing and knowledgepartner, **Terracon Ecotech Pvt. Ltd.** for supporting in the implementation of the study.

Details of IUCN team

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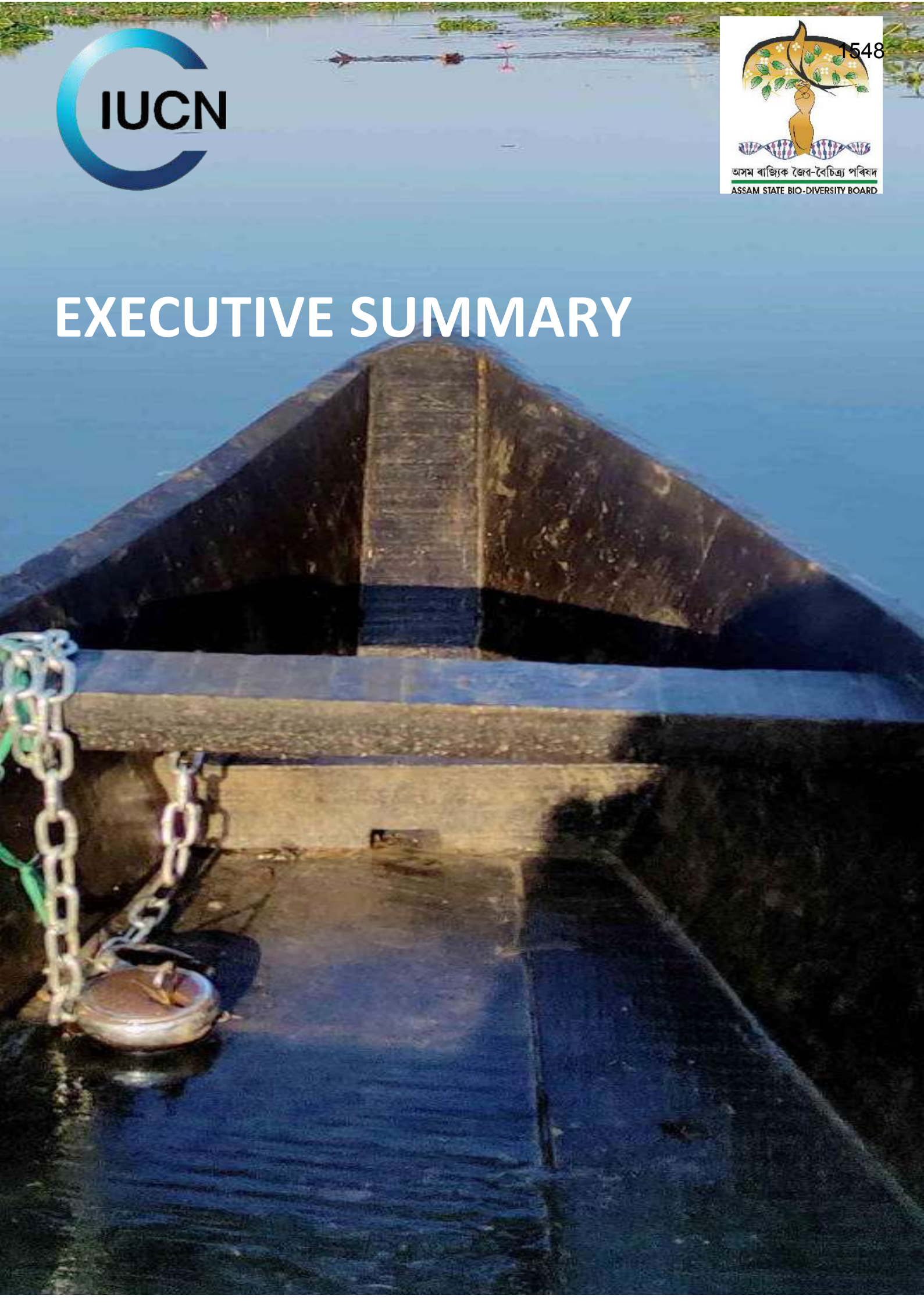
IUCN

অসম ৰাজ্যিক জৈৱ-বৈচিত্র্য পৰিষদ
ASSAM STATE BIO-DIVERSITY BOARD

EXECUTIVE SUMMARY



Executive Summary

Oil India Limited (OIL) intends to drill seven (7) extension/appraisal locations in the riverbed areas of Dibru River alongside Dibru-Saikhowa National Park (DSNP). All seven locations will be drilled from three surface well pads viz. PAD 1, PAD 2 and PAD 3 of Baghjan ML located at a minimum distance of 1.3 km outside the boundary of the DSNP. The seven wells will be drilled from the proposed drill pads through Extended Reach Drilling (ERD) Technology. The target depth of each seven wells is planned to be 3950 m (TVD). Once hydrocarbon is established in this area, it is expected to enhance the cumulative oil production of OIL adding to the national economy.

In December 2020, Guwahati High Court stayed a permission given to Oil India Limited for hydrocarbon exploration at seven locations inside the protected area due to environmental concerns. OIL sought confirmation from the Assam State Biodiversity Board (ASBB) to conduct the Biodiversity Impact Assessment Study. The Board provided a roadmap and modalities for the study in December 2020 and January 2021. OIL confirmed acceptance of the proposal from ASBB.

In this view, ASBB appointed IUCN, as the local in-country partner, to undertake biodiversity assessments of each site in order to determine the project's impact on biodiversity and ecosystem services. Under the guidance of Assam State Biodiversity Board, IUCN went beyond the compliance by conducting biodiversity impact assessment study as well as developing a Comprehensive Biodiversity Management plan with its implementation strategy and framework. IUCN utilized its Global biodiversity mapping tools like IBAT and other guiding and knowledge products to ensure the robust data collection and management.

IUCN along with its implementing partner Terracon Ecotech Private Limited (TEPL) conducted a desktop assessment and a three-season biodiversity survey for ASBB, to understand the biodiversity in the area and impact of OIL's operations on it as well as on ecosystem services. An Ecological Assessment was carried out using a stratified random sampling method for the selection of the study locations. Standard ecological sampling techniques were used for documenting the biodiversity; such as the quadrat method for flora and point count and line transect method for fauna. For line transects on foot as well as boat surveys were conducted. Secondary information was collected through desk reviews, informal discussions locals, fishermen and forest personnel.

The ERD surface (PADs) and subsurface locations falls within the depositional plains of the River Brahmaputra and its tributaries. The study area comprises of different types of habitats such as Forest, Tea Plantation, Waterbody, Cropland, Homestead Plantation, Built up and Open land. The two Important Bird Areas (IBA) Dibru-Saikhowa National Park and Maguri Motapung Beel fall in the present study area. Along with this, Bherjan and Podumoni regions of Bherjan-Borajan-Podumoni Wildlife Sanctuary also fall in the present study area. These habitats show diversity in floral and faunal species. Tea Plantation is the dominant habitat of the study area followed by Forest, Waterbody, Built-up and Open land, Cropland, and Homestead Plantation.

Baseline data was collected during the monsoon, winter and summer season. In the three seasons a total of 66 species of trees, 42 shrubs, 134 herbs and 41 Pteridophytes were recorded under flora; whereas 171 species of Birds, 143 species of Butterflies, 10 species of Mammals, 14 species of Herpetofauna and 19 species of Fishes were recorded under fauna.

In terms of species documented during survey, 4 species of birds, 3 species of mammals, 5

species of butterflies were found to be protected under schedule I of the Indian Wildlife (Protection) Act, 1972 (WPA, 1972). Whereas 5 species of mammals, 24 species of butterflies and 1 species of reptiles were found to be protected under schedule II of the WPA.

A total of 12 species of birds, 5 species of mammals, 1 species of herpetofauna and 1 species of fish was found to be protected under various categaories of The International Union for Conservation of Nature Red List of Threatened Species (IUCN).
Based on the secondary literature review and primary observations, the impacts and risks associated with the all phases of OIL's exploration activities on biodiversity and ecosystem services were determined. Management Plan has been recommended to mitigate each impact and risk identified for the asset. Impact, risks and their associated action are summarized in the following table:

Table 1 : Management Plan Action and Impacts Mitigated along with Impact category and Biodiversity Risk

Mitigation Hierarchy	Management Plan	Impacts mitigated	Impact Category	Biodiversity Risk
Avoidance	**Action 1**: **Construction of a green wall along the boundary of the ERD surface locations**	**Impact 1**: There will be an increase in the ambient noise levels in and around the drill sites due to the project activities, which will lead to changes in species abundance, and disruption of species communication, breeding, nesting and roosting patterns.	High	**Moderate**
	Action 2A) Identification and Monitoring of Fish breeding and pools site **Action 2B) Identification and Monitoring of river turtle species** **Action 2C) Third-Party Monitoring of Ganges River Dolphin using Passive acoustic monitoring (PAM)**	**Impact 2**: Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.	Medium	**Minor**
	Action 3a) Use of retrofitted emission control equipment for DG sets with duel fuel technology	**Impact 3:** Air pollutants can affect wildlife through the disruption of endocrine functions, organ injury, increased vulnerability to	Medium	**Minor**

Mitigation Hierarchy	Management Plan	Impacts mitigated	Impact Category	Biodiversity Risk
	Action 3b) Water sprinkling for the vehicular dust and fugitive emissions during operations Action 3c) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary Action 3d) Regular care and maintenance for vehicles and drilling equipment	stresses and diseases; lower reproductive success, and possible mortality.		
	Action 7: Increasing the High-Density Polyethylene (HDPE) lined pit wall's height	**Impact 8:** Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.	Medium	**Minor**
	Action 9: Construction of floating treatment wetlands and reusing the top soil	**Impact 12:** Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil.	Low	**Minor**
		Impact 13: Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings, which may affect local floral and faunal species and ecosystems.	Medium	**Minor**
	Action 11: Prevention of animal - human conflict	**Impact 15:** Decreased habitat use and increase in the roadkill of native fauna/ livestock.	Very high	**Severe**
	Action 11a) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary Action 11b) Studying	**Impact 16:** Damage to existing nearby flora	Very high	**Severe**

Mitigation Hierarchy	Management Plan	Impacts mitigated	Impact Category	Biodiversity Risk
	animal mortality due to collision with vehicles Action 11c) Installation of reflective signboards Action 11d) Installation of reflective speed breakers and adding speed limit regulations Action 11e) Preventive measures to minimize Human-Animal conflict on encountering wild animals			
	Action 12: Safe practices using groundwater resources	**Impact 17:** Over use of ground water may lower the ground water table	Low	**Minor**
		Impact 18: During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.	Medium	**Minor**
Avoidance and Minimization	**Action 10: Use of dark sky friendly lighting practices**	**Impact 14:** Illumination with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like 1) they might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals	Low	**Minor**
Minimization	**Action 4: Construction of floating treatment wetlands**	**Impact 4:** Wastewater and formation water will be generated during drilling activity and the domestic wastewater from the labor camps, which may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality.	Medium	**Minor**

Mitigation Hierarchy	Management Plan	Impacts mitigated	Impact Category	Biodiversity Risk
		Impact 5: Surface runoff from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is likely to be contaminated and have the potential to impact the water quality of the receiving waterbody. This will affect the ecologically sensitive areas of the waterbody like migratory and resident bird habitats, fish habitats, breeding and nursing ground for fishes, and the habitat of the Gangetic Dolphin. Degradation of water quality will affect the primary productivity of the river.	Medium	**Minor**
	Action 5: Solid waste management plan for the ERD locations	**Impact 6:** Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, and e-waste and municipal waste affects the soil microbes and bacterial growth and can affect the soil quality	Medium	**Minor**
		Impact 9: Kitchen Waste from Labor camps if not disposed properly can attract rodents, snakes, monkeys etc. that may lead to human wildlife conflict on the site.	Low	**Minor**
	Action 6: Preventive measures for contamination due to accidental spillage	**Impact 7:** Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.	Low	**Minor**
	Action 13: Construction underpass for water below the approach	**Impact 19:** Alteration of onsite micro drainage pattern leading to potential problems of water logging in the agricultural land	Low	**Minor**

Mitigation Hierarchy	Management Plan	Impacts mitigated	Impact Category	Biodiversity Risk
	road	and low-lying areas, which may affect habitats of reptiles, and mortality of floral species.		
Restoration	**Action 14: Restorative Practices after decommissioning**	**Impact 10:** Change in Land use and species composition along with loss of native vegetation.	Very high	**Severe**
Offset	**Action 8: Offset plantations with Native species and offset monitoring.**	**Impact 10:** Change in Land use and species composition along with loss of native vegetation.	Very high	**Severe**
		Impact 11: Faunal dispersal and loss of feeding ground.	High	**Moderate**
In case of extreme events				
Action 15: Formation of wildlife rescue teams and creating a network of veterinary hospitals and refuge sites **Action 16: Clean-up of Oil spill on surface water**				
Additional Conservations Efforts				
Action 17: Connecting fragmented forests and homestead plantations for Hoolock Gibbon populations				

As three of the identified risks, i.e. Impact 10, Impact 15, and Impact 16 fall in the 'Severe category' in the biodiversity risk matrix, it can be concluded that the overall risk for the given study on Biodiversity is 'HIGH'.

In case of extreme events such as blowouts, as four of the identified risks, i.e. Impact 23, Impact 24, Impact 26, and Impact 29 fall in the Severe category in the biodiversity risk matrix, along with above mentioned three impacts, it can be concluded that the overall risk for the given study on Biodiversity is 'HIGH'.

With the implementation of the actions in the management plan recommended, the anticipated impacts can be minimized.

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BIODIVERSITY IMPACT ASSESSMENT REPORT

Biodiversity Impact Assessment Report

Introduction

The activities associated with Oil and gas exploration, development and production generate diverse range of environmental changes and many times these changes are irreversible. The most common environmental problems associated with industrial activities are conversion of land, deforestation, soil erosion, disturbance to surface and ground water hydrological system of the area, visual intrusion, water, air, and noise pollution and reduction of faunal and floral diversity, health and resource.

This report illuminates, identified and assessed the potential impacts on the environment that could be anticipated from the planned oil & gas exploration drilling activity in ERD Surface Locations in Baghjan Petroleum Mining Lease (PML), Tinsukia District.

Biodiversity Impact Assessments are standard processes of analyzing the impacts or potential impacts of projects on the existing environment. Through identifying the type and magnitude of impact, measures can be developed to mitigate impacts.

Project Background

In exercise of powers conferred under sub-section (1) of Section 22 of the Biological Diversity Act, 2002 (Act 18 of 2003), the Government of Assam constituted the 'Assam State Biodiversity Board' on 29th September 2010 to promote biodiversity conservation in the State of Assam, sustainable use of its components, equitable sharing of benefits arising out of the use of biological resources of the state and traditional knowledge associated with these resources, and matters incidental thereto or connected therewith.

Oil India Limited (OIL), a Government of India Navaratna Enterprise, is currently engaged in carrying out exploration activities for hydrocarbon in its operational areas of Upper Assam, Arunachal Pradesh and Mizoram in the North Eastern part of India. OIL has significant presence in pan-India and overseas. Following the discovery of oil and gas in Baghjan area (2003) by OIL, extensive geoscientific works have been carried out through 3D seismic survey. Around 75 sq. km. of Petroleum Exploration License (PEL) area was converted into Baghjan Mining Lease (ML) and OIL has so far drilled 19 wells. Currently, 5000 bbl. of oil has been produced from this field per day.

Be that as it may, the Assam State Biodiversity received a copy of the order of the Hon'ble Supreme
Court in I.A. No.3934 in W.P. (Civil) No. 202 of 1995, dated 07.09.2017, which directed as follows:

"OIL will carry out Biodiversity Impact Assessment Study through Assam State Biodiversity Board,
for which budgetary offer have already been obtained on 12th May 2017."

Earlier, the Assam State Biodiversity Board received a communication on 28.01.2017 from Oil India Limited, calling for a budgetary offer/estimate for undertaking of a 'Biodiversity Impact Assessment

Study' for the 7 nos. Extended Reach Drilling (ERD) wells proposed beneath the Dibru-Saikhowa National Park (DSNP). In response thereto, the Assam State Biodiversity Board sent a budgetary offer for consultancy services, to the Oil India Limited, Duliajan on 12.05.2017 for undertaking the aforesaid study. However, the Assam State Biodiversity Board did not immediately receive any acceptance of this offer from the Oil India Limited.

On the aftermath of the oil-well blowout at Baghjan, that the Assam State Biodiversity Board received an email communication from the General Manager (HSE), S&E Department, Oil India Limited, Duliajan on 21.08.2020, requesting it to submit a fresh budgetary proposal for 'Biodiversity Impact Assessment Study' for drilling of the proposed 7. Nos. Extended Reach drilling wells, beneath the Dibru Saikhowa National Park, Assam. In response to this email, the Assam State Biodiversity Board sent its reply on 29.08.2020 which explained the Board's position as below:

"In the backdrop of the critical and extraordinary situation prevailing around the Baghjan / Dibru- Saikhowa / Maguri-Motapung Beel area on the aftermath of the oil-well blowout, it would not be possible for the Assam State Biodiversity Board to undertake any 'Biodiversity Impact Assessment Study', till the environmental crisis in and around Baghjan / Dibru-Saikhowa / Maguri-Motapung Beel area is fully mitigated by M/s. Oil India Limited."

In response to the Assam State Biodiversity Board's communication dated 29.08.2020, a letter from Oil India Limited was received on 14.12.2020 by email, seeking confirmation from the Assam State Biodiversity Board on undertaking the Biodiversity Impact Assessment Study at the proposed site, now that the Baghjan well No.5 crisis was over.

Accordingly, the Board sent a reply to the Oil India Limited on 30.12.2020, proposing the roadmap and modalities for carrying out the 'Biodiversity Impact Assessment Study', and followed it up with another clarification on 28.01.2021. The Board received confirmation from the Oil India Limited for the proposed road-map for undertaking the Biodiversity Impact Assessment wide communications dated 12.01.2021 & 02.02.2021.

After acceptance of the proposal for the 'Biodiversity Impact Assessment Study', by the Oil India Limited, the Assam State Biodiversity Board sought to partner with the International Union for Conservation of Nature (IUCN) for the study, in view of the fact that the said organization is an internationally reputed organization having expertise in the area of conservation of rare, threatened & endangered species of flora and

fauna, across the world. Accordingly, a communication was addressed to the IUCN on 03.02.2021, and acceptance by the IUCN was conveyed on 08.02.2021. Thereafter, a draft tripartite MoU along with the budgetary estimate was communicated to the Oil India Limited on 17.02.2021. The Oil India Limited suggested a few modifications to the draft tripartite MoU on 23.02.2021, and again on 03.03.2021, which basically related to the payment terms, taxes, other expenditure to be incurred etc. The said modifications were communicated to the IUCN on 03.03.2021, and the draft tripartite MoU was accordingly revised.

The 'tripartite MoU' was finally signed on 04/05/2021 between the Assam State Biodiversity Board, International Union for conservation of Nature and Natural Resources (IUCN) and the Oil India Limited, after Model Code of Conduct (MCC) pertaining to the Legislative Assembly Elections, 2021 was lifted. The study at this point of time is ongoing.

Under the guidance of Assam State Biodiversity Board, IUCN will go beyond the compliance by conducting biodiversity impact assessment study as well as developing a Comprehensive Biodiversity Management plan with its implementation strategy and framework. IUCN will be using its Global biodiversity mapping tools like IBAT and other guiding and knowledge products to ensure the robust data collection and management.

OIL intends to drill seven (7) extension/appraisal locations in the riverbed areas of Dibru River alongside Dibru-Saikhowa National Park (DSNP). All seven locations will be drilled from three surface well pads viz. PAD 1, PAD 2 and PAD 3 of Baghjan ML located at a minimum distance of 1.3 km outside the boundary of the DSNP. The seven wells will be drilled from the proposed drill pads through Extended Reach Drilling (ERD) Technology. The target depth of each of the seven wells is planned to be 3950 m (TVD). Once hydrocarbon is established in this area, it is expected to enhance the cumulative oil production of OIL adding to the national economy.

Scope of the study

The major scope of the study is to conduct a Biodiversity Impact Assessment and prepare a Biodiversity Management Plan. This is an exhaustive study that includes on-site as well as desk work. It includes three main components – ecological assessment, biodiversity impact assessment and ecosystem services review. Based on the learning of these components, various strategies and action plans will be suggested to mitigate impact, enhance and conserve biodiversity.

Type of the Project

Oil India Limited (OIL), a Government of India Navaratna Enterprise, is currently engaged in carrying out exploration activities for hydrocarbon in its operational areas of Upper Assam, Arunachal Pradesh and Mizoram in the North Eastern part of India. OIL has significant presence in pan-India and overseas. Following the discovery of oil

and gas in Baghjan area (2003) by OIL, extensive geoscientific works have been carried out through 3D seismic survey. Around 75 sq.km. of Petroleum Exploration License (PEL) area was converted into Baghjan Mining Lease (ML) and OIL has so far drilled 19 wells. Currently, 5000 bbl. of oil has been produced from this field per day.

Need of the Project

The project will help in achieving the energy requirement of India; thereby reducing the dependency of India on other countries, to an extent. Additionally, the project will help people living in neighboring villages in relation to direct & indirect employment associated with various project activities and will boost the local economy.

Project Location and Project Details

OIL intends to drill seven (7) extension/appraisal locations in the riverbed areas of Dibru River alongside Dibru-Saikhowa National Park (DSNP). All seven locations will be drilled from three surface well pads viz. PAD 1, PAD 2 and PAD 3 of Baghjan ML located at a minimum distance of 1.3 km outside the boundary of the DSNP. The seven wells will be drilled from the proposed drill pads through Extended Reach Drilling (ERD) Technology. The target depth of each seven wells is planned to be 3950 m (TVD). Once hydrocarbon is established in this area, it is expected to enhance the cumulative oil production of OIL adding to the national economy.

Typical well site details

For Biodiversity assessment, a combination of an area within a 10 km radius from the boundaries of the PAD 1, PAD 2 and PAD 3 was considered as study area. For the convenience of the survey, the entire study area is divided into grids of 4 x 4 Km. Study plots are laid in each grid to record the present biodiversity and observe ecological conditions. (Refer Figure 2, Pg.30). A total of 29 study plots and 4 transects were laid in the study area. Line Transects was considered to document the diversity in the Ecological Sensitive Areas. Environmental settings of the ERD surface locations, i.e. well pads are as follows:

PAD 1: The well pad is located in Baghjan village, Doom Dooma revenue circle under Tinsukia district. The topography of the area is flat. The site has an established approach road, facilitating the transport of the drilling rig, equipment, and materials. The habitat of this well pad is categorized as a cropland/pastureland. The presence of Baghjan settlements is observed in the vicinity of the well pad location.

PAD 2: The well pad is located in Baghjan village, Doom Dooma revenue circle under Tinsukia district. The topography of the area is flat. The site has an existing approach road that allows for easy transportation of the drilling rig, equipment, and materials. There is an earthen road passing through the village, connecting the approach road to the well pad. The habitat of this well pad is categorized as home backyard. The presence of Dighaltarang and Baghjan settlements is observed in the vicinity of the well pad location.

PAD 3: The well pad is located in Dighaltarang Tea Estate, Doom Dooma revenue circle under Tinsukia district. Thetopography of the area is flat. The site has an existing approach road that allows for easy transportation of the drilling rig, equipment, and materials. It will pass through nearby tea estates. The habitat of this well pad is categorized as Tea Plantation. The presence of Dighaltarang settlements is observed in thevicinity of the well pad location.

Salient Features of an exploratory Well:

Table 2: SALIENT FEATURES OF AN EXPLORATORY WELL

Type of Well	Depth of Well	Water Consumption	Drill Cutting	Drilling Fluid
Exploratory	3900 m	3600-4800m^3	350-400m^3	900-1200m^3

Size or Magnitude of Operation

The study area is situated in Baghjan Village, Doom Dooma revenue circle, Tinsukia District of Assam. The seven subsurface locations are located within Dibru-Saikhowa National Park (DSNP). The seven wells will be drilled from three surface well pads within Baghjan Petroleum Mining Lease (PML). The three surface locations are present in Dighaltarang and Baghjan villages in Doom Dooma revenue circle under Tinsukia District. The ERD surface locations can be accessed from the NH-37 through Doom Dooma-Baghjan Road and is about 22 km from Doom Dooma.

Three wells are planned to be drilled from the surface locations PAD 1, PAD 2, and from PAD 3. Each well site is estimated to require an area of around 3.2 hectares. The drilling operations will target a depth of 3900 meters below ground level. The drilling and testing activities at each site is anticipated to take three to four months at each well site. Table provided below illustrates site details for the Surface and Subsurface ERD locations.

ERD sites distances from Priority Biodiversity Features

Table 3 : ERD SITES DISTANCES FROM PRIORITY BIODIVERSITY FEATURES

Plinth Name	Location	Village, Revenue circle	Existing Land use	Accessibility	Ecological Sensitive Zone in Kms				Settlements in the surrounding
					Dibru River	Bherjan WLS	Podumoni WLS	Maguri Beel	
PAD 1	27.593769 95.384482	Baghjan, Doom Dooma	Cropland/ pastureland	An unnamed road is just 0.55 km away, which later meets to Gelapukhuri road.	3.1	6.4	8.3	1.6	Settlement of Baghjan within 0.08 km (NE)
PAD 2	27.599916 95.404428	Baghjan, Doom Dooma	Home Backyard	An earthen road is through the village is just beside the site.	2.6	7.6	10.5	2.11	Settlement of Dighaltarang within 0.45 km (NE) & Baghjan Gaon within 0.05 km south
PAD 3	27.612782 95.414843	Dighaltarang, Doom Dooma	Tea Plantation	There is a road through tea garden, beside the	2	9.3	12.5	3.6	Settlement of Dighaltarang within 0.15 km (SW) & Dighaltarang

				well location.					T.E. 121/122/118 within 0.07 km south
Location A	27.603265 95.366276	DSNP	Riverbed	Boat travel from Guijan Ghat	1.3	7.5	8.1	2.7	Settlements of Baghjan Gaon within 1.4 km south
Location B	27.605741 95.374595	DSNP	Riverbed	Boat travel from Guijan Ghat	1.2	7.7	9.1	3	Settlements of Baghjan Gaon within 0.9 km south
Location C	27.612961 95.373864	DSNP	Riverbed	Boat travel from Guijan Ghat	0.4	8.7	9.5	3.5	Settlements of Baghjan Gaon within 1.6 km south
Location D	27.613475 95.383092	DSNP	Riverbed	Boat travel from Guijan Ghat	0.3	8.8	9.9	3.7	Settlements of Baghjan Gaon within 1 km south
Location E	27.618875 95.385301	DSNP	Riverbed	Boat travel from Guijan Ghat	0	9.4	10.5	4.2	Settlements of Baghjan Gaon within 1.2 km south
Location F	27.618095 95.391687	DSNP	Riverbed	Boat travel from Guijan Ghat	0.1	9.1	10.9	4.1	Settlements of Baghjan Gaon within 1.1 km south
Location G	27.621662 95.401668	DSNP	Riverbed	Boat travel from Guijan Ghat	0.4	9.8	12	4.5	Settlements of Baghjan Gaon within 1.1 km south

Locations of ERD subsurface wells from ERD surface well:

Table 4 : LOCATIONS OF ERD SUBSURFACE WELLS FROM ERD SURFACE WELL

ERD Surface locations	PAD 1	PAD 2	PAD 3
ERD sub-surface locations (Below)	Distance in km		
Location A	2	3.8	4.9
Location B	1.6	3	4.1
Location C	2.4	3.4	4
Location D	2.1	2.6	3.1
Location E	2.7	2.8	3
Location F	2.7	2.4	2.3
Location G	3.5	2.4	1.6

Resource requirement for the Project

Land Requirement

During the site selection process, all legal requirements will be considered and surface location of the exploratory well will be finalized. Three wells each will be drilled from PAD 1 and PAD 2 surface locations and one well will be drilled from PAD 3. It is estimated that about 3.2 ha. area would be required for each of the well sites. Individual sites will be duly fenced to a height of about 2 m using jingle wired fencing or Expanded metal fencing. The drilling of the wells is expected to be up to a target depth of 3900 meters below ground level.

Water Requirement

During the drilling operations, water requirement at a drill site is expected to be 50 m^3 per day. The water requirement at the drilling sites during construction and drilling phase will be met groundwater after obtaining necessary permission. Approximately, 5 m^3 per day water will be required for construction and 3 m^3 per day for workers during construction phase. Potable water requirement at site will be met through packaged drinking water. As mentioned in the EIA for Drilling of ERD Locations in Tinsukia, Assam, in addition, a water storage pit of around 1000 m^3 is proposed to store water for fire water supply the likely source being surface water.[1]

Power Requirement

The power requirement for each drill site will be met through the 125 KVA DG Sets. Two DG sets, each of 1000 KW capacities, will be simultaneously operated and one will be kept as standby during drilling operation, Lighting and other power requirements at drill sites will be met through 200 KW DG sets. It is estimated that 3.5 KLD of diesel will be required during drilling phase.[1]

Manpower requirement

The drilling rig will be operated by approximately 50 persons on the rig at any particular time. The manpower will operate in two shifts with continuous operations on the rig. This will include technical experts (including expats), who will be responsible for various drilling related activities and some local workers who will be hired from nearby villages for the entire duration of the Project.

Drilling Mud

During drilling operations, a drilling fluid referred to as "mud" is pumped down through the drill string to the drilling bit and returns between the drill pipes. The decision has been made to use a uniform water- based mud system for all forthcoming drilling operations in the proposed wells. Mud used during the operation will flush out formation cuttings from the well hole. These cuttings will be separated from the drilling mud using a solids control and waste management package. Each exploratory well will produce 350-400m^3 Drill Cuttings and 900-1200m^3 of Drilling Fluids (Mud). Waste mud will be

tested for hazardous contaminants and disposed according to Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Management Plan will be made in accordance with S No. 72
C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.[1]

Technology and Process description (with drilling Rig sketch)

Drilling of Exploratory well

The exploitation of hydrocarbons requires the construction of a conduit between the surface and the reservoir. This is achieved by the drilling process. The exploration and development wells will be drilled using a standard land rig or a "Mobile Land Rig" with standard water-based drilling fluid treatment system. This rig will be suitable for deep drilling up to the desired depth of 3900 meters as planned for the project.

Well development and production phase

Extended reach technology can be used to develop long-reach wells that can extend horizontally for kilometers underground. By using this technology, previously inaccessible resources lying at the sub- surface of the DSNP can be explored during the current drilling Programme.

During drilling operations, a fluid known as drilling fluid (or 'mud') is pumped through the drill string, down to the drilling bit and returns between the drill pipe –casing annulus up to surface back into the circulation system after separation of drill cuttings /solids through solids control equipment. Mud used during the operation will flush out formation cuttings from the well hole. The total amount of cuttings produced during the entire drilling period is projected to be about 350-400 m3 per well (approximately 770-880 MT).

Once the cuttings have been separated, the drilling fluid will be reused or processed after further treatment in a Chemically Enhanced Dewatering (CED) system designed to remove suspended solids that are too fine for mechanical separation in solids control package producing inlet particles called 'flocs'. The flocs will be removed in the decanting centrifuges and the resultant sludge disposed of in High Density Polyethylene (HDPE) lined pits (of approximately 800 m3 area) for each well. The cleaned wastewater will also be stored in HDPE lined pits and disposed of, after testing and any necessary treatment, to meet the regulatory requirements. The whole process by which the drilling fluid will be reused during the drilling operation is commonly known as a "closed loop system."

Various components of the drilling mud will be selected carefully to be able to provide desired properties to the mud. Mud chemicals will be added to the uniform mud system

[1] *EIA for Extension Drilling and Testing of hydrocarbons at 7 (seven) locations under Dibru-Saikhowa National Park Area. North - West of Baghjan PML under Tinsukia District, December 2019, Reference#0426932*

to adjust the mud properties and ensure fluid loss control/circulation, lubricity, shale inhibition, pH control and pressure control in the well during drilling.

Development of a Well[2]

Well Kick Situation

A kick is defined as an intrusion of unwanted fluids into the wellbore. This can happen when the formation pressure exceeds the effective hydrostatic pressure of drilling fluids. When a kick occurs, many warning signs can be noticed at the surface that indicates that the formation fluids have been flowed into the wellbore. These signs have to be analyzed properly in order to avoid any uncontrolled situation. The warning signs or indicators are divided into two categories: primary and secondary.

Table 5 : Primary and Secondary Signs of a Kick

Primary signs of a kick	Secondary Signs of a kick
• Pit volume increase	• Drilling Break
• Flow Rate Increase	• Pump Pressure Changes
• Flowing Well with Shut Off Pumps	
• Improper Filling-up During Tripping	

Blowout Situation

The formation fluids influx or the kick has to be controlled, if no action is taken, then the formation fluids can reach the surface generating what is called as a blowout. Blowout can lead to human life losses, rig and equipment losses, reservoir fluids losses, and cause environment damage. The blowout is an uncontrolled situation which has to be remedied rapidly, carefully and effectively.

Well Control

The formation fluids are basically prevented to flow into the well bore by two types of control:

The primary control: The main method of control to prevent formation fluids influx. It is performed by maintaining the hydrostatic pressure applied by a column of drilling fluids greater than the pore pressure. The positive differential pressure is called the overbalance.

The secondary control: when the primary control fails, the secondary control is required. The main purpose of this type of control is stopping the flow of formation fluids into the well bore and circulating them out of the well in a controlled way. The secondary control is started by closing the blowout preventer (BOP), then displacing the formation

[2] *https://www.drillingcourse.com/2016/01/introduction-to-well-control.html*

fluids using heavy drilling fluids which are circulated into the drill string, down to the bottom then up to the surface.

Proposed Hole size/Casing Programme

The spudding-in well is the start of drilling activity. The top-hole section will be drilled to a desired depth based on well design. After drilling the top-hole section, it will be cased with a pipe called “Casing”. Casing provides support to hole wall and secures hole section. Other than that, it isolates the problematic hole sections such as loss zones, shale sections, over pressurized formations, etc. After running the casing, space between the hole wall and “Casing” will be cemented. This process of drilling and casing the hole section will continue until the final well depth (target) is achieved.

Surface testing and Flaring

Testing & Flaring will be undertaken in accordance with the CPCB Guidelines for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry. Flaring of gases primarily during the drilling testing phase will contribute to air pollution. Flaring will involve high temperature oxidation process to burn combustible gases that may be generated from the proposed well sites. Emissions from flaring will include CO_2, carbon particles (soot), unburnt hydrocarbons, CO and other partially burned or altered hydrocarbons, NO_x. Since sour gas1 and mercaptans are not expected, so SO_2 would not be considered as a priority pollutant. The flaring will only be intermittent and will not last for more than a few days.

Collection and Transportation of Produced Oil and Gas

This is not applicable since it is an exploration project.

<u>Details of Site Utilities</u>

Site Preparation

Site preparation will involve levelling, filling and consolidation of the site for staging equipment and machinery. Individual sites will be duly fenced to a height of about 2 m using jingle wired fencing or Expanded metal fencing. Clearance of vegetation is the first activity that will be undertaken during drill site construction. Following this, the preparation and construction of drill site will involve topsoil scraping and storage for future use; and elevating the drill platform by excavated material from the drill site and authorized quarry area. Reinforced Cement Concrete (RCC) will be used for the construction of foundation system. For making foundations of the main rig structure, cast in-situ bored under- reamed piles of specified lengths will also be used.

Approach Roads

The proposed well pads are located adjacent to the existing road; the distance of the proposed well pad will be of 200 m (maximum) from existing road. Construction of site access road will not involve displacement of any household. As far as possible,

existing roads will be used. Cutting of trees will be avoided. If necessary, existing road will be modified by widening, etc. Culverts and drainage channel will be maintained during site preparation. In case roads are not available; approach road will be constructed by contractors appointed by OIL.

Installation of facilities

Earthwork

After clearance of vegetation, top soil from non-paved areas of the drill sites site will be scraped and stored in the top soil storage area for future use. Once the top soil removal process is completed, levelling and compaction will be done with help of graders and mechanical rollers. Quantity of fill material required for each drill sites depends upon the site elevation and HFL. Fill material will be met from excavated material for pit required for drill site and balance amount will be sourced from authorized quarry area.

Reinforced Cement Concrete (RCC) will be used for the construction of foundation system. For making foundations of the main rig structure, cast in-situ bored under-reamed piles of specified lengths will also be used. For the construction of a drill site, a total of about 2500 kg of cement, 5000 kg of sand, 500m^3 of earth/fill material, 200 kg steel and 1000m^3 of aggregate will be required. A backhoe will be used for all excavation and cutting activities (for construction of pits) on site. Subsequently, the proposed well site & campsite will be duly fenced to a height of about 2 m using jingle wired fencing or Expanded metal fencing.

Site preparation will also involve the following:

- Construction of cellar pit 1.85m X 2.15m X 1.5 m for installation of well head and BOP
- Construction of HDPE lined pit of ~800m^3 for each well site for temporary storage and disposal of drill cutting
- Construction of HDPE lined pit of 3030 m^3 for temporary storage and disposal of drilling wash water & waste mud (800 m^3) and rain water (2230 m^3)
- Septic tanks and soak pits to dispose the domestic wastewater at the drill site.

Surface drainage

Surface runoff during monsoon season from operating construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.

Drainage system at site needs to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff. Cross drainage structures should be constructed in the approach road for drainage of run-off.

Fuel & Chemical Storage Area

Chemicals required for the preparation of drilling fluid will be centrally stored in Duliajan. Additionally, some chemicals will also be stored in the drill site. The storage area will be paved and bunded and will be provided with a shed. Diesel will also be stored at site within paved and bunded areas.

Waste Oil Collection, Storage and Disposal System

The project design considers construction of a HDPE lined impervious pits for storage of drill cuttings, drilling mud and drilling fluid respectively and their disposal in accordance with "CPCB Oil & Extraction Industry Standard – Guidelines for Disposal of Solid Wastes" in their planning stage.

Spill Containment system

In the event of a chemical spill, spill control materials and protective equipment should be in a readily accessible location within or immediately adjacent to the site. The management needs to provide spill containment bladders and valves that can be retrofitted to existing drainage systems in short time interval.

Water & Drilling Fluid Storage Pit

Cuttings will then be stored in the High-Density Polyethylene (HDPE) lined pits. Drilling fluid will be reused or processed after further treatment in a Chemically Enhanced Dewatering (CED) system to remove fine suspended solids, producing inlet particles called 'flocs'. The flocs will be removed in the decanting centrifuges and the resultant sludge disposed of in HDPE lined pits (of approximately 800 m3 area) for each well. The cleaned wastewater will also be stored in HDPE lined pits and disposed of, after testing and any necessary treatment, to meet the regulatory requirements.

A closed loop system will be used for reusing the drilling fluid during the drilling operations. This system will cut down immensely on the total water consumption for the formulation of drilling mud and save on the consumption of chemicals.

Drilling wastewater including drill cuttings wash water shall be collected in HDPE lined disposal pit, evaporated, treated, and shall comply with the S No. 72, Schedule I-Standards for Emission or Discharge of Environmental Pollutants from various industries.

Drill Cuttings Disposal Pit

During the site development construction of HDPE lined pit of ~800m3 for each well site for temporary storage and disposal of drill cutting will take place. The total amount of cuttings produced during the entire drilling period is projected to be about 350-400 m3 per well (approximately 770-880 MT).

Domestic Sewage Treatment & Disposal System

During the site development construction of HDPE lined pit of 3030 m3 for temporary

storage and disposal of drilling wash water & waste mud (800 m3) and rain water (2230 m3) and Septic tanks and soak pits to dispose the domestic wastewater at the drill site will take place. Domestic wastewater generation of about 8.0 m3 per day for the drilling camp will be treated through a septic pit/soak tank arrangement.

Post Drilling Operations- Abandonment & Restoration

Demobilization & Decommissioning

Well Capping- Removal of Equipment & Materials

After completion of the drilling activity, partial de-mobilization of the drilling rig and associated infrastructure will be initiated if OIL does not strike gas after drilling at the required depth.

The complete demobilization of the facilities at site will happen after well testing has been completed. This will involve the dismantling of the rig, all associated equipment and the residential camp, and transporting it out of the project area. It is expected that demobilization phase will last about 10-15 days and will involve the transportation of materials, equipment and other materials from site to bring it back to original condition.

Restoration of Cutting Containment Area

Following steps will be typically involved to restore and rehabilitate the area:

- The wellhead and all casing string will be cut off to a minimum depth of 3 m (10 ft.) below ground level. Drill cuttings and drill mud will be treated as per G.S.R 546 (E) dated 30th August 2005 to render them harmless.
- Drilling wastewater including drill cuttings wash water shall be collected in HDPE lined disposal pit, evaporated, treated, and shall comply with the S No. 72, Schedule I-Standards for Emission or Discharge of Environmental Pollutants from various industries.
- All fencing and access gates will be removed.
- All pits whose contents will show regulatory compliance for on-site disposal, at the time of site closure, will be backfilled and closed out as per Hazardous and other Waste (Management and Transboundary Movement) Rules, 2016.
- Restoration of unusable portion of the access track, removal of pilings will take place.

Restoration of Well Sites

Decommissioning upon Abandonment

On completion of activities, the exploratory wells will be either plugged and connected with flow lines or suspended. In the event of a decision to suspend the well, it will be filled with a brine solution containing very small quantities of inhibitors to protect the well. The well will be sealed with cement plugs and a few wellhead equipment (Blind Flange) left on the surface (Cellar). After the development activities, the well will be

sealed with a series of cement plugs, all the wellhead equipment will be removed leaving the surface clear of any debris and the site will be restored.

Traffic Volumes

It is estimated that about 60 truckloads will be transported out of site during this period.

Sources of Pollution

General

- Organic kitchen waste produced 10-20 kg per day will be disposed in compost pits on daily basis that will be buried during site closure.
- About 2 to 3 Acid – lead batteries per drilling of well, will be recycled through the vendors supplying acid – lead batteries as required under the Batteries (Management & Handling) Rules, 2001.
- Used oil & spent Oil will be collected in metal drums kept in secured dyked area & disposed through approved used oil recycling facility.
- Proper segregation and storage of recyclable waste such as packaging wastes, paper, plastic, packaging wastes will be carried out in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.

Wastewater Generation and Disposal

Domestic Wastewater

Domestic wastewater generation of about 8.0 m3 per day for the drilling camp will be treated through a septic pit/soak tank arrangement.

Air Emissions

Point sources emissions are expected from the proposed drilling mainly from sources such as combustion of diesel in the diesel engines of power generators that will be operated to meet power requirement of the drilling rig and the campsite. The principal pollutants will comprise of Particulate Matter (PM), Sulphur Dioxide (SO2) and Oxides of Nitrogen (NOx) and other Hydrocarbons (HC). The quantity of diesel consumption during drilling will be approximately 3.5 KL /day/drilling site. Additionally, the flaring and burning of gas during the testing of well will also lead to the release of some pollutants including un-burnt hydrocarbons to the atmosphere. Some fugitive emissions of dust and air pollutants from vehicular exhaust will also happen during the Project lifecycle, mostly during the construction and decommissioning activities. Additionally, there will be re-entrainment of dust from the approach road leading to the site mainly during the dry season. If hydrogen sulfide is found then appropriate measures will be taken as outlined in the safety protocol and in accordance to Industrial Best Practice.

Solid Waste

Drilling Mud

Drilling mud will be mainly composed of Barite, Bentonite and Traces of Heavy metals. About 900- 1200 m3 drilling mud, will be tested for hazardous contaminants and will be disposed as per S No. 72
C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.

The drilling wastewater around 270-360 m3 will be generated during the entire drilling period from rig wash and dewatering of spent drilling mud.

Drill Cuttings

Drill cuttings will be mainly composed of inert material consisting of shales, sands and clay; about 1% of drilling mud. About 350-400 m3 drill cuttings produced per well, will be disposed off in a well- designed pit lined with impervious liner located on site as per S No. 72 C.1.a Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB as modified in 2005.

Waste Pit Details

The rig wash water and drilling wastewater generation is proposed to be collected in a wastewater pit (constructed at the drilling site). Domestic wastewater generation of about 8.0 m3 per day for the drilling camp will be treated through a septic pit/soak tank arrangement.

To ensure that effluent from the project comply with the waste water discharge standards as mentioned in the S No. 72 A (ii) Schedule I Standards for Emission or Discharge of Environmental Pollutants from Oil Drilling and Gas Extraction Industry of CPCB, a mobile Effluent Treatment Plant will be installed. The plant would be capable of handling 125m^3/day of drilling effluents.

Noise Levels

Noise will be produced during different stages of the project, including site preparation, drilling and decommissioning phases. In the drilling and testing phase, major source of noise would include the operation of rotary drilling equipment as part of rig, diesel engines for power generation, mud pumps and operation of vehicles. Noise during the site preparatory phase will primarily be contributed by heavy construction machinery operating on site and vehicular sources for constructing the facilities for wells. During the drilling phase, noise would be generated from operation of the rig, mud pumps, diesel generators and shale shakers.

The Biodiversity Baseline and Priority Biodiversity Features

Ecological assessments of Flora and Fauna for forming a Biodiversity baseline

Ecological assessment includes the compilation of baseline data, collected through literature reviewand field survey, about the biodiversity and ecosystems, of the study area. It involves off-site as wellas on-site studies where data collection will be carried out. It comprises of three main sections –Background studies, primary data collection and preparation of a Biodiversity richness map of thestudy area.

Background Studies

In the preparatory phase of the assessment, desk studies were carried out to move forward to the baseline study. Secondary records were collected regarding the bio-geographical conditions of the study area, from various sources. This involves information such as the geographical location of the site, layout maps of the core, the land-use pattern of the study area (10 km radius), etc. Previous documentation of the biodiversity of the region, documents such as environmental impact assessmentand monitoring reports were obtained from the client. After a comprehensive study of the project site, the primary data collection was initiated.

Primary Data Collection

The primary data collection entails all the information on biodiversity at the sites and in the entire project area. It includes the baseline data collection as well as information obtained from the variousstakeholders identified in the social interactions. Data on the flora and fauna in the area under 10 kmradial distance of the PAD 1, PAD 2, and PAD 3 was collected on the field. Baseline data collection wascarried out for two seasons. The study locations were chosen using a stratified random sampling approach. To document biodiversity, standard ecological sampling techniques were used. such as the quadrat method for flora and point count and line transect method for fauna. The flora assessments utilized methods such as quadrat method whereas fauna utilized line transect method.

Figure 1 : Boat Survey in Maguri Motapung Beel

Table 6 : METHODS FOR PRIMARY DATA COLLECTION

Methodology for biodiversity documentation		
Flora Survey	*Trees*	10m circular plot (List Count Method)
	Shrubs and Climbers	5m concentric circle (List Count Method)
	Herbs	1m x 1m quadrat
Fauna Survey	*Avifauna*	50m circular plot (Point Center Count)Aquatic: Total Count
	Herpetofauna	Intensive time constrained
	Mammals	Direct Sighting (Visual Encounter) Indirect sightings (droppings, scat, other tracts and signs)
	Fish	Fish Capture technique/Local fish market surveys
	Phyto and Zooplankton	Sampling and Fixation
	Other insects and Arachnids	Opportunistic sightings

Opportunistic sightings of all taxas were also documented for creating species richness of the study area. The different habitats were noted during the primary data collection.

For navigation and taking GPS readings, ‘Samsung A51’ device was used. For creating .kmz file of GPS points taken, android software titled ‘GPS essentials’ was used in ‘Samsung A51’ android device.

For making observations of biodiversity, for photo-documentation of flora and fauna, Canon 600D with 55-250mm Canon lens, Canon 80D with 150-600mm Tamron lens and Canon 700D with 100- 400mm Tamron lens.

For identification of fauna various field guides were used (Inskipp, 2011) and citizen science portals (Butterflies of India, BirdLife International) were also referred for taking expert help. For latest scientific names of flora, website https://www.theplantlist.org was referred.

Besides the baseline data on terrestrial flora and fauna, the aquatic biodiversity was documented. The number of samples was determined utilizing the background studies of the study area. The collection of samples was conducted in diverse water bodies located within a 10km radius. The samples were collected using standard ecological techniques employing plankton net. These samples were preserved using standard methods and were analyzed in the laboratory to identify the presence of phytoplankton, zooplankton and their diversity. Analytical measurements such as the calculation of the Simpson Diversity index as a part of the assessment were conducted. Terrestrial flora and fauna were analyzed using statistical tools of relative density and relative frequency.

Figure 2 : Terrestrial Survey at PAD 1

Secondary information on the data such as the conservation and protection status (IUCN and Wildlife Protection Act Schedules), distribution status (whether indigenous or exotic, in case of flora and whether resident or migratory, in case of birds), ecological significance, etc. was also collected off- site. This will further help in assessing the impacts of the operations and formulating management actions. **Socio-ecological**

surveys are best known to reveal information (including traditional) about biodiversity hold by the local communities. Information on the presence of biodiversity management committees, use of biodiversity in day-to-day life, the dependence of local people on biodiversity, etc. can be obtained from the socio-ecological surveys. Although tentative baseline data was collected by field surveys, it is sometimes difficult to directly obtain data on taxa such as mammals and reptiles.

In order to obtain in-depth data, socio-ecological surveys were conducted. The surveys include the knowledge of local communities for information on the biodiversity of the region, the use of biodiversity and their awareness about biodiversity. Further, information was also collated from the community conservation initiatives, reports by Government bodies and other such documents.

In order to devise alien invasive species population control methods, it is important to understand the extent of the population of alien invasive species found in the study area and the magnitude of nuisance caused by them to the local population.

Figure 3 : Team photographing ground birds at Podumoni Forest

Species Richness Map

A species richness map depicts the survey habitats of a study along with the number of species of all taxa observed in those habitats. It allows a comparative overview of the biodiversity present in the study area. Key areas such as national parks, wildlife sanctuaries and such protected areas are also depicted in this map. Areas not legally protected but of ecological concern such as roosting sites, breeding sites, migratory pathways, important bird areas, Ramsar sites, etc. are also marked on the map. This integrated biodiversity richness map uses the data collected and analyzed during the primary data collection.

Species Richness is the number of species of trees, shrubs, herbs, butterflies, birds, amphibians, reptiles and mammals recorded at a sampling site. In the given study area, 6 habitats were surveyed for flora and fauna diversity. Number of species recorded in both the monsoon and winter season helped us determine the richness of

the habitat.

Project Area (Description of project site)

The study area is situated in Baghjan Village, Doom Dooma revenue circle, Tinsukia District of Assam. The seven subsurface locations are located within Dibru-Saikhowa National Park (DSNP). The seven wells will be drilled from three surface well pads within Baghjan Petroleum Mining Lease (PML). The three surface locations are present in Dighaltarang and Baghjan villages in Doom Dooma revenue circle under Tinsukia District. The ERD surface locations can be accessed from the NH-37 through Doom Dooma-Baghjan Road and is about 22 km from Doom Dooma.

The study area is characterized by distinct ecological features, including Tropical Evergreen Forest, Tropical Semi Evergreen Forest, and Seasonal Swamp Forest. These features are representative of the North East Region biogeographic zone. [3]. The ERD surface and subsurface locations falls within the depositional plains of the River Brahmaputra and its tributaries. The elevation range varies between 110-130 m thus this area is relatively flat. This area falls in humid sub-tropical climate zone with warm seasons and moderately cold winters. The average annual temperature in Tinsukia is 23.7 °C; highest maximum temperature of 27.9 °C in monsoon and the minimum temperature can reach up to 10 °C in winters. It receives an average rainfall of about 2699 mm annually. Alluvial plains are the major physiography of the district followed by piedmont plain, flood plain and hilly terrain.[4]

For Biodiversity & Impact assessment, a combination of an area within a 10 km radius from the boundaries of the PAD 1, PAD 2 and PAD 3 was considered as study area. For the convenience of the survey, the entire study area is divided into grids of 4 x 4 Km. Study plots are laid in each grid to record the present biodiversity and observe ecological conditions. (Refer Figure 1, Pg. 27). A total of 29 study plots and 4 transects were laid in the study area. Line Transects was considered to document the diversity in the Ecological Sensitive Areas. Environmental settings of the ERD surface locations, i.e. well pads are as follows:

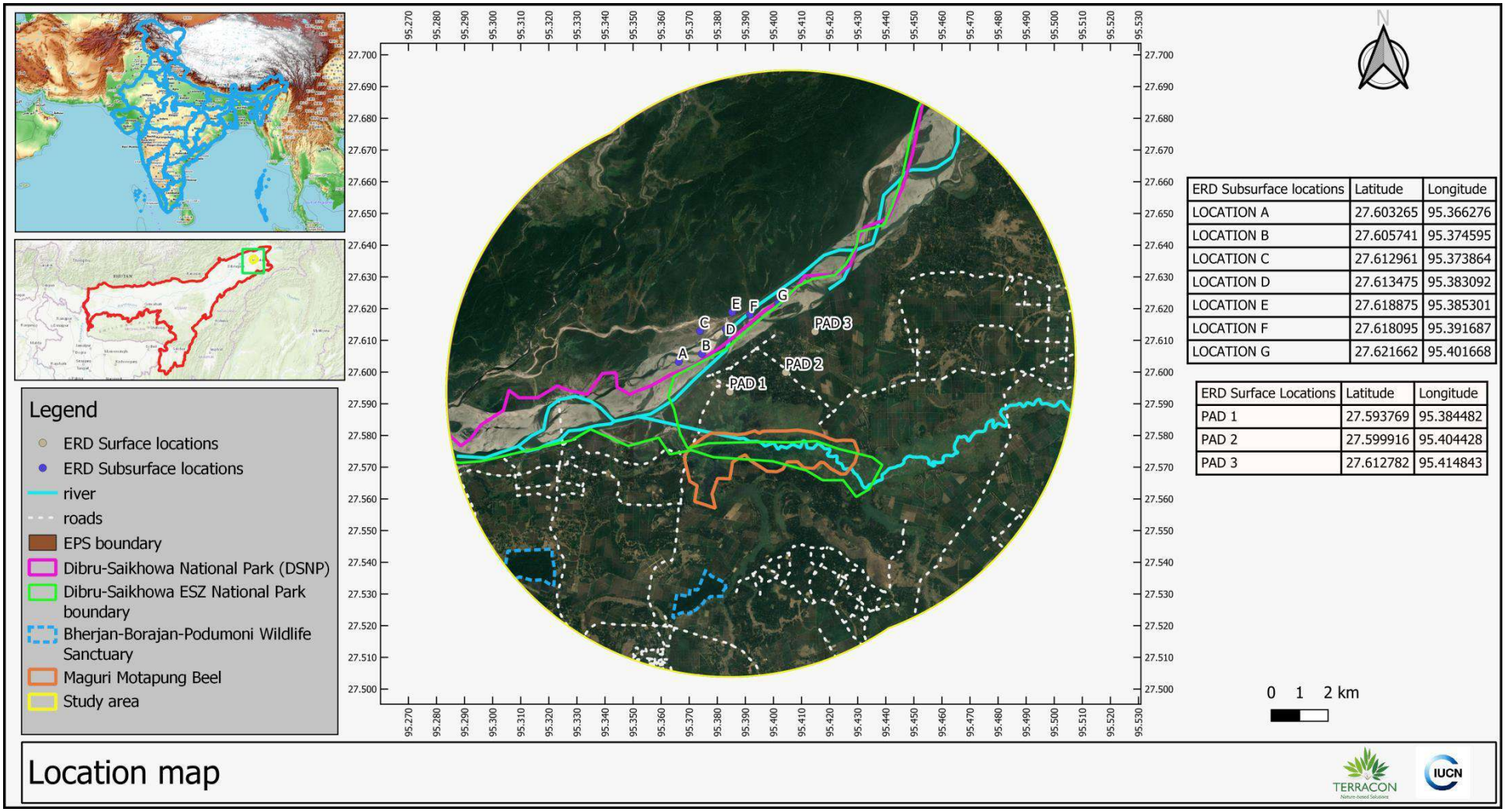
PAD 1: The well pad is located in Baghjan village, Doom Dooma revenue circle under Tinsukia district. The topography of the area is flat. Approach road to the site is already developed for the transport of the drilling rig, equipment and materials to the site. The habitat of this well pad is categorised as a cropland/pastureland. Presence of Baghjan settlements is observed in the vicinity of the well pad location.

PAD 2: The well pad is located in Baghjan village, Doom Dooma revenue circle under Tinsukia district. The topography of the area is flat. Approach road to the site is already developed for the transport of the drilling rig, equipment and materials to the site. An earthen road passing through the village connects the approach road to the well pad. The habitat of this well pad is categorised as grassland. The presence of Dighaltarang and Baghjan settlements is observed in the vicinity of the well pad location.

PAD 3: The well pad is located in Dighaltarang Tea Estate, Doom Dooma revenue

[3] Rodgers, W.A. and Panwar, S.H. (1988) Biogeographical classification of India. New Forest, Dehra Dun, India.
[4] https://slusi.dacnet.nic.in/srm/srmabstracts/SRM_39_Tinsukia.pdf

circle under Tinsukia district. The topography of the area is flat. Approach road to the site is already developed for the transport of the drilling rig, equipment and materials to the site. It will pass through nearby tea estates. The habitat of this well pad is categorised as Tea Plantation. Presence of Dighaltarang settlements is observed in the vicinity of the well pad location.



ERD Subsurface locations	Latitude	Longitude
LOCATION A	27.603265	95.366276
LOCATION B	27.605741	95.374595
LOCATION C	27.612961	95.373864
LOCATION D	27.613475	95.383092
LOCATION E	27.618875	95.385301
LOCATION F	27.618095	95.391687
LOCATION G	27.621662	95.401668

ERD Surface Locations	Latitude	Longitude
PAD 1	27.593769	95.384482
PAD 2	27.599916	95.404428
PAD 3	27.612782	95.414843

Figure 4 : LOCATION MAP OF STUDY AREA

Figure 5 : Location for PAD 1 – Cropland/ Pastureland from Season 1

Figure 6 : Location for PAD 2 – Home Backyard from Season 1

Figure 7 : Location for PAD 3 – Tea Plantation from Season 1

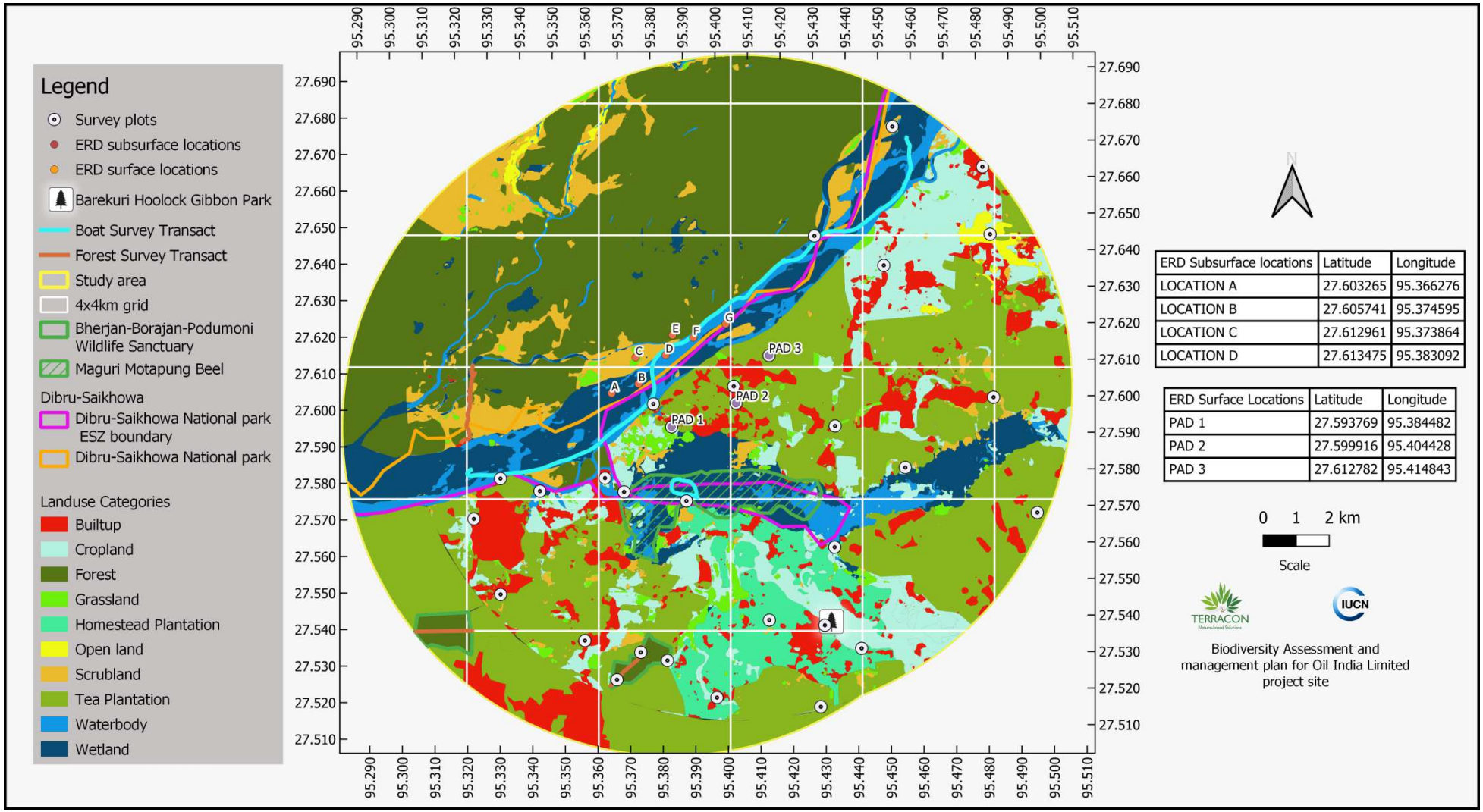


Figure 8 : LANDUSE MAP OF STUDY AREA WITH 4X4KM GRIDS

A land use map was prepared to understand the distribution of various habitats. The study area comprises of different types of habitats such as Forest, Grassland, Tea Plantation, Wetland, Riverbank, Cropland, Dense Homestead Plantation, Pastureland, Built up and Open land. These habitats show diversity in floral and faunal species. Baseline data was collected during the monsoon and winter season. For the convenience of the study, following habitats were clubbed together:

Table 7 : Habitat and Sub-habitat

Habitat	Sub-habitat
Wetland/Waterbody	Wetland/Waterbody, Riverbank, River
Forest	Forest
Tea plantation	Tea plantation
Homestead plantation	Homestead plantation
Crop land	Cropland, Pastureland
Built up/open land	Settlements, Markets, EPS, Open land

The distribution of study plots across various habitats observed in the study area is as follows:

Table 8 : Distribution of study plots across various habitats observed in the study

Habitat	Area (Sq.km.)	Proportion of Study Area (%)	Proportion of Survey Plots laid (%)	
Wetland/Waterbody	58.73	16.11	27.27	
Forest	98.32	26.98	12.12	
Tea plantation	99.47	27.29	27.27	
Homestead plantation	16.23	4.45	9.09	
Crop land	38.58	10.58	15.15	
Built up/open land	53.14	14.58	9.09	

More number of survey plots were laid in wetland habitat, as it had various sub-habitats. Homestead plantation found to have many key species restricted to the habitat, scattered throughout the study area.

Ecological important areas – Important Bird Areas (IBA)

Dibru - Saikhowa Complex and Bherjan-Borajan-Podumoni Wildlife Sanctuary are the two, BirdLife International accredited Important Birding Sites (IBA).

Dibru - Saikhowa Complex comprises of Dibru-Saikhowa National Park, Poba Reserve Forest, Kobo chapori (river islands) proposed reserve forest, Amarpur chapori, Maguri and Motapung Beel, and the adjacent riverine tract of the Brahmaputra and Lohit rivers; out of which, only Dibru-Saikhowa National Park and Maguri Motapung Beel fall in the present study area.

Bherjan-Borajan-Podumoni Wildlife Sanctuary comprises of Bherjan (105 ha), Borajan (493 ha) and Podumoni (176 ha) as separate three pockets of lowland tropical forest, present in Tinsukia district, Assam. Bherjan and Podumoni regions fall in the present study area.

The distances of ERD surface locations i.e., PAD sites and ERD sub-surface locations i.e., well sites from Priority Biodiversity Features in the study area are given in Table 2.

Table 9: IBAS IN THE STUDY AREA

Site Name	PA Status	IBA Criteria	IBA site Code
Dibru - Saikhowa Complex[5]		A1, A2	IN378
Bherjan-Borajan-Podumoni Wildlife Sanctuary[6]	WLS	A1	IN371

A1= Threatened species; A2 = Restricted Range species; A3= Biome species; A4=Congregatory species

[5] http://datazone.birdlife.org/site/factsheet/dibru--saikhowa-complex-iba-india
[6] http://datazone.birdlife.org/site/factsheet/bherjan-borajan-podumoni-wildlife-sanctuary-iba-india

Maguri Motapung Beel

This wetland is situated near Motapung village of Tinsukia district. It is a valuable natural capital for the region, providing critical habitat to numerous species, especially resident and migratory birds. It serves as a fisheries resource to local communities as well as a flood buffer and a water and sediment regime regulator. A small channel connects Maguri Beel with the Dibru River to the North; hence this wetland regime is a critical part of the Dibru-Saikhowa National Park (DSNP), an ecological corridor to Namdhapa National Park, and sustains the ecological integrity of the Indo-Burma Biodiversity Hotspot.

Figure 9 : Maguri Motapung Beel

Dibru-Saikhowa National Park (DSNP)

The Dibru-Saikhowa NP proper covers 34,000 ha in the districts of Tinsukia and Dibrugarh in eastern Assam. It is 13 km north of Tinsukia town. It is also a Biosphere Reserve. Dibru-Saikhowa has the largest Salix swamp forest in north-eastern India. Tropical Moist Deciduous, Tropical Semi-evergreen, Evergreen Forests and grassland forms the main habitat type. The original vegetation of the Park wastropical rainforest, but a large part sank by a few meters during the earthquake in 1950, causing significant geomorphological changes. Due to regular flooding, the rainforest gradually gave way to deciduous forest and swamps[7]. The park is surrounded by the Brahmaputra River, Lohit river and Arunachal Hills in the north and Dibru river, Debang river, Dibru hills in the south, making for verdant environments.

Figure 10 : Dibru-Saikhowa National Park (DSNP)

[7] Choudhury, A. U. (1998) Mammals, birds and reptiles of Dibru-Saikhowa wildlife sanctuary, Assam, India. Oryx 32(3) 192- 200.

Bherjan-Borajan-Podumoni Wildlife Sanctuary

Bherjan, Borajan, and Podumoni are three different forest regions disjunct and separated by tea gardens and human habitations. These are entirely on the flat plains of the Brahmaputra Valley, so theylie in the Endemic Bird Area called Assam Plains by BirdLife International. The site lies in Biome-9 (Indo-Chinese Tropical Moist Forest) as classified by BirdLife International. It is a perfect habitat for primatesand it nestles many rare birds. Bherjan is almost entirely covered with trees with closed canopy. Delakhat road passes through forest area. The Podumoni region is observed to have a brokencanopy and it is surrounded by tea estates, village settlements and croplands.

Figure 11 : Bherjan Forest

Figure 12 : Podumoni Forest

Biodiversity Assessment

The study area falls in North East Region biogeographic zone[8], which is characterized by Tropical Evergreen Forest, Tropical Semi Evergreen Forest and Seasonal swamp forests. The ERD surface and subsurface locations falls within the depositional plains of the River Brahmaputra and its tributaries. The study area comprises of different types of habitats such as Forest, Tea Plantation, Waterbody, Cropland, Homestead Plantation, Built up and Open land. These habitats show diversity in floral and faunal species. Tea Plantation is the dominant habitat of the study area followed by Forest, Waterbody, Built-up and Open land, Cropland, and Homestead Plantation.

Baseline data was collected during the monsoon and winter season. In the two seasons a total of 86 species of trees, 57 shrubs, 152 herbs and 47 Pteridophytes were recorded under flora; whereas 147 species of Birds, 112 species of Butterflies, 10 species of Mammals, 6 species of Herpetofauna and 19 species of Fishes were recorded under fauna.

Figure 13 : Asian Openbills at Maguri Motapung Beel

[8] Rodgers, W.A. and Panwar, S.H. (1988) Biogeographical classification of India. New Forest, Dehra Dun, India

Forest Habitat

The forest habitat includes protected area of Dibru-Saikhowa National Park and Bherjan-Borajan-Podumoni Wildlife Sanctuary. Area of DSNP falling into the study area is 143.10 Sq. Km. along with Eco-sensitive Zone of 123 Sq. Km.; it has been conserved for its unique and pristine forest and its biodiversity. DSNP has river Dibru at its north and river and river Brahmaputra to its south, and is at the extreme east of State Assam, India. The National park is situated in the flood plains of Brahmaputra has among the most vibrant wildness on earth and is also distinct for its pristine scenic beauty and harbors many extremely rare and endangered species of Wildlife.

Bherjan-Borajan-Podumoni Wildlife Sanctuary comprises of Bherjan, Borajan and Podumoni as separate three pockets of lowland tropical forest, present in Tinsukia district, Assam. Bherjan and Podumoni regions fall in the present study area. The area of Bherjan and Podumoni region was 1.21 Sq. Km. and 1.68 Sq. Km. respectively.

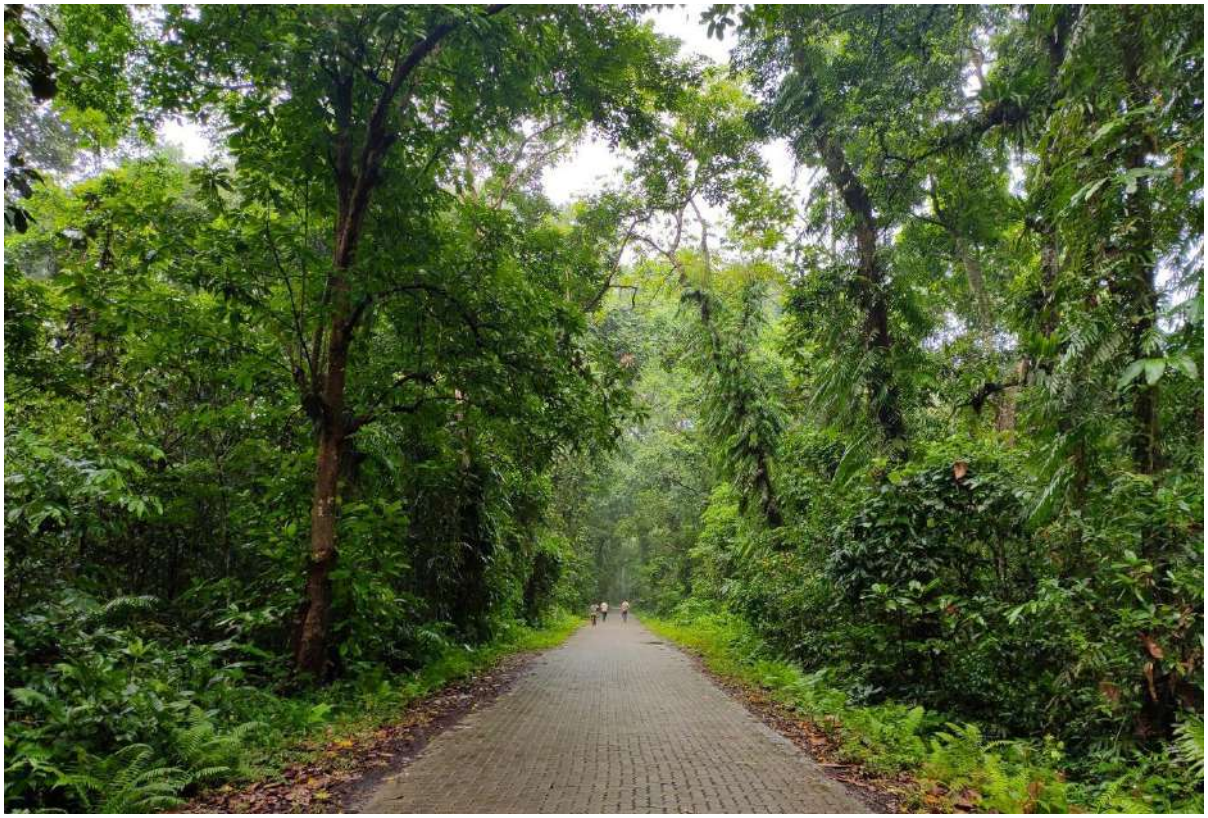


Figure 14 : Bherjan Forest

Flora Diversity

Unique bio-geographic factors and huge water resource Brahmaputra has exceptional biogeographic influences on the state's unique biodiversity. These factors have shaped the abundant endemic plant diversity of the state. Secondary data suggests more than 3000 species of flowering plants have been recorded in Assam which

constitutes 25.12% of total floristic wealth of India. Apart from the angiosperms, state is rich in ferns, fern allies and orchid flora. State holds many species primitive angiosperms and Gymnosperms. Variety in huge fern species, especially the tree fern species are the special features in the understory here, making the forest most attractive and distinct from the rest of Indian forest.[9]

Complexity in biogeography has made the forest so spectacular that it is often difficult to clearly identify and separate the forest types due to overlapping of forest species. According to the Champion & Seth's "Revised forest types of India", state Assam has 51 forest types/sub types. Further, for convenience, these forest types are broadly classified into 8 forest types. Out of these, District Dibrugarh and Tinsukia have the Tropical Wet Evergreen Forest.[10]

Bherjan region has tall trees with closed canopy. It has a good number of *Dipterocarpus macrocarpus, Lagerstroemia parviflora* and *Terminalia myriocarpa*. Locals use *Mesua ferra, Dillenia indica* for eco- friendly dinner plate making. Along the periphery, *Alstonea scholaris*, *Tectona grandis, Dillenia indica* was planted. Fairly good diversity of Pteridophytes is observed in the forest. Dhekia lata (Stenochlaena palustris), Dragon scale fern Pyrrosia piloselloides *and* Bird Nest fern (*Aslplenuim nidus)* are the common pteridophytes of Bherjan*.*

Figure 15 : Stenochlaena palustris

Figure 16 : Dillenia indica

Amongst the tree species, Elephants Apple (Dillenia indica), Dipterocarpus macrocarpus, Lagerstromoea parviflora, Bishop Wood (*Bischofia javanica)*, Copal tree (Ailanthus altissima)*, East Indian Almond (Terminalia myriocarpa)* forms the major tree component.

The Understorey of the forest was dominated with *Brassaiopsis sp.,* Hamiltonian Sterculia *(Sterculia hamiltoniana),* Nilgiri Actephila *(Actephila excels). Apart from the angiosperms,* King fern (*Angiopteris evecta)*, and Giant Cyathea (*Cyathea gigantean)* are the most prominent tree ferns species of the forest.

[9] *http://www.asbb.gov.in/*
[10] Govt. of Assam, India website

The vertical mid zone of forest showed presence of Climbing fern (*Lygodium flexuosus)* Bird Nest's fern (*Asplenium nidus*), Climbing Aroid (*Pothos scandens)* and Climbing Swamp fern *(Stenochlaena palustris)* as pioneers.

Settlements are observed in the vicinity of Podumoni region. Forest was disturbed and is in degrading state, canopy is broken and some of the trees were fallen. Bamboo, *Dillenia indica, Lagerstromoea sp*.are common here. The Hollong tree (*Dipterocarpus marcrocarpus*) is the dominant tree species of the region. During the winter season, Hollong trees were in fluting stage, whereas new growths of bamboo shoots were commonly observed.

Angiopteris evecta

Asplenium nidus

Hollong Tree with seeds

Figure 17 : Angiopteris evecta, Asplenium nidus and Hollong Tree with seeds

The forest type of Dibru-Saikhowa comprises of semi-evergreen forests, deciduous

forests, littoral and swamp forests and patches of wet evergreen forests and prominent grasslands. The Park is renowned for natural regeneration of Salix trees.

The Indian Subcontinent possesses tropical tall grasslands which are strongly latitude dependent and climate driven. Grass community or formations *Phragmites, Saccharum, Imperata* are present across the alluvial soils of the entire north-western Gangetic plain to the eastern Brahmaputra plain descending along the Ganges-Brahmaputra-Meghna watersheds.

Grasslands cover the major area of area of the national park. Among these, three dominant grass species (given below in table) are characterized by their tall and densely packet growth. These grasses are crucial resource for large mammals such as Elephants.

Table 10 : GRASSES OBSERVED AT IBRU-SAIKHOWA NATIONAL PARK

Sr. No.	Grass species	Common name	Origin
1	*Phragmites karka*	Tall Reed	Exotic
2	*Saccharum ravennae*	Ravenna grass	Native
3	*Imperata cylindrical*	Cogon grass	Native

Figure 18 : Ravenna grass - Saccharum ravennae & Imperata cylindrica (DSNP)

In spite of being noxious weeds and unpalatable or low palatable to cattle's, both Ravenna Grass and Elephant grass are important species of landscape. Grasses being not favored by cattle's or other herbivores remain untouched and intact. Such unpalatable grasses, in turn, have been assumed to be ideal for proper avian breeding, feeding and roosting ground. Wild buffalos, Elephants, Feral horses and other herbivores depend on grasslands and birds mostly use it to refuge and ambush.

Faunal Diversity

A wide range of birds and butterflies were found in forest habitats. In total 100 birds, 115 butterflies, 6 mammals, and 6 Herpetofauna species was found in the forested habitat of the study areas.

Birds such as Chestnut tail Starling (*Sturnia malabarica*), Hair Crested Drongo (*Dicrurus hottentottus*), Red vented Bulbul (*Pycnonotus cafer*), White throated Bulbul (*Alophoixus flaveolus*), Great Myna (*Acridotheres grandis*), Oriental Pied Hornbill (*Anthracoceros albirostris*) and Lineated Barbet (*Psilopogon lineatus*) were observed in the forested areas frequently.

Rare bird sightings include Rusty-bellied Shortwing (*Brachypteryx hyperythra*) & Lesser racket-tailed Drongo (*Dicrurus remifer*) in Bherjan region, Kalij Pheasant (*Lophura leucomelanos*) in Podumoni region and Lesser Fish-eagle (*Icthyophaga humilis*) in DSNP regions.

Migratory birds like Scarlet Minivet (*Pericrocotus flammeus*), Long-tailed Shrike (*Lanius schach*), Verditer Flycatcher (*Eumyias thalassinus*), Brown Shrike (*Lanius cristatus*), Large Hawk-cuckoo (*Hierococcyx sparverioides*) were observed using emergent layer; whereas Grey-bellied Tesia (*Tesia cyaniventer*), Lesser Shortwing (*Brachypteryx leucophris*), Large Niltava (*Niltava grandis*), Small Niltava (*Niltava macgrigoriae*) where observed in the dense under cover of the Bherjan forest.

Single individuals of resident birds like Black-napped Monarch (*Hypothymis azurea*) and Little Spiderhunter (*Arachnothera longirostra*) were observed feeding on insects in the Podumoni region.

Great Myna

Lineated Barbet

Scarlet Minivet

Large Niltava

Figure 19 : Great Myna, Lineated Barbet, Scarlet Minivet and Large Niltava

Dibru-Saikhowa complex is very rich in bird life. It is one of the sites in the northeast where highly endangered and elusive species have been observed. The tall wet grasslands of Dibru-Saikhowa are important for many threatened and non-threatened species. White-rumped Vulture (*Gyps bengalensis*), Himalayan Griffon (*Gyps himalayensis*), Slender-billed Vulture (Gyps tenuirostris) were spotted soaring in the skies of DSNP along with migratory flocks of Black Storks (*Ciconia nigra*). Common Greenshanks (*Tringa nebularia*) along with many other migratory birds were seen on the dried riverbed. Mating pairs of Oriental Pied Hornbill (*Anthracoceros albirostris*) and its nesting site was sighted in DSNP.

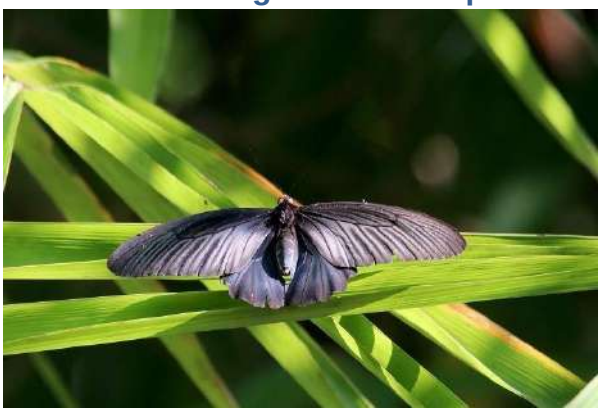
Assamese macaque (*Macaca assamensis*) and Northern Pig-tailed Macaque (*Macaca leonina*) were observed in the Bherjan wildlife Sanctuary. Rhesus Macaque (*Macaca mulatta*) was sighted in the Dibru Saikhowa National Park. Presence of Asian Elephant (*Elephas maximus*) was confirmed by the footmarks and dung. Pugmarks of Golden Jackal (*Canis aureus*) were also observed on the dried riverbed in the DSNP.

In the study area, Western Hoolock Gibbons (*Hoolock hoolock*) has become extirpated in recent years from Podumoni and Bherjan region of Bherjan-Borajan-Podumoni Wildlife Sanctuary as per the locals, forest guards and forest official, interviewed informally. But interestingly, there is occurrence of Hoolock Gibbons in village homestead plantations/woodlands.

Rhesus Macaque

Northern Pig-tailed Macaque

Wizard Butterfly



Lesser Batwing

Figure 20 : Rhesus Macaque, Northern Pig-tailed Macaque, Wizard Butterfly and Lesser Batwing

A total of 115 species of butterflies were observed in the forest habitat. Wizards (*Rhinopalpa polynice*), Lesser Batwing (*Atrophaneura aidoneus*), Red Lacewing (*Cethosia biblis*), and Angled Red Forester (*Lethe chandica*) were some of the rare sightings from these protected areas to name a few. Large numbers of the butterflies were seen feeding on the flowers of *Sida acuta, Eupatorium odoratum, Leucas sp., Mikania micrantha, Sena tora, tectona grandis, and Leea sp.* and mud puddling in the wetpatches of forests and riverbeds of Dibru River along the DSNP boundaries.

Himalayan Vulture

Griffon Vulture

Figure 21 : Himalayan Vulture and Griffon Vulture

A road-kill of Reptile species, Checkered Keelback (*Fowlea piscator*) was observed on the Dhelakhatroad passing through the Bherjan region.

Waterbody Habitat

Waterbodies and its riparian habitats are ecologically diverse and may occur in a range of general habitat types, including damp grasslands, wetlands, marshes, forests, jungles, canyons, and mountains. The primary characteristics of these areas are an active water source and the subsequent vegetation that relies on that water.

They are often home to a wide range of flora and fauna, easily meeting basic survival needs, including food in the form of fish and aquatic invertebrates, a shelter made from aquatic vegetation, and nesting sites within the aquatic vegetation that are sheltered from view.

Waterbody/wetland areas in the study area comprise of Maguri Motapung Beel, Dibru River with its riverbeds and riparian areas. From IBA of Dibru - Saikhowa Complex, Maguri Motapung Beel falls in the wetland habitat of the study area. Maguri Motapung Beel is one of the largest floodplain lakes in upper Brahmaputra basin. Maguri Motapung Beel is connected to Dibru River and is affected by frequent channel changes and sedimentation. A small channel connects the Beel with the Dibru River to the North; hence this wetland regime is a critical part of the Dibru-Saikhowa National Park (DSNP), an ecological corridor to Namdhapa National Park, and sustains the ecological integrity of the Indo- Burma Biodiversity Hotspot. The Beel is also very rich in aquatic life and this has led to the development of many fishing camps near it. The nearby areas of the Beel displays grassland environment, creating a suitable shelter for grassland birds.

Figure 22 : Maguri Motapung Beel

Floral Diversity

A variety of birds were seen nesting, feeding, and perching on the tall reeds of *Phragmites karka* and other low vegetation, such as *Nymphea sp.*, *Alternanthera sp., Persicaria sp*., *Diplanzium esculantum*,*Colocasia esculentus, Doob grass (Cyanodon dactylon*) and other floating/ submerged plants.

It is observed that the alien invasive plant species Water Hyacinth (*Eicchornia crassipes)* has taken over the landscape. 28 Aquatic plant species are recorded in Beel, out of which 4 species are free floating, 7 species submerged in water, 6 species were anchored to the bottom of lake with their leaves and flowers floating on water surface and 11 species on the land with their stem growing inward to the water.

Nymphae spp.

Ravenna grass

Figure 23 : Nymphae spp. And Ravenna grass

Dibru-Saikhowa is said to have the largest Salix swamp forest in north-eastern India. Tropical Moist Deciduous, Tropical Semi-evergreen, Evergreen Forests and grassland forms the main habitat type observed at the national park. On the banks of Dibru River, dense vegetation of Tall Reeds *(Phragmites karka)*, Ravenna grass *(Saccharum ravennae)* and Tall reed *(Imperata cylindrica)* were observed. Apart from grasses, river bank has good number of *Dubanga grandiflora*, Red-Silk cotton *(Bombax ceiba),* Utenga *(Dillenia indica), Terminalia myriocarpa* species.

Faunal Diversity

A total of 41 species of birds were recorded in monsoon season and 79 species of birds were recorded during winter season; out of which 34 species of birds are migratory in the study area. Enormous flocks of migratory birds such as Ruddy Shelduck (*Tadorna ferruginea*), Bar-headed Goose (*Anser indicus*), Eurasian Wigeon (*Mareca penelope*), and Wagtails were observed in the Maguri Motapung Beel. Mallard (*Anas platyrhynchos*) dominated the banks of Dibru River. Little Pratincole (*Glareola lactea*), Purple Swaphen (*Porphyrio porphyrio*), Glossy Ibis (*Plegadis falcinellus*), Asian Openbill (*Anastomus oscitans*), Lesser Whistling-duck (*Dendrocygna javanica*), Jacanas, Egrets etc. were most commonly sighted, amongst the resident birds.

A mating pair of Oriental Pied hornbill (*Anthracoceros albirostris*) was also observed during the monsoon season along the boundaries of the Beel. Reeds, free floating plants, submerged plants, fish and insect diversity of the Beel provides a good breeding and feeding ground for resident as well as migratory birds.

During the boat survey at Dibru River, three adult Gangetic Dolphins (*Platanista gangetica*) were recorded along transect marked in Figure 3 (Pg. 63). Gangetic dolphin (*Platanista gangetica*) is one of the two species of river dolphins found in India. The Ganges River system in Northern India and the Assam's Brahmaputra River system in of North Eastern India are the major habitats of this endangered river dolphin species. River dolphins also act as an indicator of river health. The presence of elephant was confirmed by the dung and foot marks on the banks of Dibru River; dominated by the Elephant Grass. Rhesus macaque (*Macaca mulatta*) and Golden Jackal (*Canis aureus*) were the other two mammals observed on the riverbanks.

Bar-headed Geese

Glossy Ibis

Rhesus Macaque

Jackal crossing the riverbed

Common Castor

Chocolate Albatross

Figure 24 : Bar-headed Geese, Glossy Ibis, Rhesus Macaque, Jackal crossing the riverbed, Common Castor and Chocolate Albatross

A total of 66 species of butterflies in were sighted in three seasons in the wetland habitat of study area. Butterflies such as Wizard (Rhinopalpa polynice), Commander (Moduza procris), Map Butterfly (Cyrestis thyodamas), Chocolate Tiger (Parantica melaneus), Yellow-crested Spangle (Papilio elephenor), Eastern Striped Albatross (Appias olferna) were sighted at in study area falling under DSNP. Butterflies such as Common Castor (Ariadne merione), Chocolate Albatross (Appias lyncida), Common Grass Yellow (Eurema hecabe), Common Mormon (Papilio polytes), Lemon Emigrant (Catopsilia pomona), Striped Tiger (Danaus genutia) and Pale Wanderer (Pareronia avatar) were some of the butterflies frequently sighted at the Beel.

19 species of fish were reported from Maguri Motapung Beel and Dibru River. *Wallago attu* which is categorized as “Vulnerable” in IUCN Red List was also reported. Grass Carp (*Ctenopharyngodon Idella)* was the only exotic species found in fish-catch of the Beel.

Heteropneustes fossilis

Wallago attu

Purple Swamphen

Ruddy Shelduck

Figure 25 : Heteropneustes fossilis, Wallago attu, Purple Swamphen and Ruddy Shelduck

Phytoplanktons and Zooplanktons

To assess phytoplankton and zooplankton diversity, water samples were collected from two different locations, preserved and analysed using standard methods.

Table 11 : STATION DETAILS

Station Name	Area	Location
Station 1	Maguri Motapung Beel	N27.663280 E95.481476
Station 2	Dibru river	N27.625099 E95.399617

Phytoplanktons

A total of 16 species of Phytoplanktons with density of 188 no /ml at station 1 and 15 species with density of 174 no/ml at station 2 were recorded in the monsoon season. While in the winter season, a total of 18 species of Phytoplanktons with density of 159 no /ml at station 1 and 19 species of Phytoplanktons with density 181 no/ml at station 2 were recorded. In summer 16 species of Phytoplanktons with density of 76 no /ml at station 1 and 19 species with density of 91 no/ml were recorded.

Group *Bacillariophyceae* were dominant in the Monsoon followed by group *Chloro-Phyceae* and *Cyanophyceae* while in winter season group *Chlorophyceae* were dominant followed by *Bacillariophyceae* and *Cyanophyceae.*

Zooplanktons

Station 1 represents 13 species of zooplankton with 118 no/ml density and Station 2 represents 12 species of zooplankton with 107 no/ml density at station 2 in the monsoon season, while in winter, station 1 represents 12 species of zooplankton with

179 no/ml density at station 1 and station 2 represents 14 species of zooplankton with 140 no/ml density occurred. In summer season, station 1 represents 7 species of zooplanktons with 31 no/ml density and station 2 represents 6 species of with density of 36 no/ml.

Group *Rotifera* and *Cladocera* found dominant followed by *Copepoda* at both station in both seasons. The organisms like *Microcystis sp., Oscillatoria sp., Navicula sp., Euglena sp., Closterium sp., Ankistrodesmus sp., Anabaena sp., Nitzschia sp., Scenedesmus sp., among phytoplanktons* and zooplanktons forms like *Brachionus sp., Keratella sp., Mesocyclopes sp*. are the water pollution tolerant species.

Table 12 : LIST OF PHYTOPLANKTON GENERA OBSERVED IN STUDY AREA DURING MONSOON AND WINTER SEASON SURVEY

Sr. No.	Class	Species	Station 1	Station 2
1	**Cyanophyceae**	**Anabaena sp.*	√	√
2		*Merismopedia spp.*	√	√
3		**Oscillatoria sp.*	√	√
4		**Microcystis sp.*	√	√
5	**Chlorophyceae**	**Ankistrodesmus sp*	√	√
6		*Actinastrum sp*	√	√
7		**Closterium sp*	√	√
8		*Pedistrum sp*	√	√
9		**Scenedesmus*	√	√
10		*Cosmarium sp.*	√	-
11		*Eudorina sp*	√	√
12	**Bacillariophyceae**	*Asterionella sp.*	√	√
13		*Amphora sp.*	√	√
14		**Navicula sp.*	√	√
15		**Nitzschia sp.*	√	√
16		*Synedra sp.*	√	√
17		*Urosolenia sp.*	√	√
18		*Pluerosigma sp.*	√	√
19		*Melosera sp.*	√	√
20	**Euglenophyceae**	**Euglna sp*	√	√
21		*Phacus sp.*		
22	**Chrysophyta**	*Dinobryon sp*	√	√
23	**Coscinodiscophyceae**	*Cyclotella sp.*	√	√
24		*Thalassiosira sp.*	√	√
25	**Zygnematophyceae**	*Spirogyra sp.*	√	√
26		*Cosmarium sp.*	√	√
27	**Flagilariophyceae**	*Synedra sp.*	√	√

*Note: * indicates pollution tolerant species*

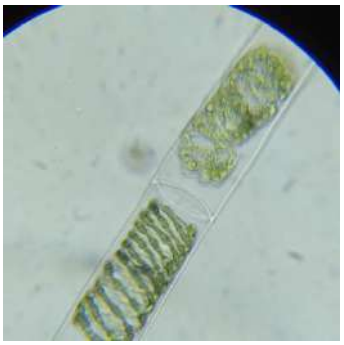
Table 13 : ZOOPLANKTON GENERA OBSERVED IN STUDY AREA DURING MONSOON AND WINTER SEASON SURVEY

Sr. No.	Genera	Species	Station 1	Station 2
1	**Rotifera**	**Brachionus sp*	√	√
2		*Plationus sp*	√	√
3		**Keratella sp.*	√	√
4		*Trichocerca sp*	√	√
5		*Filinia sp.*	√	-
6	**Copepoda**	**Mesocyclops sp*	√	√
7		*Thermocyclops sp.*	√	√
8		*Copepod Sp.*	√	√
9	**Cladocerans**	*Diaphanosoma sp.*	√	√
10		*Scapholeberis sp.*	√	√
11		*Bosminopsis sp.*	√	√
12		*Moinodaphnia sp.*	√	√
13		*Ceratella Sp.*	√	√
14		*Insect larva*	√	√
15		*Mosquito larva*	√	√

*Note: * indicates pollution tolerant species*

Cosmarium

Navicula



Spirogyra

Thalassiosira

Unidentified worm

Unidentified worm

Benthic Organisms - Maguri Motapung Beel

Benthic Organisms - Dibru River

Tea Plantation Habitat

The study area is characterized by extensive tea estates, spanning across the districts of Tinsukia and Dibrugarh. These tea plantations encompass a diverse range of habitats, from commercial estates to smaller homestead gardens, collectively forming the iconic Tea Estate Habitat. This distinctive landscape not only contributes significantly to the local economy through the export of tea leaves but also serves as a crucial intersection of human livelihoods and biodiversity conservation.

The Tea Estate Habitat serves as a testament to the intricate relationship between people and nature. It forms an integral part of the livelihoods of many communities, providing employment opportunities for both skilled and unskilled labor. The cultivation and processing of tea leaves create jobs that sustain local families, contributing to the socio-economic fabric of the region.

Beyond its economic importance, the Tea Estate Habitat hosts a surprising diversity of flora and fauna. The cultivated tea plants themselves provide shelter and sustenance for various species of insects, birds, and mammals. Additionally, the surrounding landscape of these estates often acts as corridors that facilitate the movement of wildlife across fragmented habitats. Many animals utilize these tea estates as safe pathways to navigate between pockets of natural habitat, thereby contributing to the preservation of genetic diversity and promoting ecological balance.

Figure 26 : Tea Plantation Habitat

Floral Diversity

Within the tea gardens, a strategic approach to enhancing the environment was

undertaken through the planting of fast-growing trees in the rows. This thoughtful practice not only introduced shade to the tea plantations but also enriched the landscape with a diverse array of tree species. Among the notable species included are the Chinese Albizia (Albizia chinensis), Albizia lenticularis, and the Indian Poison Berry (Melia azedarach).

Alongside the aforementioned tree species, the inclusion of the Areca nut (Areca catechu) has been recorded, showcasing the intertwining of nature and local cultivation practices. This amalgamation of carefully selected tree species underscores the commitment to cultivating not just tea leaves, but a holistic and ecologically balanced habitat within the tea gardens and their adjacent spaces.

Figure 27 : Camellia sinensis – Flower of Tea Plant

Faunal Diversity

Tea plantations are intensive monoculture of *Camellia sinensis* species with spares tree cover of Chinese Albizia (*Albizia chinensis*), Albizia lenticularis, Indian Poison Berry (*Melia azedarach*). Most of the tea estates in the study area are adjacent to Bherjan forest region, Maguri Motapung Beel and Dibru River, which forms an ecotone zone. This area does not show a gradient in floral community but displays an abrupt switch from one habitat type to another.

A total of 52 species of birds were observed in the two seasons in Tea plantation habitat. Insectivorous birds such as Common Myna (*Acridotheres tristis*), Jungle Myna (*Acridotheres fuscus*), Great Tit (*Parus major*), Red-vented Bulbul (*Pycnonotus cafer*), and Green bee-eaters (*Merops orientalis*) were a common sight in the tea gardens.

Asian Barred Owlet

Jungle Myna

Figure 28 : Asian Barred Owlet and Jungle Myna

Tea is a perennial mono-culture crop. It provides a relatively steady microclimate and food supply for insect and mite pests; which in turn attracts insectivorous birds. Resident birds such as Asian barred Owlet (*Glaucidium cuculoides*), Green Billed Malkova (*Phaenicophaeus tristis*) and migratory birds such as Small (*Niltava macgrigoriae*) and Large Niltava (*Niltava grandis*), Rusty-bellied shortwing (*Brachypteryx hyperythra*) etc. were also seen using the ecotone region. Tea estates adjacent to the wetlands, birds such as Cattle egret (*Bubulcus ibis*), Greater (*Phalacrocorax carbo*) & Little Cormorant (*Microcarbo niger*), Pond heron (*Ardeola grayii*), Osprey (*Pandion haliaetus*) were seen roosting on tall trees of Albizia.

Dark Evening Brown

Pond Heron

Roadkill of Checkered Keelback

Indian Roller

Figure 29 : Dark Evening Brown, Pond Heron, Roadkill of Checkered Keelback and Indian Roller

Mammals such as Hoary-bellied Squirrels (*Callosciurus pygerythrus)* were encountered during the surveys. Presence of Leopards, Golden Jackals (*Canis aureus*), and Hare were confirmed from the locals and workers.

A total of 54 species of butterflies were observed in the two seasons in Tea plantation habitat. Common Grass Yellow (*Eurema hecabe*), Grey Pansy (*Junonia atlites*), Common Gull (*Cepora nerissa*), Lemon Emigrant (*Catopsilia pomona*), Peacock Pansy (*Junonia almana*), Striped Tiger (*Danaus genutia*), Indian Wanderer (*Pareronia hippia*), Dark Evening Brown (*Melanitis phedima*), Pale Wanderer (*Pareronia avatar*), Common Five-ring (*Ypthima baldus*), Yeoman (*Cirrochroa tyche*), Plain Tiger (*Danaus*

chrysippus), Three-spot Grass Yellow (*Eurema blanda*) were seen in the Tea Plantation Habitat.

Two roadkill of Checkered Keelbacks (*Fowlea piscator*) were observed on the Delakhat road, on the edges of tea garden and Bherjan Forest boundary.

The well PAD 3 is located in Dighaltarang Tea Estate of Doom Dooma Revenue circle. Birds such as Common Myna (*Acridotheres tristis*), Indian Roller (*Coracias benghalensis*), Red-vented Bulbul (*Pycnonotus cafer*) and butterflies such as Common Grass Yellow (*Eurema hecabe*), Lemon Emigrant (*Catopsilia pomona*), and Striped Tiger (*Danaus genutia*) were the observed in this area along with *camellia sinensis* tea plantation.

Figure 30 : Common Yeoman

Cropland Habitat

Cropland is majorly comprised of paddy fields of rice. Crop land when not in cultivation is used as a pastureland.

Figure 31 : Cropland Habitat

Floral Diversity

Few areas were under agriculture. Paddy fields were observed in the study area. After harvesting the land remains fallow and is used as a pasture/grazing land for cattle, sheep and goat grazing.

Figure 32 : Pastureland or Cropland Habitat

Faunal Diversity

A variety of management practices such as land preparation, crop establishments, irrigation, nutrient and pest management, harvesting within the paddy field facilitate to create different habitats with different ecotones and suitable food for bird species.

Asian Pied Starling

Cattle Egret

Grass Yellow Butterfly

Striped Tiger

Figure 33 : Asian Pied Starling, Cattle Egret, Grass Yellow Butterfly and Striped Tiger

A total of 58 species of birds were observed in the two seasons in Cropland Habitat. The insects and worms in paddy field attract insectivorous birds such as Jungle Myna (*Acridotheres fuscus*), Cattle Egret (*Bubulcus ibis*), Common Myna (*Acridotheres tristis*), Asian Pied Starling (*Gracupica contra*), and Red-vented Bulbul (Pycnonotus cafer). These birds also act as a pest control for the paddy field. Migratory birds sighted during the survey are Barn swallows (*Hirundo rustica*), Common Stonechat (*Saxicola torquatus*), Rosy Pipit (*Anthus roseatus*). An individual of Lesser Adjutant (*Leptoptilos javanicus*), which falls in the Near Threatened category of IUCN Red List of Threatened Species, was observed.

Hoary-bellied Squirrel (*Callosciurus pygerythrus*) was the mammal species sighted in the Cropland. A troop of Northern Pig-tailed Macaques (*Macaca leonina*) was sighted in the Bherjan forest area was observed feeding on rice crop uprooted from the adjacent field.

A total of 22 species of butterflies were observed in the three seasons in Cropland

Habitat. Common Grass Yellow (*Eurema hecabe*) was the most dominant butterfly species in this habitat.

The well PAD 1 is located in Dighaltarang Tea Estate of Doom Dooma Revenue circle, falls into Cropland Habitat category. Birds such as Common Myna (*Acridotheres tristis*), Indian Roller (*Coracias benghalensis*), Red-vented Bulbul (*Pycnonotus cafer*) and butterflies such as Common Grass Yellow (*Eurema hecabe*), Lemon Emigrant (*Catopsilia pomona*), and Striped Tiger (*Danaus genutia*) were the observed in this area along with *camellia sinensis* tea plantation.

Homestead Plantation Habitat

Homestead plantation is naturally or planted trees on community or private land. Bamboo and timberwoods are planted in this area.

Figure 34 : Homestead Plantation

Floral Diversity

Naturally or planted trees on community or private land are cultivated in these areas. Tea plantations were prominently seen in the backyards of the houses as well as in the between patches of the densehomestead plantation.

Lofty emergent trees top of Jackfruit *(Artocarpus heterophyllus),* Burr-flower *(Neolamarkia cadamba)* and Hollong tree *(Dipterocarpus macrocarpus),* Devils tree *(Alstonea scholaris)* were being used as by Western Hoolock Gibbons (*Hoolock Hoolock*) for swinging through the forest and foraging for food. Some of these shy

individuals also use Bamboo patches for crossing through the forests.

Areca nut Plantation in Homesteads

Gibbon feeding on Kadamba Tree

Figure 35 : Areca nut Plantation in Homesteads and Gibbon feeding on Kadamba Tree

Some important tree species observed were *Mangifera indica, Melia azedarach, Aegle marmelos, Delonix regia, Ficus religiosa, Syzigium cumini, Gmelina arborea,* etc.

Faunal Diversity

Survey plots were laid in the Homestead plantations of Barekuri Village. A total of 14 species of birds were observed in the two seasons in homestead plantations. Birds like Blue-throated Barbet, Common Myna (*Acridotheres tristis*), Oriental Magpie Robin (*Copsychus saularis*) etc. were the common birds sighted during the survey in this area. Owl species such as Brown Boobook (*Ninox scutulata*) & Asian Barred Owlet (*Glaucidium cuculoides*) were observed roosting in the dense bamboo plantations.

Blue-throated Barbet

Common Myna

Brown Boobook

Western Hoolock Gibbons

Figure 36 : Blue-throated Barbet, Common Myna, Brown Boobook and Western Hoolock Gibbons

Western Hoolock Gibbons (*Hoolock Hoolock*) have inhabited the homestead plantations of Na- Matapung Gaon, Borgaon, Denka Gaon, Dighal Sako Gaon, Baghjan Gaon, and Dhelakhat Gaon Villages. Western Hoolock Gibbon (*Hoolock Hoolock*) is the only ape species found in India; it is an extremely shy and strictly arboreal animal, is classified as Endangered by IUCN Red List. These families of Gibbons in this region have adapted themselves to coexist with humans. They were observed foraging and singing songs on Jackfruit, Burr-flower trees, Hollong tree, Devils trees. Hoary-bellied Squirrel (*Callosciurus pygerythrus*) was also found in these homestead plantations.

A total of 42 species of butterflies were observed in the three seasons in homestead plantations. Great Orange-tip (*Hebomoia glaucippe*), Punchinello (*Zemeros flegyas*), Grey Pansy (*Junonia atlites*) and Red Helen (*Papilio helenus*) were some of the commonly sighted species in this area.

The well PAD 2 is located in Baghjan village of Doom Dooma revenue circle; it has the habitat of homestead plantation/backyard. Birds such as Common Myna (*Acridotheres tristis*), Red-vented Bulbul (*Pycnonotus cafer*), and Rufous Treepie (*Dendrocitta vagabunda*) were the observed in this area.

Hoary – Bellied Squirrel

Grey Pansy

Punchinello

Red Helen

Figure 37 : Hoary – Bellied Squirrel, Grey Pansy, Punchinello and Red Helen

Built up and Openland Habitat

Roadside plantations, settlements and market areas encompassed built ups habitat. The survey plots were laid at Guijan Market, Plastic park industrial area, and Baghjan EPS. A lower biodiversity was observed in the region as compared to other plots.

Figure 38 : Built-Up Habitat

Floral Diversity

These Built up landscapes were modified by the addition of the horticulture varieties. Roadsides walkways were planted with avenue trees species. In villages, the front

yards of the houses had small homestead tea gardens.

In total 15 species of trees,9 species of Shrubs and 29 species Herbs were observed in the three seasons. Flora such as Burr-flower (*Mytragyna parviflora*), Pongam (*Pongamia pinnata*) and Devil's tree (*Alstonea scholaris*) were predominant in this habitat.

Faunal Diversity

Human dominated built-up areas showed less diversity compared to the other landuse. A total of 30 species of birds and 22 species of butterflies were observed in the three seasons in Built up and open land Habitats.

Birds such as Jungle Myna (*Acridotheres fuscus*), Eurasian Tree Sparrow (*Passer montanus*) and butterflies like Common Lascar (*Pantoporia hordonia*) and Lemon Emigrant (*Catopsilia pomona*) were predominant.

Built-Up Habitat – Market Area

Jungle Myna

Eurasian Tree Sparrow

Common Lascar

Figure 39 : Built-Up Habitat – Market Area, Jungle Myna, Eurasian Tree Sparrow and Common Lascar

Socio Ecological Survey

Figure 40 : Socio Ecological Survey at Barekuri Village

Informal discussions with the locals revealed that as per the last counting done the villagers, Dighal Haku Gaon, famously known as Barekuri Hoolock Gibbon Park, has 22 families of Gibbons in homestead plantation/woodland of the village.. Apart from Gibbons, Slow Loris and Indian Leopards were also rarely sighted around the village. Tea workers and officials also revealed that leopards have been sighted using the tea gardens as the corridors to move around in the study area along with Jackals and Hares.

Forest guards and officials confirmed that Western Hoolock Gibbons are no longer sighted in Podumoni and Bherjan regions of Bherjan-Borajan-Podumoni Wildlife Sanctuary but can be sighted in Dibru Saikhowa National Park. Other mammals mentioned by them in Podumoni and Bherjan regions were Common Palm Civet (*Paradoxurus hermaphroditus*), Small Indian Civet (*Viverricula indica*), Slow Loris (*Nycticebus bengalensis*), Capped Langur (*Trachypithecus pileatus*), and small wild cats; whereas Stump-tailed Macaque (*Macaca arctoides*), Wild Water Buffalo (*Bubalus arnee*), Jungle cat (*Felis chaus*), Clouded leopard (Neofelis nebulosa), Wild Boar (*Sus scrofa*), Sambar (*Rusa unicolor*), otters (Family: Mustelidae) are mammals seen in in study area falling under DSNP.

In study area falling under DSNP, discussions with villgers from Laika and Dodhia

village, locals mentioned they have had sightings of Asian Elephants (Asiatic maximus) through tall grasses as well as Indian Leopards (Panthera pardhus pardhus). They also mentioned that there were no recent animal human interactions reported recently.

For identification of fishes, photos of fishes were shown to local fishermen during informal conversations. Fishermen mentioned that fishes such *Nandus nandus* and *Rasbora elanga* species have been gradually declining in the numbers, due to reasons not known. They also confirmed presence of fishes such as *Puntius sarana, Amblypharyngodon mola, Chitala chitala, Cirrhinus mrigala, Cyprinus carpio, Hypophthalmichthys molitrix* through photo identification.

Interactions with fishermen during Dibru River boat survey

Interactions with local residents in Barekuri Village

Interactions with local fishermen at Maguri Motapung Beel

Tinsukia Fish market survey

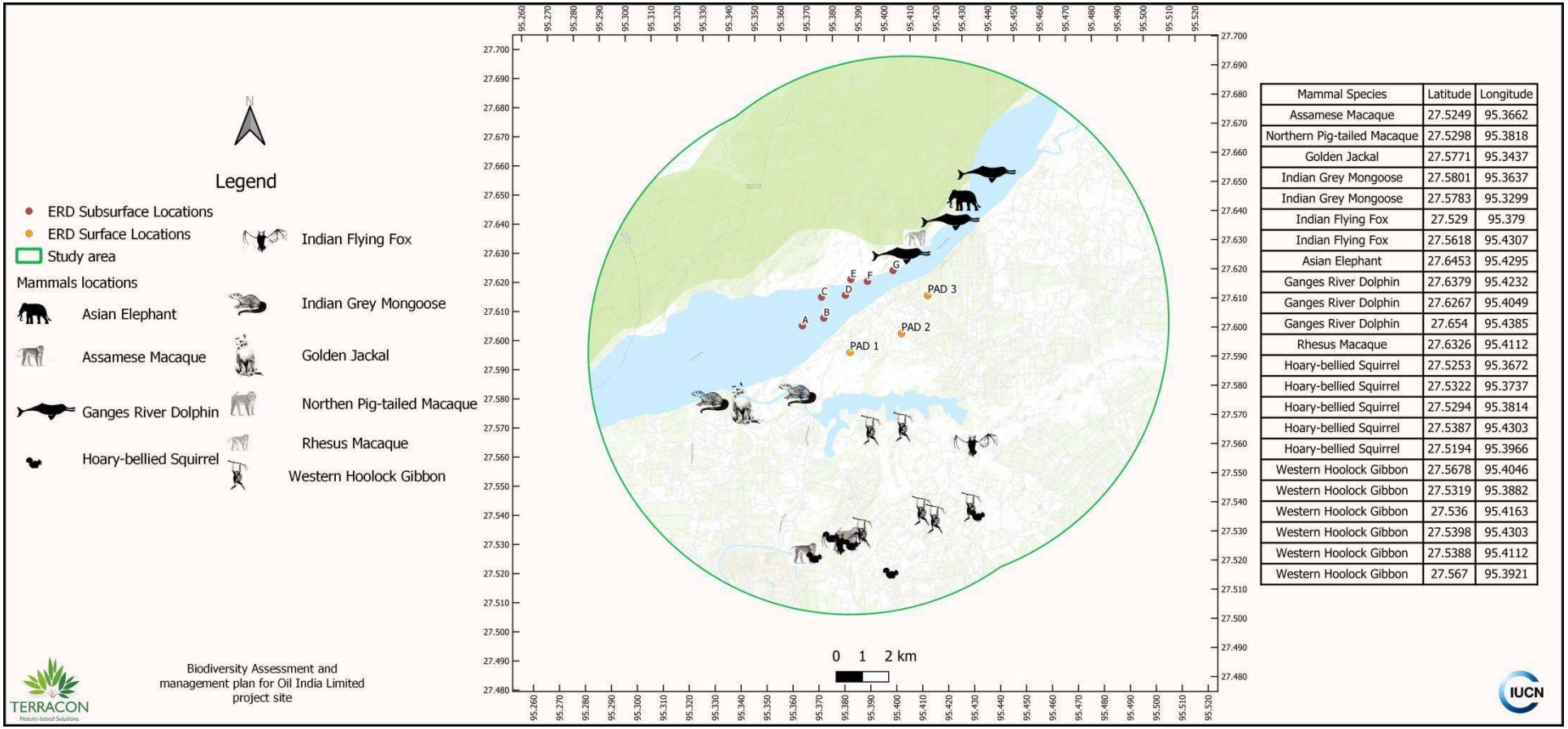
Figure 41 : Interactions with the Local Population

Locations of important Mammal species sighted in the study area

Western Hoolock Gibbons (*Hoolock hoolock*) were sighted in Homesteaded plantations whereas other macaques such as Northern Pig-tailed (*Macaca leonina*), Assamese (*Macaca assamensis*) and Rhesus (*Macaca mulatta*) were observed in the Forested habitats. Ganges River Dolphin (*Platanista gangetica*) was sighted swimming in Dibru River. Following table shows the locations of mammals sighted (direct and indirect) in the study area:

Table 14 : LOCATIONS OF IMPORTANT MAMMAL SPECIES SIGHTED IN THE STUDY AREA

Mammal Species	Latitude	Longitude
Assamese Macaque	27.5249	95.3662
Northern Pig-tailed Macaque	27.5298	95.3818
Golden Jackal	27.5771	95.3437
Indian Grey Mongoose	27.5801	95.3637
Indian Flying Fox	27.5783 27.5291 27.5618	95.3299 95.3791 95.4307
Asian Elephant	27.6453 27.6476	95.4295 95.4132
Ganges River Dolphin	27.6379 27.6267 27.6541	95.4232 95.4049 95.4385
	27.6013 27.6073	95.3050 95.3780
Rhesus Macaque	27.6326	95.4112
Hoary-bellied Squirrel	27.5253 27.5322 27.5294 27.5387 27.5194	95.3672 95.3737 95.3814 95.4303 95.3966
Western Hoolock Gibbon	27.5678 27.5319 27.5361 27.5398 27.5388 27.5671	95.4046 95.3882 95.4163 95.4303 95.4112 95.3921



Mammal Species	Latitude	Longitude
Assamese Macaque	27.5249	95.3662
Northern Pig-tailed Macaque	27.5298	95.3818
Golden Jackal	27.5771	95.3437
Indian Grey Mongoose	27.5801	95.3637
Indian Grey Mongoose	27.5783	95.3299
Indian Flying Fox	27.529	95.379
Indian Flying Fox	27.5618	95.4307
Asian Elephant	27.6453	95.4295
Ganges River Dolphin	27.6379	95.4232
Ganges River Dolphin	27.6267	95.4049
Ganges River Dolphin	27.654	95.4385
Rhesus Macaque	27.6326	95.4112
Hoary-bellied Squirrel	27.5253	95.3672
Hoary-bellied Squirrel	27.5322	95.3737
Hoary-bellied Squirrel	27.5294	95.3814
Hoary-bellied Squirrel	27.5387	95.4303
Hoary-bellied Squirrel	27.5194	95.3966
Western Hoolock Gibbon	27.5678	95.4046
Western Hoolock Gibbon	27.5319	95.3882
Western Hoolock Gibbon	27.536	95.4163
Western Hoolock Gibbon	27.5398	95.4303
Western Hoolock Gibbon	27.5388	95.4112
Western Hoolock Gibbon	27.567	95.3921

Figure 42 : LOCATIONS OF IMPORTANT MAMMAL SPECIES SIGHTED IN THE STUDY AREA

Species of Special Concern

Biodiversity data collected in the study area is analyzed qualitatively as well as quantitatively. Qualitative analysis involves referencing the IUCN (International Union for Conservation of Nature and Natural Resources) Red List for worldwide population and conservation status of the species and Indian Wildlife (Protection) Act (WPA), 1972 which provides legal protection level to different species in India. This information helps predict the sensitive species present in the study area to formulate an action plan for their protection and conservation within the study area.

The quantitative analysis involves the calculation of relative density and relative frequency for the recorded population of floral and faunal biodiversity. These values indicate species with the densest population, most frequently encountered species and areas with good biodiversity richness.

IUCN (International Union for Conservation of Nature and Natural Resources)Red List of Threatened Species

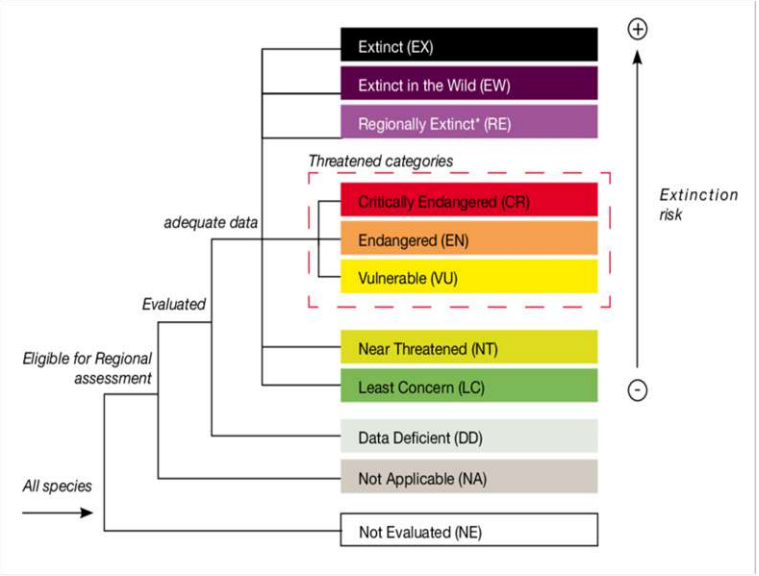


Figure 43 : IUCN RED LIST CATEGORIES

The IUCN Red List is a critical indicator of the health of the world's biodiversity. Far more than a list of species and their status, it is a powerful tool to inform and catalyze action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive. It provides information about a range, population size, habitat and ecology, use and/or trade, threats, and conservation actions that will help inform necessary conservation decisions.

The IUCN Red List of Threatened Species is widely recognized as the most comprehensive global approach for evaluating the conservation status of plant and animal species. The Red List has been created by applying a rigorous set of scientific quantitative criteria. It is widely recognized as the most comprehensive and reliable data on the conservation status of a species. The red list categorizes all the species in 8 broad categories with varying degrees of conservation importance. These categories are prepared based on certain criteria. The most critical categories are the

'threatened categories' consisting of Vulnerable, Endangered and Critically Endangered Species; While 'Near Threatened' category denotes likeliness of a species to fall in the threatened categories due to the decline in the population.

Fauna

White-rumped Vulture (*Gyps bengalensis*) was sighted soaring in the DSNP, which falls under Critically Endangered category of IUCN Red List. Lesser Adjutant (*Leptoptilos javanicus*), a large solitary scavenging bird was observed in the croplands and in Maguri Motapung Beel along with Common Pochard (*Aythya ferina*), Swamp Francolin (*Francolinus gularis*), three of which fall in the Vulnerable category of IUCN Red List.

Western Hoolock Gibbons (*Hoolock hoolock*), the only ape species found in India, were sighted swinging along high canopies of Barekuri Village, Na-Matapung Gaon, Borgaon, Denka Gaon, Dighal Sako Gaon, Baghjan Gaon, and Dhelakhat Gaon Villages Assam. Secondary data suggests presence of Western Hoolock Gibbons (*Hoolock hoolock*) in the DSNP regions; however, no sightings were occurred in the study period. Asian Elephant (*Elephas maximus*) footprints were observed on the riverbed's regions of DSNP whereas Ganges River Dolphin (*Platanista gangetica*) was seen moving across Dibru River, on the edges of DSNP. All of these mammals fall in the Endangered category of IUCN Red List.

Wallago attu, is a widely consumed fish in the study area, falls under Vulnerable category of IUCN Red List. During Fish market surveys, this fish found in the fish catch, captured from Maguri Motapung Beel as well as from Dibru River by the fishermen.

As the Table 11 suggests, 7 birds and one mammal species, falling in the Near Threatened category of IUCN Red List were also observed in the study area.

Table 15 : FAUNA SPECIES UNDER IUCN RED LIST

Sr. No.	Species Name	Scientific name	IUCN status
Birds			
1	Lesser Adjutant	*Leptoptilos javanicus*	VU
2	Red-breasted Parakeet	*Psittacula alexandri*	NT
3	Rusty-bellied Shortwing	*Brachypteryx hyperythra*	NT
4	Common Pochard	*Aythya ferina*	VU
5	Swamp Francolin	*Francolinus gularis*	VU
6	Oriental Darter	*Anhinga melanogaster*	NT
7	Ferruginous Duck	*Aythya nyroca*	NT
8	Lesser Fish-eagle	*Icthyophaga humilis*	NT
9	Himalayan Griffon	*Gyps himalayensis*	NT
10	White-rumped Vulture	*Gyps bengalensis*	CR
11	Black-tailed Godwit	*Limosa limosa*	NT
12	Blossom Headed	Himalayapsitta roseata	NT

	Parakeet		
13	Slender-billed Vulture	Gyps tenuirostris	CR
Mammals			
1	Western Hoolock Gibbon	*Hoolock hoolock*	EN
2	Assamese Macaque	*Macaca assamensis*	NT
3	Northern Pig-tailed Macaque	*Macaca leonina*	VU
4	Asian Elephant	*Elephas maximus*	EN
5	Ganges River Dolphin	*Platanista gangetica gangetica*	EN
Herpetofauna			
1	Assam roofed turtle	*Pangshura sylhetensis*	CR
Fishes			
1	-	*Wallago attu*	VU

Flora

No IUCN Red Listed floral Species were observed during the survey conducted.

Wildlife (Protection) Act, 1972 Schedules

Indian Wildlife (Protection) Act, 1972 (here onwards mentioned as WPA) categorizes the wildlife of India in six different schedules, the first five of which are for animals and the sixth for plants. Organisms listed in these schedules are accorded varying degrees of protection, with animals falling under Schedule I and Schedule II being accorded maximum protection. Table 12 explains the degree of protection for each schedule.

Table 16 : WILDLIFE (PROTECTION) ACT, 1972 SCHEDULES

Schedules	Description
Schedule I and Schedule II	Provide absolute protection – offences under these are charged with the highest penalties
Schedule III and IV	Provide protection, penalties milder than that of Schedule I and Schedule II
Schedule V	'Vermin' animals as per the act
Schedule VI	Plants that are prohibited from cultivation and planting

Thus, schedule I and II are most essential from a conservation point of view. It is important to know whether any species under these schedules are present in an area, their population status and threats to implement conservation measures.

Fauna

Lesser Fish-eagle (*Icthyophaga humilis*) and White-rumped Vulture (*Gyps bengalensis*) were observed near the forested regions of DSNP. Kalij Pheasant (*Lophura leucomelanos*) was observed in the thickets of Podumoni region of Bherjan-Bhorajan-Podumoni wildlife sanctuary. Osprey (*Pandion haliaetus*) was observed perched on a tree near the riparian areas of Maguri Motapung Beel. These birds along with mammals such as Western Hoolock Gibbon (*Hoolock hoolock*), Asian Elephant (*Elephas maximus*), and Ganges River Dolphin (*Platanista gangetica*) are protected under schedule I of the wildlife (protection) Act, 1972.

Four mammal species, which are Rhesus Macaque (*Macaca mulatta*), Assamese Macaque (*Macaca assamensis*), Northern Pig-tailed Macaque (*Macaca leonina*), Golden Jackal *(Canis aureus*) and Indian Grey Mongoose (*Urva edwardsii)* are found to be protected under schedule II of the WPA.

In terms of butterfly species documented during survey, 5 species were found to be protected under schedule I of the WPA and 24 under schedule II of the WPA. One reptile species 'Checkered Keelback' (*Fowlea piscator*) was found to be placed in schedule II of the WPA.

Table 17 : FAUNA SPECIES UNDER WPA SCHEDULE

Sr. No.	Species Name	WPA schedule
Birds		
1	Osprey	I
2	Kalij Pheasant	I
3	Lesser Fish-eagle	I
4	White-rumped Vulture	I
5	Slender-billed Vulture	I
Mammals		
1	Western Hoolock Gibbon	I
2	Rhesus Macaque	II
3	Assamese Macaque	II
4	Northern Pig-tailed Macaque	II
5	Golden Jackal	II
6	Asian Elephant	I
7	Ganges River Dolphin	I
Butterflies		
1	Eastern Striped Albatross	II
2	Chocolate Albatross	II
3	Common Pierrot	I
4	Danaid Eggfly	I
5	Grey Count	II
6	Common Gull	II
7	Common Duffer	I
8	Great evening brown	II
9	Metallic Cerulean	II
10	Orchid Tit	I
11	Blackvein Sergeant	II
12	Common Gem	II
13	Sylhet Oakblue	II
14	Tawny Rajah	II
15	Pale Wanderer	II
16	Clear Sailer	II
17	Double-branded Bushbrown	II
18	Wizard	II
19	Yellow-crested Spangle	II
20	Tamil Oakblue	II
21	Chinese Bushbrown	II
22	Pale Four-Lineblue	II
23	Lesser Gull	II

24	Blue Baron	I
25	Assam Chain Swordtail	II
26	Blue-spotted Crow	II
27	Common Albatross	II
28	Green Flash	II
29	Malayan	II
Reptiles		
1	Checkered Keelback	II

Flora

No floral species falling in schedule of WPA 1972 was observed during the survey conducted.

Invasive Species

The species documented during the study was screened through the IUCN Global Invasive Species Database for documenting the invasive species. *Trapa natans* and *Eicchornia crassipes*, *Ceratophyllum demersum* and *Hydrilla verticillata, Ipomoea aquatic* are the species exclusively dominating the waterscapes. Out of which *Ceratophyllum demersum* and *Hydrilla verticillata* are water submerged species, and *Trapa natans* and *Eicchornia crassipes* are water surface floating species. Ipomoea aquatic is a marginal species, growing along the periphery of lake. *Imperata cylindrica* is found around the wetland habitat.

Ageratum conyzoides, Alternanthera sessilis, Eupatorium odoratum, Mikania micrantha, Senna tora are the terrestrial plant species and were recorded in all habitats in the study area.

Table 18 : IUCN GLOBAL INVASIVE SPECIES (GISD) SPECIES IN STUDY AREA

Sr. No.	*Scientific Name*	Habit	English Common Name
1	*Ageratum conyzoids*	Herbs	Billy Goat Weed
2	*Alternanthera sessilis*	Herbs	Dwarf Copperleaf
3	*Ceratophyllum demersum*	Herbs	Coon Tail
4	*Eichhornia crassipes*	Herbs	Common Water Hyacinth
5	*Eupatorium odoratum*	Shrubs	Siam Weed
6	*Hydrilla verticillata*	Herbs	Hydrilla
7	*Imperata cylindrica*	Herbs	Cogon Grass
8	*Ipomoea aquatica*	Herbs	Water Spinach
9	*Lantana camera*	Shrubs	West Indian Lantana
10	*Mikania micrantha*	Herbs	-
11	*Mimosa pudica*	Herbs	Touch Me Not
12	*Potamogeton crispus*	Herbs	Curled Pondweed
13	*Solanum torvum*	Shrubs	Turkey Berry
14	*Solanum viarum*	Shrubs	Tropical Soda Apple

15	*Trapa natans*	Herbs	Water Chestnut
16	*Ipomea carnea*	Shrubs	Bush Morning Glory
17	*Senna tora*	Herbs	Sickle Pod

Eupatorium odoratum

Mikania micrantha

Eicchornia crasssipes

Ipomoea aquatica

Ipomoea carnea

Trapa natans

Figure 44 : Invasive species

Findings from Secondary Literature Review

Assam nestles a number of charismatic mammalian fauna Rhino, Elephant, Tiger, Pygmy hog, Hispid hare, Golden langur, Leopard, Golden Cat, Clouded leopard, Himalaya palm civet, Binturong, Himalayan black bear, Sloth bear, Gaur, Water buffalo, Sambar, Hog deer, Barking deer, Swamp deeretc. Wildlife in Assam is given protection through a network of 5 National Parks, 20 Wildlife Sanctuaries, three Tiger Reserves and five Elephant Reserves.

Dibru - Saikhowa Complex and Bherjan-Borajan-Podumoni Wildlife Sanctuary are the two, BirdLife International accredited Important Birding Sites (IBA).

Dibru - Saikhowa Complex comprises of Dibru-Saikhowa National Park, Poba Reserve Forest, Kobo chapori (river islands) proposed reserve forest, Amarpur chapori, Maguri and Motapung Beel, and theadjacent riverine tract of the Brahmaputra and Lohit rivers; out of which, only Dibru-Saikhowa National Park and Maguri Motapung Beel fall in the present study area.

Bherjan-Borajan-Podumoni Wildlife Sanctuary

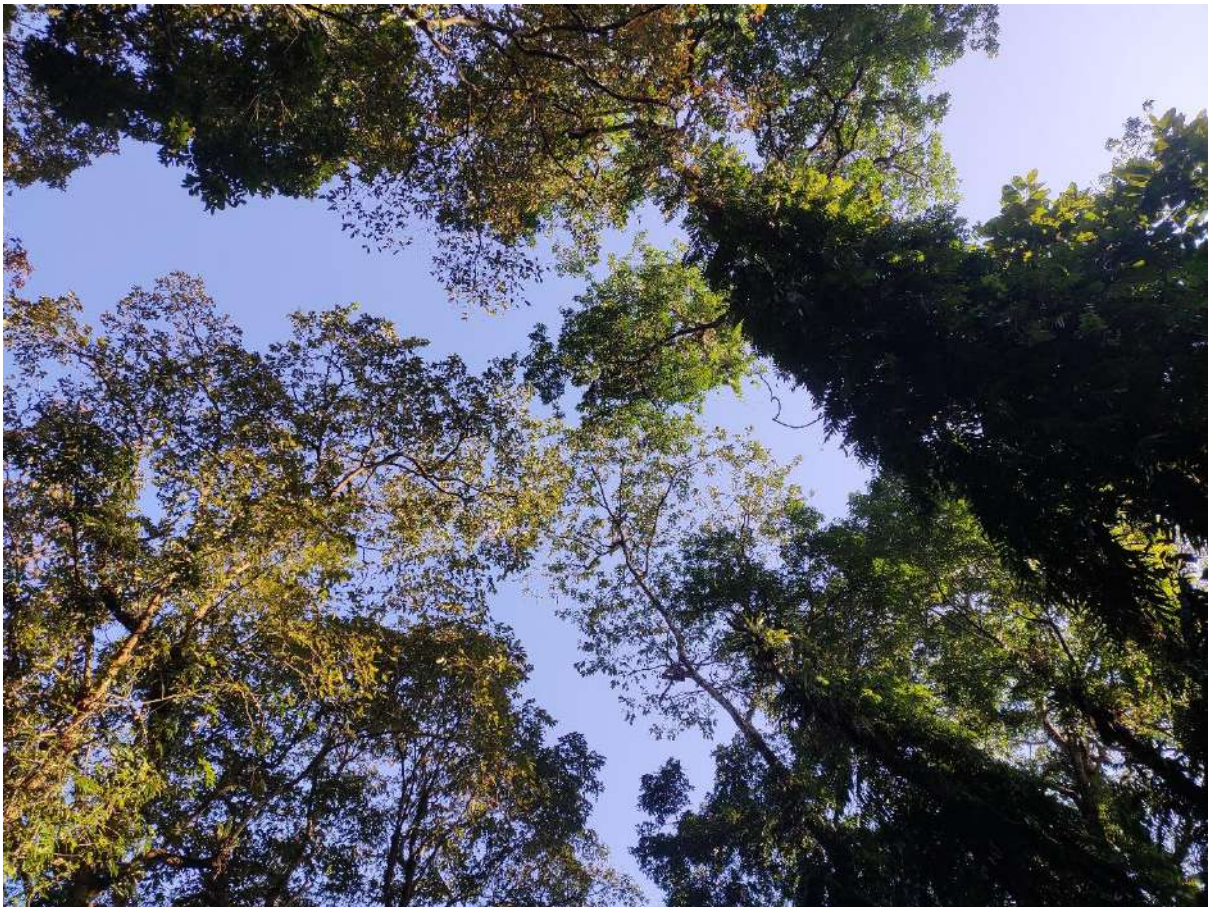


Figure 45 : Canopy of Bherjan region of Bherjan-Borajan-Podumoni Wildlife Sanctuary

The Bherjan – Borajan – Podumoni Wildlife Sancturay comprises of Bherjan (105 ha), Borajan (493 ha) and Podumoni (176 ha) as separate three pockets of lowland tropical forest, present in Tinsukia district, Assam. Bherjan and Podumoni regions fall in the present study area.

The Bherjan-Borajan-Padumoni WLS is one of the smallest wildlife sanctuaries of Assam covering 7.22 km^2 of area spreading across three blocks located in Tinsukia district of the Upper Brahmaputra Valley of Assam, India which consists of three separate forests, namely Bherjan, Borajan and Podumoni. Bherjan, Borajan and Podumoni are tiny isolated pockets of lowland tropical forest[11]. The Sanctuary area has some very significant patches of remnants of Assam Valley Tropical wet Evergreen Forest interspersed with Easter Seasonal Swamp Forest and Assam alluvial plains semi-evergreen forests[11]. The three areas are disjoint and unconnected by tea gardens and human settlement. These are entirely on the flat plains of the Brahmaputra Valley. There are small, scattered marshes, with swamps, covered with dense growth of grass and *Alpinia* herb. The natural vegetation of all these areas is tropical wet evergreen 'rainforest' type.[12]

[11] *https://moef.gov.in/wp-content/uploads/2021/06/berjan-borajan.pdf*

[12] *Borah, P. & J. Barukial (2021). On the pteridophytes of Bherjan-Borajan-Padumoni Wildlife Sanctuary, Assam, India. Journal of Threatened Taxa 13(12): 19781-19790*

Bherjan is almost entirely covered with trees with a closed canopy. The original vegetation has been replaced by a fairly old mixed plantation dominated by the deciduous species *Lagerstroemia parviflora* and *Terminalia myriocarpa*. The Podumoni part is mostly in a degraded state due to large-scale felling. The canopy has been very badly broken up. Only a few mature trees of *Artocarpus*, *Bombax, Lagerstroemia*, and *Mesua* species can be seen. Borajan is a pocket of excellent rainforest, dominated by *Dipterocarpus macrocarpus*. Except for Teak, all the species as in the other two forest pockets are found. Bamboo species are found in all areas[13].

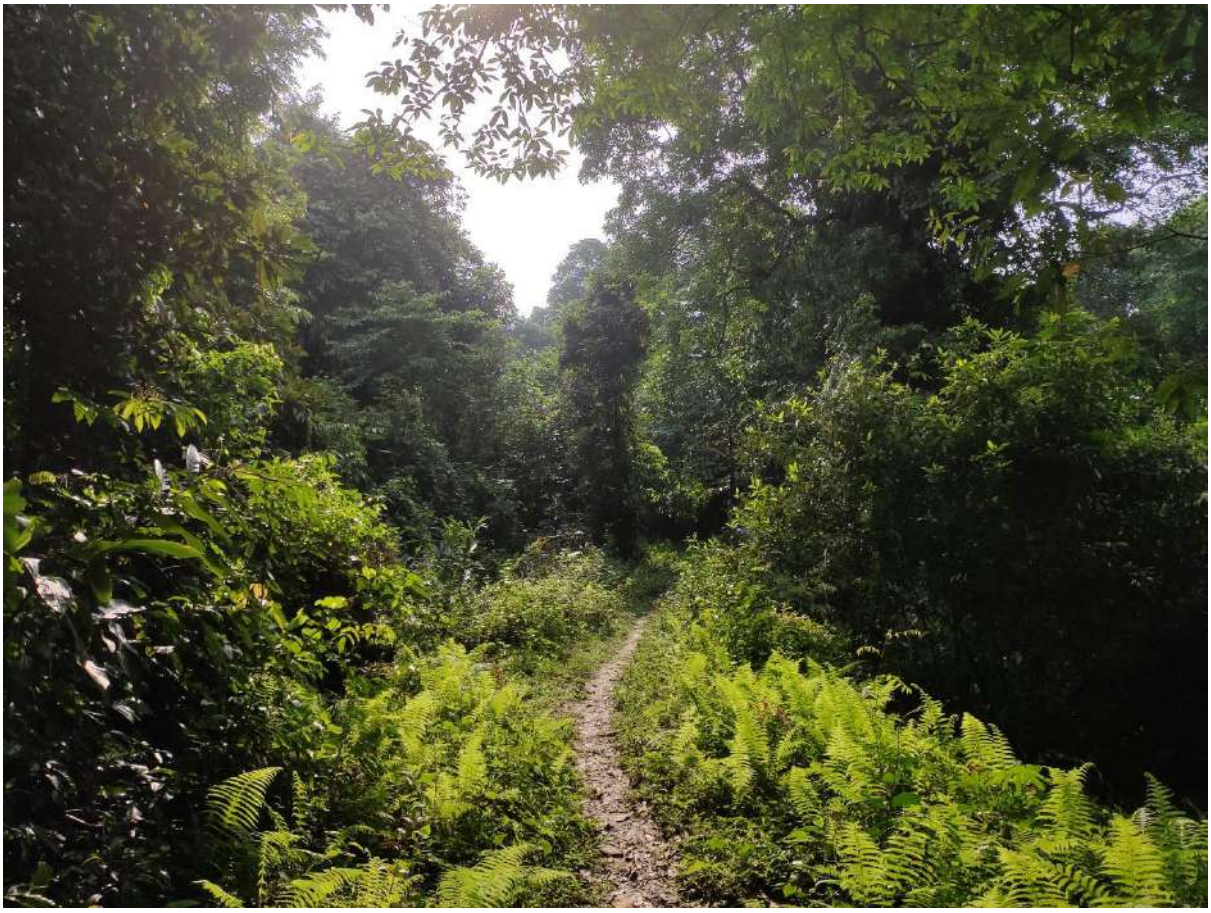


Figure 46 : Podumoni region of Bherjan-Borajan-Podumoni Wildlife Sanctuary

The forest is the home for an endangered primate species, i.e., Western Hoolock Gibbon (*Hoolock hoolock*) and ideal habitat for primate species like the Bengal Slow Loris (*Nycticebus bengalensis*), Assamese Macaque (*Macaca assamensis*), Pig-tailed Macaque (*Macaca leonina*), Rhesus Macaque (Macaca mulatta), Capped Langur (Trachypithecus pileatus), Stump-tailed Macaque (*Macaca arctoides*).[13] Species which are not strictly confined to top canopy like Rhesus macaque and Pig tailed Macaque can be found throughout the study area, including in proximity to the settlements.[14]

[13] *Borah, P. & J. Barukial (2021). On the pteridophytes of Bherjan-Borajan-Padumoni Wildlife Sanctuary, Assam, India. Journal of Threatened Taxa 13(12): 19781-19790*

[14] *Anwaruddin Choudhury; The Hoolock Gibbon (Hoolock hoolock) in Tinsukia and Dibrugarh districts of Assam, India, Asian Primates Journal 1(2), 2009*

The major avian species found in the area are White-rumped Vulture (*Gyps bengalensis*), Slender- billed Vulture (*Gyps tenuirostris*), Lesser Adjutant (*Leptoptilos javanicus*), Rusty-bellied Shortwing (*Brachypteryx hyperythra*).

Other fauna of the sanctuary include the Short-tailed Mole (*Euroscaptor micrura*), Chinese Pangolin (*Manis pentadactyla*), Golden Jackal (*Canis aureus*), Leopard Cat (*Prionailurus bengalensis*), Leopard (*Panthera pardus*), Tiger (*Panthera tigris*), Asiatic Elephant (*Elephas maximus*), Common Giant Flying Squirrel (*Petaurista petaurista*), Pallas's Squirrel (*Callosciurus erythraeus*), Malayan Giant Squirrel (*Ratufa bicolor*), Chinese Porcupine (*Hystrix hodgsoni*), Wild Boar (*Sus scrofa*), and Barking Deer (*Muntiacus muntjak*) [15]

Maguri Motapung Beel

Figure 47 : Maguri Motapung Beel

Maguri Motapung Beel is one of the major floodplain wetlands situated in the Tinsukia; covering an area of 1000 ha, located about 3.8 km away from the Guijan Ghat, the gateway of Dibru- Saikhowa National park and biosphere reserve.[15] The Beel complex is 12 km north of Tinsukia town.

In Maguri Motapung Beel wetland, *Nelumbo nucifera, Brasenia schreberi, Euryale ferox, Trapa natans* and *Hydrocharis dubia,* these floating leaved *macrophytes* provide shade and shelter for fish, and waterfowl often eat their seeds. They also provide various economic benefits for the local people.[16]

Maguri and Motapung, a complex of Beels, are fringed with wide marshes, water channels, and tall to medium grassland. The Maguri-Motapung area is very rich in birdlife, especially marsh birds and water birds. Critically endangered species from area

[15] *Rahmani, A. R., Islam, M. Z., & Kasambe, R. M. (2016). Important bird and biodiversity areas in India: Priority sites for conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (UK), 1992.*

[16] *Lahon, D. (2019). The Density of Floating-Leaved Aquatic Plants During the Monsoon Season: A Case Study of Maguri Motapung Wetland of Assam, India. Think India Journal, 22(10), 5604-5609*

are White-bellied Heron (*Ardea insignis*), White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Red-headed Vulture (*Aegypius calvus*), Baer's Pochard (*Aythya baeri*) and Bengal Florican (*Houbaropsis bengalensis*). The endemic birds are Black-breasted Parrotbill (*Paradoxornis flavirostris*) and Marsh Babbler (*Pellorneum palustre*).

Some of the migratory bird species visiting the Beel includes the Ruddy Shelduck (*Tadorna ferruginea*), Baikal Teal (*Sibirionetta formosa*), Bar-Headed Goose (Anser indicus), Falcated Duck (Anser indicus) , Ferrigunuous Duck (*Aythya nyroca*), Northern Pintail (*Anas acuta*), Eurasian Wegion (*Mareca penelope),* Common Teal (*Anas crecca*), Black- Headed Ibis (*Threskiornis melanocephalus*), Glossy Ibis (*Plegadis falcinellus*), Eurasian Curlew (*Numenius arquata*) etc.[5]

Other fauna includes Hog Deer (*Axis porcinus*), Ganges River Dolphin (*Platanista gangetica*), Bengal Monitor Lizards (*Varanus bengalensis*) and Asian Water Monitor (*Varanus salvator*), Indian Cobra (*Naja kaouthia*) and Indian Rock Python (*Python molurus*).[15]

Due to its unique topography and ecological conditions, Assam harbours a diverse ichthyofaunal resource. About 217 fish species have been reported from this area. The species includes *Chitala chitala, Danio devario, Amblypharyngodon mola, Puntius sarana, Cirrhinus mrigala, Cyprinus carpio, Ctenopharyngodon idella, Hypophthalmichthys molitrix, Lepidocephalichthys guntea, Puntius sophore, Mystus tengara, Chanda nama, Labeo gonius, Osteobrama cotio, Glossogobius giuris, Trichogaster fasciata, Xenentodon cancila, Macrognathus aral, Macrognathus pancalus, Mastacembelus, armatus, Channa sp., Wallago attu, Heteropneustes fossilis, Trichogaster lalius, Clarias magur etc.* In Maguri Motapung Beel, abundant fish species are *Puntius sophore, Mystus tengara, Chanda nama, Labeo gonius, Osteobrama cotio, Glossogobius giuris, Trichogaster fasciata, Xenentodon cancila, Macrognathus aral, Macrognathus pancalus* and three exotic carps are *Cyprinus carpio, Ctenopharyngodon idella and Hypophthalmichthys molitrix.*[17]

In Maguri Motapung Beel, mollusc diversity belongs to Viviparidae, Ampullaridae, Thiaridae, Pachychilidae, Lymnaeidae, Planorbidae, Unionidae, Cyrenidae, Sphaeriidae. Mollusc such as *Indoplanorbis exustus, Intha umbilicalis, Lymnaea acuminata, Brotia costula, Tarebia lineata, Tarebia granifera, Melanoides tuberculata, Plotia scabra, Pila virens, Pila globosa, Angulyagra oxytropis, Angulyagra microchaetophora, Idiopoma dissimilis, Mekongia crassa* and *Bellamya bengalensis* belong to Gastropoda; and *Lamellidens marginalis, Lamellidens corrianus, Parreysia corbis, Parreysia smaragdites, Parreysia lima, Parreysia pachysoma, Corbicula assamensis, Corbicula striatella, Sphaerium indicum* and *Sphaerium austeni* belong to Bivalvia [18]

[17] *Kalita, P., Pathak, S., & Deka, P. (2016). A preliminary study on ichthyofaunal resource of Motapung-Maguri Beel of Tinsukia district of Assam, India. Intl J of Fauna and Biol Studies, 3(4), 97-102.*

[18] *Kardong, Devid & Puzari, Munmi & Sonowal, Jyotish. (2020). Diversity of freshwater mollusc in Maguri Beel Tinsukia district in Assam, India; International Journal of Current Research 8. 29169-29176*

Table 30 illustrates list of molluscan species found in Maguri Motapung Beel and Dibru River complex.

Table 29 illustrates the ichthyofaunal resource of Motapung-Maguri Beel in detail.

River and wetlands play a vital role in the productivity as they are beset with varieties of flora and fauna including plankton. Phytoplankton are the primary producers of water bodies, these are the main source of food directly or indirectly for various animal groups. The productivity of any aquatic water body depends on the amount of plankton present in the said water body. Phytoplanktons such as Navicula sp., Nitzschia sp., sp., Phacus sp. Coleastrum sp., Coscinodiscus sp, and zooplankton families of Lecanidae, Lepadellidae, Brachionidae, Chydoridae, Daphniidae, and Macrothricidae have been recorded maximally in the research conducted in Maguri Motopung Beel and Dibru River.[19]

Dibru-Saikhowa National Park

Figure 48 : Dibru-Saikhowa National Park

From Dibru - Saikhowa Complex, Dibru-Saikhowa National Park fall in the study area; it is located at Dibrugarh and Tinsukia Districts of Assam. The National Park represents a unique geo-morphological structure created by the river Brahmaputra and its tributaries, and the water channels, especially the Brahmaputra, forming an important habitat for the Gangetic Dolphin (*Platanista gangetica*)[20].
The entire Reserve is placed in the low laying flood plain of the mighty Brahmaputra River and Lohit River bordering the North and the Dibru River bordering the south.

The forest types of the Dibru-Saikhowa Biosphere Reserve consist of semi-evergreen,

[19] *https://www.researchgate.net/publication/339553462_Zooplankton_diversity_of_three_floodplain_lakes_of_the_Dibru-Saikhowa_Biosphere_reserve_upper_Assam_northeast_India_International_Journal_of_Aquatic_Biology_8118-34/link/5e61052d299bf182deeabd5a/download*

[20] *https://moef.gov.in/wp-content/uploads/2019/10/dibru-saikhowa.pdf*

deciduous, littoral and swamp forests and patches of wet evergreen forests. Diverse vegetation types of the reserve support a variety of floristic elements that accounted for over 680 species (464 genera and 143 families) of flowering plants that represents an array of life forms like tree (126 spp.), shrubs and under shrubs (155), herbs including aquatics (295), climbers and twiners (81), epiphytes (19) and parasites (4). Of the total, dicotyledonous plants accounted for 511 species (350 genera and 169 families) while the rest 169 species under 114 genera and 27 families are monocotyledonous plants. The legume family Fabaceae is the largest family with 35 genera and 66 Species. Poaceae (39 genera & 50 species) and Asteraceae (27 genera & 32 species) are the other largest families in the reserve. The fig plant i.e. Ficus is the largest genus among the Dicotyledons and *Cyperus* among the monocotyledons.[21]

The original natural vegetation of the National Park was tropical wet evergreen rainforest (1/1/1B/C1 Assam valley Tropical wet evergreen forest) with grassland and reed beds (1/4/4D/2S1: Eastern wet alluvial grasslands and 1/4/4D/SS: Eastern seasonal swamp forests) in the riverine tracts and depressions. During the great earthquake of 1950, large parts of the reserve sank by a few meters, resulting in the regular flooding of the area. This was followed by the emergence of a new type of vegetation. 'Salix swamps' (1/4/4D/SS2 Barringtonia swamp forests) and deciduous forest now dominate the reserve, and evergreen forest is now restricted to a few patches. About a third of the national park is covered with Salix tetrasperma and Bischofia javanica—the most abundant tree species. Dipterocarpus macrocarpus trees, which were common before 1950, are now rare. Grassland and reed beds cover another third of the park (1/3/1/S2b Eastern Hollock Forests and 1/4/4D/2S1: Eastern wet alluvial grasslands). The main reed and grass species are *Arundo donax, Phragmites karka, Imperata cylindrica, Saccharum* spp. etc. The core area of Dibru Saikhowa Biosphere Reserve is a mosaic of habitat types, the diversity of which is reflected in the faunal diversity it supports. The core is characterized by littoral and swamp forests, semi-evergreen forests, deciduous forests and patches of wet evergreen forests.

Assam the second largest state of North-East India is a rich store house of Orchids in India. The total number of species may be around 193 under 71 genera out of which 27 are endemic. The Dibru- Saikhowa National Park and Biosphere Reserve has been a natural dwelling home of a wide variety of orchids. So far, 35 species of epiphytic orchids and 8 species of terrestrial orchid have been recorded from this area. The Orchid flora of Dibru-Saikhowa National Park is a valuable natural resource. Out of these 35 are epiphytic and 8 are terrestrial. The various species *Aerides multiflorum, A. rosea, A. odorata, Cymbidium bicolor, C. dayanum, Dendrobium moschatum*, *D. fimbriatum, D. nobile, D. transparens, D. lituiflorum, D. aphyllum, D. aduncum, Micropera rostratum, Rhynchostylis albiflora, R. retusa* along with some species *Acampe papilliosa, Aerides multiflorum, A. odoratum, Cleisostoma appendiculatum, Cymbidium dayanum, Dendrobium nobile, Gastrochilus calceolaris, Habenaria stenopetala, Rhyncostylis albiflora, Zeuxine lindleyana, Cymbidium bicolour,*

[21] *Chaudhry, Shivaji. (2012). Dibru Saikhowa Biosphere Reserve, Brahmaputra Valley, India*

Micropera rostratum, Promatocalpa undulatum, Robiquetia spathulata are observed in the DSNP. [2223] [24]

The Wildlife (Protection) Act 1972 protected six species are Beddome's cycad (Cycas beddomei), Blue Vanda (Vanda coerulea), Kuth (Sassurea lappa), Ladies slipper orchids (Paphiopedilum spp.), Pitcher plant (Nepenthes khasiana), Red Vanda (Rananthera imshootiana) also said to be observed in the DSNP

About 958 species and subspecies of birds have so far been reported or likely to occur in Assam. This is the highest diversity of birds in any of the Indian states. Arunachal Pradesh comes next with more than 750 species. About 500 species of birds were reported by the Forest Department from Dibru- Saikhowa National Park. The Dibru Saikhowa Biosphere Reserve is the proposed Ramsar site and falls in the course of two major international fly-ways of migratory birds. There are around 50 species of globally threatened avifauna reported in the National Park[25]. The resident birds of Dibru-Saikhowa National Park include White-bellied Heron (*Ardea insignis*), Greater Adjutant (*Leptoptilos dubius*), Lesser Adjutant (*Leptoptilos javanicus*), White-winged Duck (*Asarcornis scutulata*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Swamp Francolin (*Francolinus gularis*), Black-breasted Parrotbill (*Paradoxornis flavirostris*), Jerdon's Bushchat (*Saxicola jerdoni*), Spot-billed Pelican (*Pelecanus philippensis*), Oriental Darter (*Anhinga melanogaster*), Bengal Florican (Houbaropsis bengalensis), etc.[26]

The avifaunal species that are winters visitor in the area include Bar-headed goose (*Anser indicus*), Ruddy shelduck (*Tadorna ferruginea*), Eurasian teal (*Anas crecca*), Common greenshank (*Tringa nebularia*), European starling (Sturnus vulgaris),Chestnut-bellied rock thrush (Monticola rufiventris), Rosy pipit (*Anthus roseatus*), Dusky warbler (*Phylloscopus fuscatus*), Red-throated thrush (*Turdus ruficollis*), Lesser whitethroat (*Sylvia curruca*), Eastern crowned warbler (*Phylloscopus coronatus*), Chestnut-crowned warbler (*Phylloscopus castaniceps*), Green-crowned warbler (*Phylloscopus burkii*), etc. [27] Dibru-Saikhowa area is among the most important wintering sites in Assam of the Black Stork (*Ciconia nigra*).

The unique habitat and climate of DSNP makes a hotspot for Butterfly fauna. [2628] Early European lepidopterists explored this biodiversity hotspot between 1840 and 1950. A total of 125 species are found in DSNP; amongst these Cornelian (*Deudorix epijarbas amatius),* Common Duffer *(Discophora sondaica)* are protected under Schedule I (part

[22] *Hedge, S.N., 2000. Orchid Biodiversity of North East India. J. Assam Sci. Soc. 41(4): 289 – 311.*

[23] *Rao, A.N. 1995. New Contribution to the Orchid flora of North East India during 1950-1990, with special reference to Arunachal Pradesh- A review. J. Econ. Taxon. Bot. (Addl. Ser.) 11: 49 – 63*

[24] *Gogoi, Khyanjeet. (2010). Orchid flora of Dibru –Saikhowa National Park and Biosphere Reserve, Assam, India. Pleione. 4. 124 - 134*

[25] *Nongmaithem, R. & Lodhi, Mahendra & Samal, Prasanna & Dhyani, P.P. & Sharma, Subrat. (2016). Faunal diversity and threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. 7. 523-532*

[26] *Choudhury, A. (1998). Mammals, birds and reptiles of Dibru-Saikhowa Sanctuary, Assam, India. Oryx, 32(3), 192-200*

[27] *Nongmaithem, R. & Lodhi, Mahendra & Samal, Prasanna & Dhyani, P.P. & Sharma, Subrat. (2016). Faunal diversity and threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. 7. 523-532*

[28] *Evans, W. H. 1932. The Identification of Indian Butterflies. (Second Edition). Bombay Natural History Society, Mumbai, India. 454 pp.*

IV), Common Gem (*Poritia hewitsoni),* Assam Banded Lineblue *(Prosotas aluta coelestis),* Royal Cerulean *(Jamides caerulea),* Chinese Branded Swift *(Pelopidas sinensis),* Pea Blue *(Lampides boeticus),*Pointed Ciliate Blue *(Anthene lycaenina),* Broad- bordered Sylhet Oakblue *(Arhopala silhetensis silhetensis),* Broad-bordered Dusted Oakblue *(Arhopala bazaloides bazaloides),* Common Onyx (*Horaga onyx),* Chinese Bushbrown *(Mycalesis gotama),* Myanmarese Wizard *(Rhinopalpa polynice birmana),* Assam Unbroken Sergeant *(Athyma pravara acutipennis),* Blackvein Sergeant *(Athyma ranga),* Grey Count *(Tanaecia lepidea)* are in Schedule II (part II) and Striped Blue Crow (*Euploea mulciber),* Complete Paint-brush Swift *(Baoris farri),* Chinese Branded Swift *(Pelopidas sinensis)* listed in Schedule IV of Wildlife Protection Act, 1972.[29]

Dibru-Saikhowa National Park houses numerous species of unique & endangered mammals such as Chinese Pangolin, Wild Water Buffalo, Dhole, Asian Elephants, Tigers, Bengal Slow Loris, Western Hoolock Gibbon, South Asian River Dolphin, Hog Deer etc. [30]It is a key protected area for the Endangered Wild Water Buffalo (*Bubalus arnee*). Assam is the stronghold of the wild water buffalo in the world having 4-5th of the known population.[31] Primate species present in Dibru-Saikhowa National Park are Slow Loris (*Nycticebus coucang*), Southern Pig-tailed Macaque (*Macaca nemestrina*), Rhesus Macaque (*Macaca mulatta*) Assamese Macaque (*Macaca assamensis*), Capped Langur (*Trachypithecus pileatus*) and Western Hoolock Gibbon (*Hoolock hoolock*)[32]. Some of the key fauna of the Dibru-Saikhowa National Park includes Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Sloth Bear (*Melursus ursinus*), Barking Deer (*Muntiacus muntjak*), Hog Deer (*Axis porcinus*), Great Indian one horned rhinoceros (Rhinoceros unicornis), Pygmy hog (Parcula salvanius). The national park shelters a small population of feral horses as well. [33] Elephants use the Dibru-Deomali elephant corridor for migration. The Dibru-Deomali elephant corridor includes D' Ering WLS, Jonai and Kobo Chapori areas (Assam), Dibru-Saikhowa National Park, Joypur RF and Deomali Forest Division. Consequently, this whole area is under the Dibru-Deomali Elephant Reserve[34]

Two aquatic mammals were reported from the study area, they are Eurasian otter (*Lutra lutra*) and Gangetic Dolphin (*Platanista gangetica*). Both of these two animals

[29] *Das, G. N., Tamuly, T., Hussain, A., Boruah, A. & Das, S. 2017. An update list of butterflies (Lepidoptera) of Dibru-Saikhuwa National Park, North-East India. Munis Entomology & Zoology, 12 (2): 408-418*

[30] *Integrated Biodiversity Assessment Tool Proximity Report Oil India Limited Project*
Integrated Biodiversity Assessment Tool Proximity Report Oil India Limited Project

[31] *Choudhury, A. Upward trend in numbers of the wild water buffalo (Bubalus arnee)*

[32] *Choudhury A. (2001) Primates in Northeast India: An Overview of their Distribution and Conservation Status. Wildlife and Protected Areas 1(1), 92–101*

[33] *Nongmaithem, R. & Lodhi, Mahendra & Samal, Prasanna & Dhyani, P.P. & Sharma, Subrat. (2016). Faunal diversity and threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. 7. 523-532*

[34] *Bharath Sundaram et. al (2003) The Asian elephant (Elephas maximus): its habitat, status and distribution in Arunachal Pradesh, India*

can only be encountered in the Brahmaputra River and the numerous streams flowing through the DSNP.

Reptiles species of the Dibru-Saikhowa National Park are Bengal Monitor Lizards (*Varanus bengalensis*), Common monitor lizard (*Varanus salvator*), Assam Roofed Turtle (*Pangshura sylhetensis*), Brown roof turtle (*Pangshura smithii*), Narrow-headed softshell (*Chitra indica*), Southeastasian box turtle (*Cuora amboinensis*), Spotted pond turtle (Geoclemys hamiltonii), Asian leaf turtle Indian (*Cyclemys dentata*), Gharial (*Gavialis gangeticus*), King cobra (*Ophiophagus hannah*) and Indian Rock Python (*Python molurus*) etc.[35]

A total of 64 genera and 104 species of fish fauna belonging to 29 families and 11 orders are recorded from National Park. The family Cyprinidae exhibited a maximum number of species, followed by the family Bagridae, family Channidae, family Sisoridae species. The dominant genera are *Chanda, Labeo, Puntius, Mystus* and *Barilius*[36]

Table 19 : Near Threatened and endangered fishes from Dibru- Saikhowa National Park

Near Threatened and endangered fishes from Dibru- Saikhowa National Park[37]		
Scientific Name	**Common Name**	**IUCN Red List Category**
Chitala chitala	-	Near Threatened
Anguilla bengalensis	Indian Mottled Eel	Near Threatened
Tor putitora	Himalayan mahseer	Endangered
Ompok bimaculatus	Butter catfish	Near Threatened
Ompok pabda	Butter catfish	Near Threatened

Differences in species of mollusca have been found in aqautic populations Dibru and it's tributaries and wetlands. Species like Filopaludina bengalensis, M. tuberculata, Tarebia granifera, T. lineata, Brotia costula, Lamellidens corrianus, L. marginalis, P. corbis, P. corrugata, and P. favidens are common to both tributaries and wetlands. While species like Thiara aspera, L. ovalior, Scabies crispata, Balwantia soleniformis, Indonaia olivaria, I. nuttaliana, I. shurtleffiana, I. theobaldi, and T. exolescens are also found towards the riverbanks. Unique species like Mekongia crassa, Idiopoma dissimilis, F. micron, Angulyagra microchaetophora, Pila olea, Gyraulus convexiusculus, Sphaerium austeni, and Musculium indicum were recorded also from the wetlands in and around Dibru- Saikhowa Complex.[38]

Table 30 illustrates list of molluscan species found in Maguri Motapung Beel and Dibru River complex.

[35] *Choudhury, A. (1998). Mammals, birds and reptiles of Dibru-Saikhowa Sanctuary, Assam, India. Oryx, 32(3), 192-200*

[36] *Nongmaithem, R. & Lodhi, Mahendra & Samal, Prasanna & Dhyani, P.P. & Sharma, Subrat. (2016). Faunal diversity and threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. 7. 523-532*

[37] *https://biostor.org/reference/151138*

[38] *https://threatenedtaxa.org/JoTT/article/view/7144/7518*

Amphibians such as Common Indian Toad (*Duttaphrynus melanostictus*), Common Indian Bull Frog (*Hoplobactrachus tigerinus*), Field Frog (*Limnonectus limnocharis*), and Tree Frog (*Ploypedates leucomystax*) are observed in the NP area.[39]

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- Evans, W. H. 1932. The Identification of Indian Butterflies. (Second Edition). Bombay Natural History Society, Mumbai, India. 454 pp.

[39] *Nongmaithem, R. & Lodhi, Mahendra & Samal, Prasanna & Dhyani, P.P. & Sharma, Subrat. (2016). Faunal diversity and threats of the Dibru-Saikhowa Biosphere Reserve: A study from Assam, India. 7. 523-532*

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IBAT Proximity Report

The following table of Key Biodiversity Areas is generated by using **IBAT (Integrated Biodiversity Assessment Tool Proximity Report)** on 08 July 2021 (GMT) that includes full list of protected areas, Key Biodiversity Areas in the 10 km buffer of the study area.

Area name	Distance
Bherjan-Borajan-Podumoni Wildlife Sanctuary	10 km
Dibru - Saikhowa Complex	10 km
Maguri and Motapung Beels	10 km

The following table of species is generated by using IBAT (Integrated Biodiversity Assessment Tool Proximity Report) on 08 July 2021 (GMT) that includes full list of threatened species are potentially found in the protected areas & Key Biodiversity Areas in the 50 km buffer of the study area.

Table 20 : LIST OF SPECIES IS GENERATED BY USING IBAT IN THE 50 BUFFERS OF THE STUDY AREA

Sr. No.	Common Name	Scientific Name	IUCN Status	Population Trend	Biome
Flora					
1	Love Apple	*Paris polyphylla*	VU	Decreasing	Terrestrial
2	-	*Oryza malampuzhaensis*	VU	Decreasing	Terrestrial
3	Atlas Daisy	*Anacyclus pyrethrum*	VU	Decreasing	Terrestrial
4	-	*Magnolia pealiana*	EN	Decreasing	Terrestrial
5	-	*Magnolia gustavii*	CR	Decreasing	Terrestrial
Birds					
1	Baer's Pochard	*Aythya baeri*	CR	Decreasing	Freshwater
2	Bengal Florican	*Houbaropsis bengalensis*	CR	Decreasing	Terrestrial
3	White rumped Vulture	*Gyps bengalensis*	CR	Decreasing	Terrestrial
4	Red-headed Vulture	*Sarcogyps calvus*	CR	Decreasing	Terrestrial
5	White-bellied Heron	*Ardea insignis*	CR	Decreasing	Terrestrial, Freshwater
6	Yellow-breasted Bunting	*Emberiza aureola*	CR	Decreasing	Terrestrial, Freshwater

7	Manipur Bush-quail	*Perdicula manipurensis*	EN	Decreasing	Terrestrial, Freshwater
8	White-winged Duck	*Asarcornis scutulata*	EN	Decreasing	Terrestrial, Freshwater
9	Masked Finfoot	*Heliopais personatus*	EN	Decreasing	Terrestrial, Freshwater
10	Indian Skimmer	*Rynchops albicollis*	EN	Decreasing	Terrestrial, Freshwater
11	Black-bellied Tern	*Sterna acuticauda*	EN	Decreasing	Terrestrial, Freshwater
12	Pallas's Fish eagle	*Haliaeetus leucoryphus*	EN	Decreasing	Terrestrial, Freshwater
13	Steppe Eagle	*Steppe Eagle*	EN	Decreasing	Terrestrial
14	Greater Adjutant	*Leptoptilos dubius*	EN	Decreasing	Terrestrial, Freshwater
15	Swamp Grassbabbler	*Laticilla cinerascens*	EN	Decreasing	Terrestrial, Freshwater
16	Swamp Francolin	*Francolinus gularis*	VU	Decreasing	Terrestrial, Freshwater
17	Chestnut-breasted Partridge	*Arborophila mandellii*	VU	Decreasing	Terrestrial
18	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	VU	Decreasing	Terrestrial
19	Rufous-necked Hornbill	*Aceros nipalensis*	VU	Decreasing	Terrestrial
20	Pale-capped Pigeon	*Columba punicea*	VU	Decreasing	Terrestrial
21	Sarus Crane	*Grus antigone*	VU	Decreasing	Terrestrial, Freshwater
22	River Tern	*Sterna aurantia*	VU	Decreasing	Terrestrial, Freshwater, Marine
23	Greater Spotted Eagle	*Clanga clanga*	VU	Decreasing	Terrestrial, Freshwater
24	Eastern Imperial Eagle	*Aquila heliaca*	VU	Decreasing	Terrestrial, Freshwater
25	Lesser Adjutant	*Leptoptilos javanicus*	VU	Decreasing	Terrestrial, Freshwater,

					Marine
26	Grey-sided Thrush	*Turdus feae*	VU	Decreasing	Terrestrial
27	Marsh Babbler	*Pellorneum palustre*	VU	Decreasing	Terrestrial
28	Jerdon's Babbler	*Chrysomma altirostre*	VU	Decreasing	Terrestrial, Freshwater
29	Black-breasted Parrotbill	*Paradoxornis flavirostris*	VU	Decreasing	Terrestrial, Freshwater
30	Slender - billed Vulture	*Gyps tenuirostris*	CR	Decreasing	Terrestrial
Mammals					
1	Chinese Pangolin	*Manis pentadactyla*	CR	Decreasing	Terrestrial
2	Wild Water Buffalo	*Bubalus arnee*	EN	Decreasing	Terrestrial, Freshwater
3	Asian Elephant	*Elephas maximus*	EN	Decreasing	Terrestrial
4	Dhole	*Cuon alpinus*	EN	Decreasing	Terrestrial
5	Tiger	*Panthera tigris*	EN	Decreasing	Terrestrial
6	Bengal Slow Loris	*Nycticebus bengalensis*	EN	Decreasing	Terrestrial
7	Western Hoolock Gibbon	*Hoolock hoolock*	EN	Decreasing	Terrestrial
8	South Asian River Dolphin	*Platanista gangetica*	EN	Unknown	Freshwater
9	Hog Deer	*Axis porcinus*	EN	Decreasing	Terrestrial, Freshwater
10	Mishmi Hills Hoolock Gibbon	*Hoolock hoolock ssp. mishmiensis*	EN	Decreasing	Terrestrial
11	Blond-bellied Langur	*Trachypithecus pileatus ssp. pileatus*	EN	Decreasing	Terrestrial
12	Gaur	*Bos gaurus*	VU	Decreasing	Terrestrial
13	Sun Bear	*Helarctos malayanus*	VU	Decreasing	Terrestrial
14	Stump-tailed Macaque	*Macaca arctoides*	VU	Decreasing	Terrestrial
15	Clouded Leopard	*Neofelis nebulosa*	VU	Decreasing	Terrestrial
16	Leopard	*Panthera pardus*	VU	Decreasing	Terrestrial

17	Fishing Cat	*Prionailurus viverrinus*	VU	Decreasing	Terrestrial, Freshwater
18	Greater One-horned Rhino	*Rhinoceros unicornis*	VU	Decreasing	Terrestrial
19	Capped Langur	*Trachypithecus pileatus*	VU	Decreasing	Terrestrial
20	Asiatic Black Bear	*Ursus thibetanus*	VU	Decreasing	Terrestrial
21	Northern Pig-tailed Macaque	*Macaca leonina*	VU	Decreasing	Terrestrial
22	Binturong	*Arctictis binturong*	VU	Decreasing	Terrestrial
23	Sambar	*Rusa unicolor*	VU	Decreasing	Terrestrial
24	Asian Small-clawed Otter	*Aonyx cinereus*	VU	Decreasing	Terrestrial, Freshwater, Marine
25	Western Hoolock Gibbon	*Hoolock hoolock ssp. hoolock*	VU	Decreasing	Terrestrial
Reptiles					
1	Spotted Pond Turtle	*Geoclemys hamiltonii*	EN	Decreasing	Terrestrial, Freshwater
2	Tricarinate Hill Turtle	*Melanochelys tricarinata*	EN	Decreasing	Terrestrial, Freshwater
3	Indian Eyed Turtle	*Morenia petersi*	EN	Decreasing	Terrestrial, Freshwater
4	Indian Softshell Turtle	*Nilssonia gangetica*	EN	Decreasing	Terrestrial, Freshwater
5	Black Softshell Turtle	*Nilssonia nigricans*	CR	Decreasing	Terrestrial, Freshwater
6	Gharial	*Gavialis gangeticus*	CR	Decreasing	Terrestrial, Freshwater
7	Assam roofed Turtle	*Pangshura sylhetensis*	CR	Decreasing	Terrestrial, Freshwater
8	Southeast Asian Box turtle	*Cuora amboinensis*	EN	Decreasing	Terrestrial, Freshwater
9	Indian Peacock Softshell	*Nilssonia hurum*	EN	Decreasing	Terrestrial, Freshwater

	Turtle				
10	Keeled Box Turtle	*Cuora mouhotii*	EN	Decreasing	Terrestrial, Freshwater
11	Mugger	*Crocodylus palustris*	VU	Stable	Terrestrial, Freshwater
12	King cobra	*Ophiophagus hannah*	VU	Decreasing	Terrestrial
Amphibians					
1	Rotung Oriental Frog	*Ingerana borealis*	VU	Decreasing	Terrestrial, Freshwater
Fishes					
1	-	*Devario horai*	EN	Decreasing	Freshwater
2	-	*Lepidocephalichthys arunachalensis*	EN	Unknown	Freshwater
3	-	*Amblyceps arunchalensis*	EN	Unknown	Freshwater
4	-	*Tor putitora*	EN	Decreasing	Freshwater
5	-	*Wallago attu*	VU	Decreasing	Freshwater
6	-	*Bagarius yarrelli*	VU	Decreasing	Freshwater
7	-	*Aborichthys tikaderi*	VU	Unknown	Freshwater
8	-	*Devario assamensis*	VU	Unknown	Freshwater
Crustaceans					
1	-	*Liotelphusa quadrata*	VU	Unknown	Freshwater

Data used to generate the IBAT report is as follows:

- UNEP-WCMC and IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - July 2021.
- BirdLife International (on behalf of the KBA Partnership), 2021. Key Biodiversity Areas - April 2021. IUCN, 2021.
- IUCN Red List of Threatened Species - April 2021

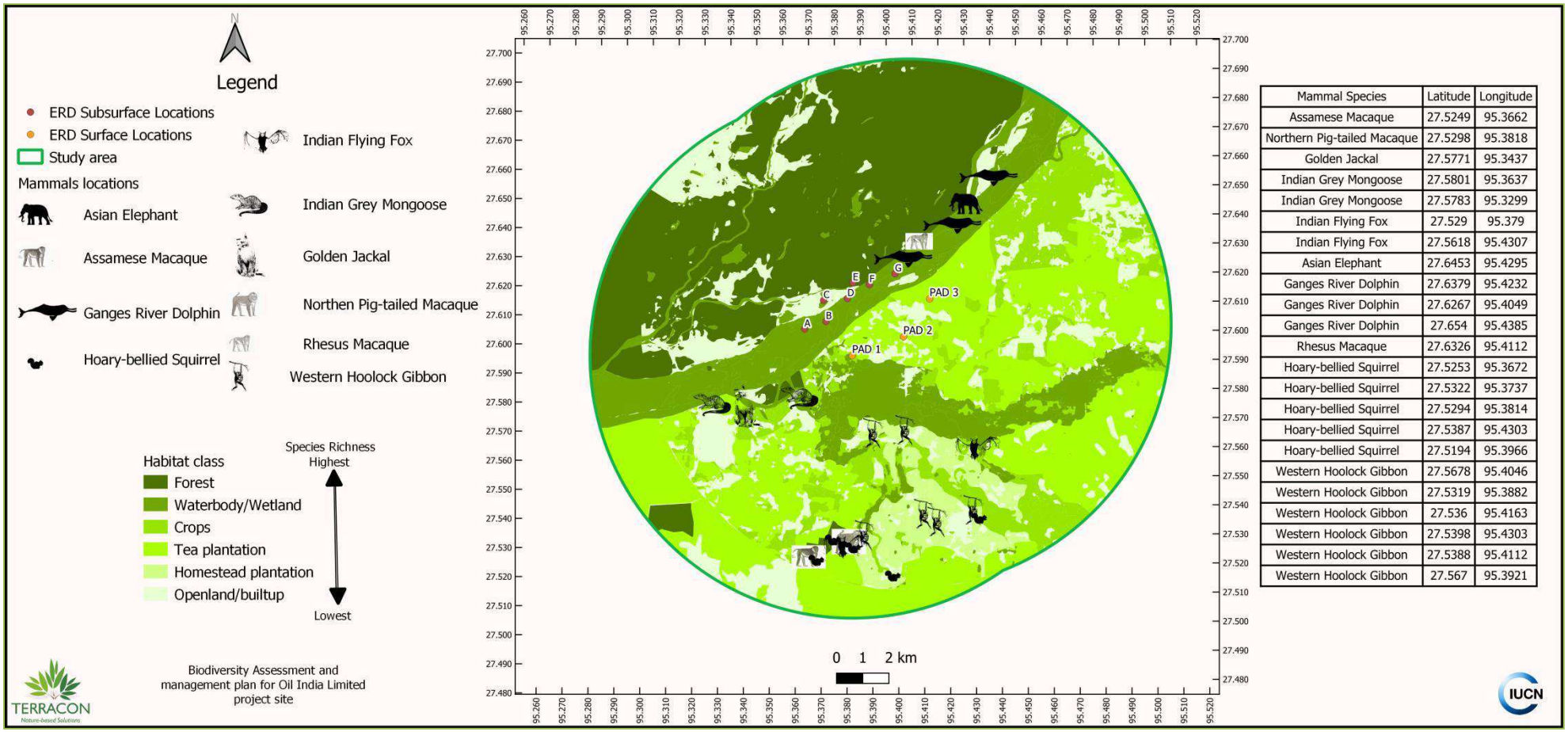
Bherjan-Borajan-Podumoni Wildlife Sanctuary, Maguri Motapung Beel, and Dibru - Saikhowa National Park along with Dibru River provide important aquatic habitats for birds, butterflies, fish, amphibians, reptiles, and mammals.

Species Richness Map

The forest habitat shows the highest species richness having an overall good diversity compared to others. It is followed by waterbodies which is a congregation point of

many migratory and resident birds like Ruddy Shelduck (*Tadorna ferruginea*), Glossy Ibis (*Plegadis falcinellus*), Purple Swamphen (*Porphyrio porphyrio*), Mallard (*Anas platyrhynchos*), Eurasian Wigeon (*Mareca penelope*), Wagtails, Egrets, Jacanas etc. Human dominated Built-up areas show the least species richness. Pad 1, 2 and 3 lies in the Cropland, homestead plantation and tea plantation respectively and shows medium to lowspecies richness.

The species richness was mapped according to their presence of in the habitats.



Mammal Species	Latitude	Longitude
Assamese Macaque	27.5249	95.3662
Northern Pig-tailed Macaque	27.5298	95.3818
Golden Jackal	27.5771	95.3437
Indian Grey Mongoose	27.5801	95.3637
Indian Grey Mongoose	27.5783	95.3299
Indian Flying Fox	27.529	95.379
Indian Flying Fox	27.5618	95.4307
Asian Elephant	27.6453	95.4295
Ganges River Dolphin	27.6379	95.4232
Ganges River Dolphin	27.6267	95.4049
Ganges River Dolphin	27.654	95.4385
Rhesus Macaque	27.6326	95.4112
Hoary-bellied Squirrel	27.5253	95.3672
Hoary-bellied Squirrel	27.5322	95.3737
Hoary-bellied Squirrel	27.5294	95.3814
Hoary-bellied Squirrel	27.5387	95.4303
Hoary-bellied Squirrel	27.5194	95.3966
Western Hoolock Gibbon	27.5678	95.4046
Western Hoolock Gibbon	27.5319	95.3882
Western Hoolock Gibbon	27.536	95.4163
Western Hoolock Gibbon	27.5398	95.4303
Western Hoolock Gibbon	27.5388	95.4112
Western Hoolock Gibbon	27.567	95.3921

Figure 49 : SPECIES RICHNESS MAP

Analysis

To gain a perspective on the population trend of various species present in the study area, relative frequency and relative density i.e. frequency and density of each species for frequencies and densities of all the species of taxa found in the study area, are considered. These values give us the species of fauna and flora that is encountered most commonly (relative frequency value) and in most numbers (relative density value).

The floral diversity of the study area shows a wide spectrum, from species of scrubland forests, dry deciduous forests to species of riparian habitats. The floral diversity is bound to change as per seasonal changes.

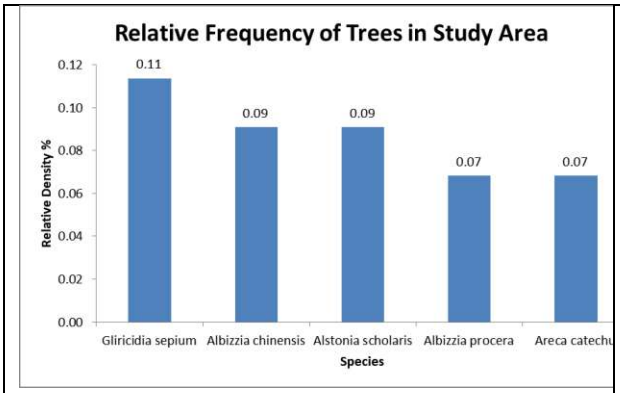
The present study was carried out in August and December, representing monsoon and winter vegetation and related fauna respectively. Analysis of recorded population and diversity in the study area is discussed in this section.

Flora – Season 1 (Monsoon)

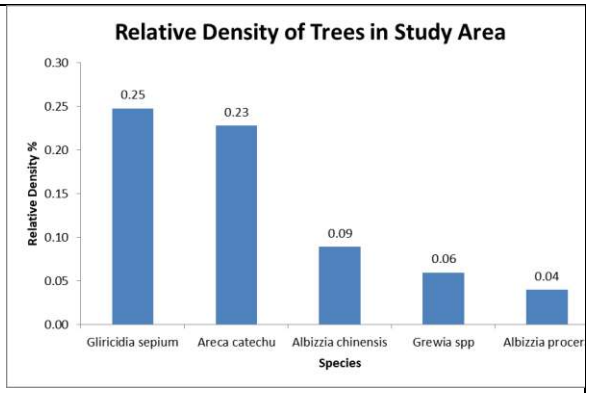
Trees

The quantitative analysis involves calculation of relative density, relative for the recorded population of floral and faunal biodiversity. These values indicate species with the densest population, most frequently encountered species and areas with good biodiversity.

For primary data collection, a circular plot of 10m radius was laid for trees. Considering the same center, another circle of 5m radius was taken for the shrubs. On the periphery to the shrub circle, a total of four- square plots of 1X1 sq. were placed radially, for herbs.



Relative Frequency of trees in study area



Relative Density of trees in the study area

Figure 50 : Flora Season 1 : Relative Frequency and Density of trees in study area

Relative frequency of trees in study area

Alstonia Scholari was observed in all plots. Albizzia chinensis is a common tree *species in tea gardens. Areca catechu with good density is restricted to the homestead tea gardens.* Good density of Gliricidia sepium is only observed near Pad II and Barekuri Gibbon Park area. In the study area, forest plots being few, wild trees are not showing dominance in graph.

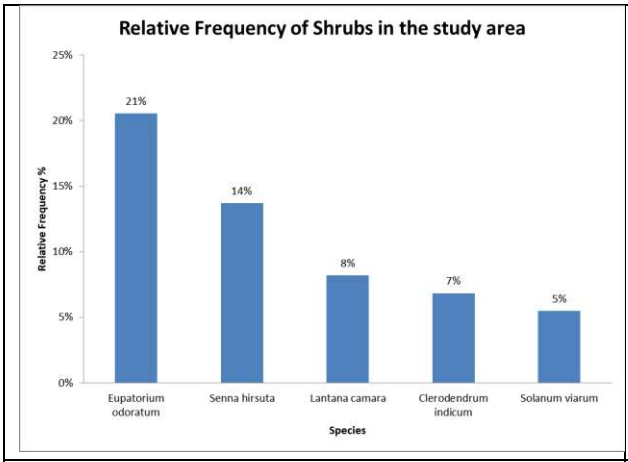
Relative density of trees in the study area

With respect to the data analysed, spreads to trees species seems to be even. *Albizzia chinensis* is a common tree in the study area planted in the tea estates. *Alstonia scholaris, Albizzia procera* and *Gliricidia sepium* are dominant in landscape. Areca catechu is reported from Homestead tea gardens.

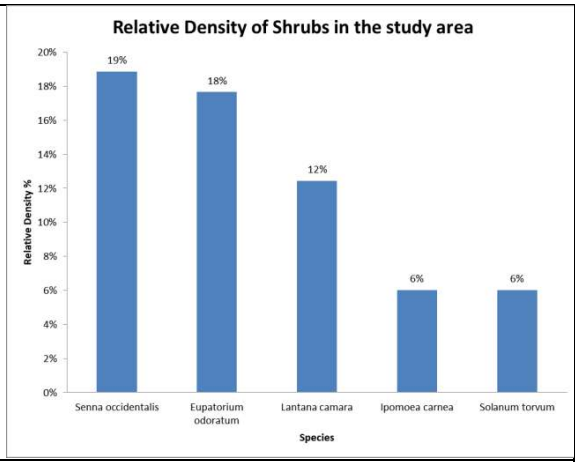
Shrubs

Relative frequency of Shrubs in study area

Eupatorium and *Senna hirstua* is widely spread in the landscape. *Lantana camara, Senna occidentalis*
and *Solanum viarum* are common species in forest landscape. The shrub community is evenly distributed.



Relative Frequency of Shrubs in study area



Relative Density of Shrubs in the study area

Figure 51 : Flora Season 1 : Relative Frequency and Density of shrubs in study area

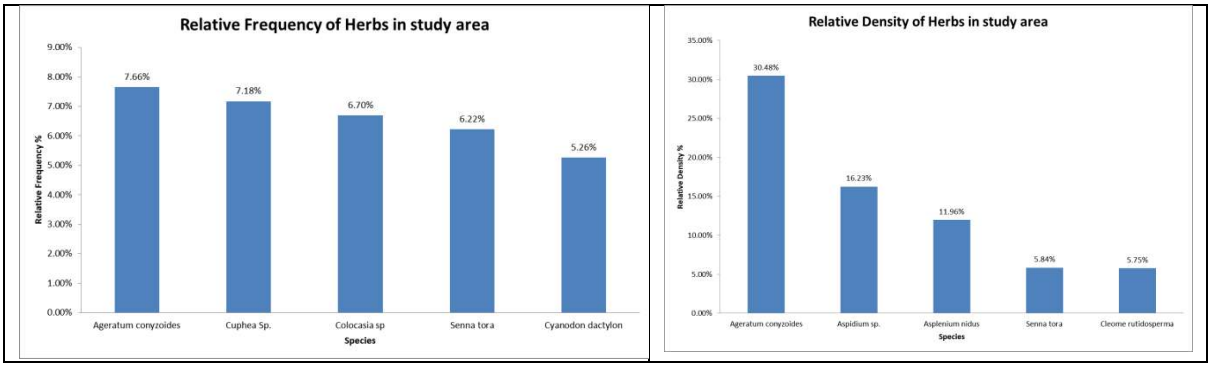
Relative density of Shrubs in the study area

Eupatorium odoratum, Lantana camara and *Senna occidentalis* all three alien invasive species has invaded the study area. *Ipomoea carnea* is dominant in wetland habitat.

Herbs

Relative frequency of Herbs in study area

Ageratum conyzoides shows its dominance in all the landscapes. *Aspidium sp.* and *Asplenium nidus* are dominant in forest landscapes whereas, *Senna tora* and *Cleome rutidosperma* forms the dominant around waterbodies. Moreover, the species dominance seems to be even in the respective landscape.



Relative Frequency of Herbs in study area	Relative Density of Herbs in the study area

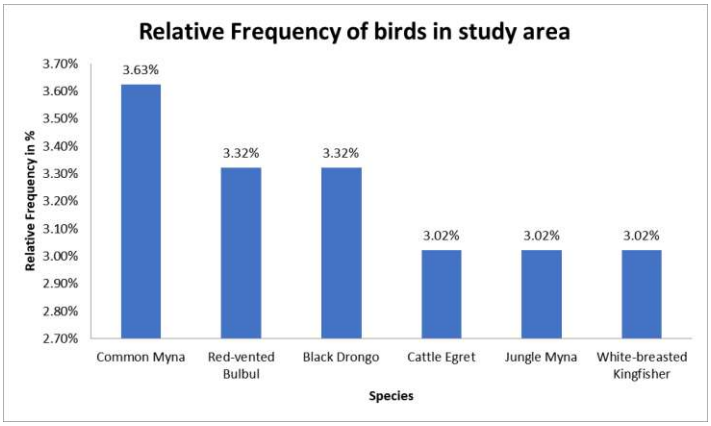
Figure 52 : Flora Season 1 : Relative Frequency and Density of herbs in study area

Relative density of Herbs in the study area

With respect to the data analysed, the herbs community seems to be distributed evenly, through the landscape in their respective habitat.

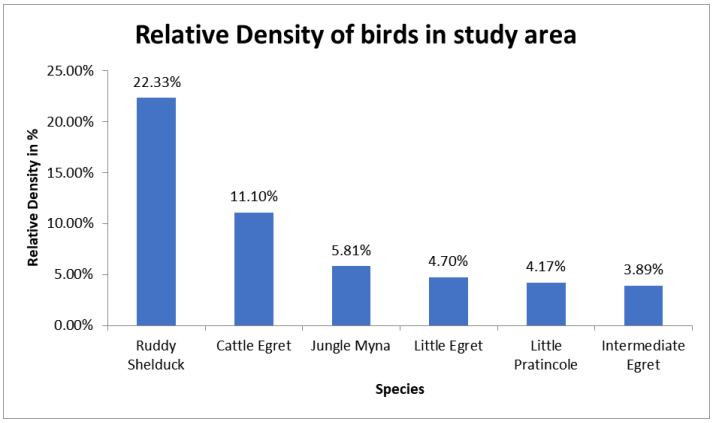
Fauna – Season 1(Monsoon)

Birds



Relative frequency of Birds in study area

In Monsoon Season, omnivores and insectivores' birds like Common myna (*Acridotheres tristis*), Cattle Egret (*Bubulcus ibis*), Red Vented Bulbul (*Pycnonotus cafer*), Rufous Treepie (*Dendrocitta vagabunda*), Jungle myna (*Acridotheres fuscus*) were common seen throughout the study area. This is be due to ground-foraging habits of most of the above-mentioned bird



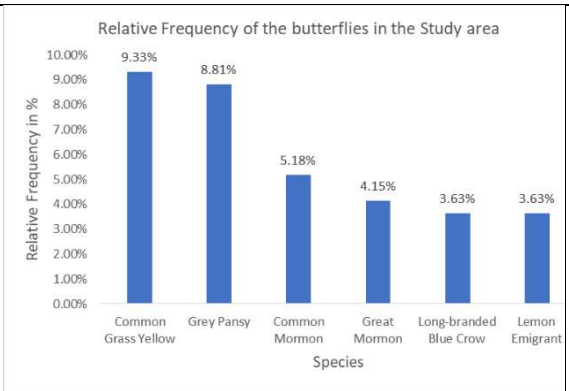
Relative density of Birds in the study area

and greater availability of insects and files during the monsoon season in the tea plantation, croplands and wetlands. Huge flocks of Barn swallow (*Hirundo rustica*) and Jungle myna (*Acridotheres fuscus*) were found in the wetlands and agricultural areas hence showing the high density.

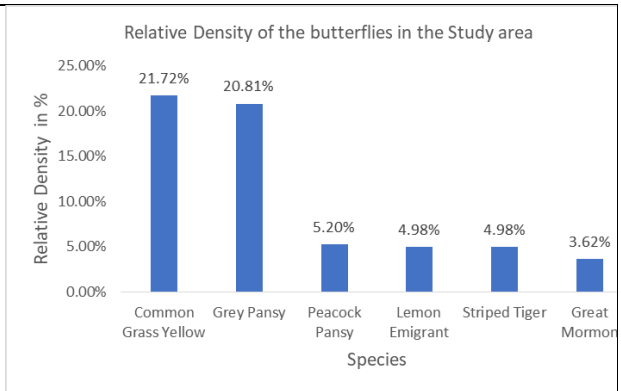
Figure 53 : Fauna Season 1 : Relative Frequency and Density of Birds in study area

Butterflies

Common Grass yellow (*Eurema hecabe*) and Grey Pansy (*Junonia atlites*) were found to have the highest frequency and highest density due to availability of large source of both nectar and food plants, in tea plantation and forested areas. Swallowtails such as Great Mormon (*Papilio memnon*) and Common Mormon (*Papilio polytes*) are also attracted to the flowering trees throughout the study area. The adults usually fly rapidly at tree-top height, except when they come down to feed at flowering bushes or to look for oviposition sites. *Citrus maxima* is a host plant for these two *Papilio* species, was found throughout the study area. Availability of wet patches for mud puddling along with abundant herbs added to the high species number.



Relative frequency of Butterflies in study area



Relative density of Butterflies in the study area

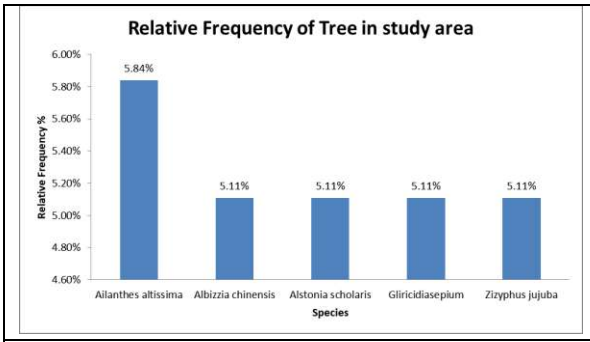
Figure 54 : Fauna Season 1: Relative Frequency and Density of Butterflies in study area

Flora – Season 2 (Winter)

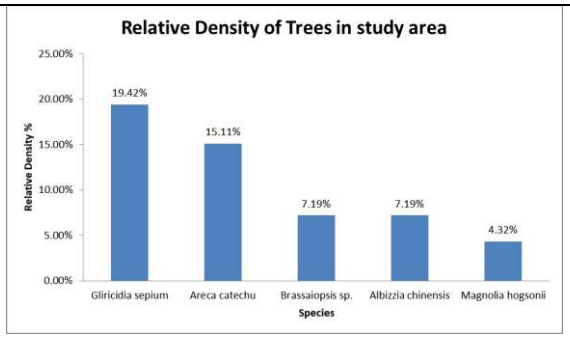
Trees

Relative frequency of trees in study area

Distribution of tree species is even throughout the landscape. *Albizzia chinensis* is a common tree planted in the tea estates.
Alstonia scholaris, Albizzia procera, Ailanthes altissima and *Gliricidia sepium* are not dominant in landscape but individuals are reported at many places showing their presence in most of the area. *Areca catechu*s are reported from Homestead tea gardens. *Gliricidia sepium* is invasive in in Australia, Hawaii, the Philippines, Cook Islands, French Polynesia, Tonga, Singapore, Comoros, and Trinidad and Tobago. The plant is seen to have negative effects on native flora and fauna.[33]



Relative Frequency of trees in study area



Relative Density of trees in the study area

Figure 55 : Flora Season 2: Relative Frequency and Density of Trees in study area

Relative density of trees in the study area

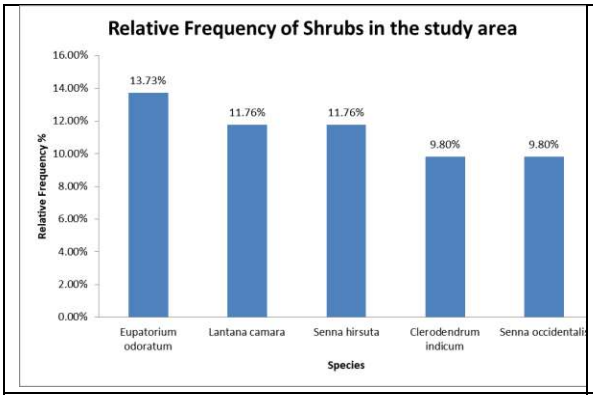
Tea gardens occupies the majority of the region in the study area. *Albizzia chinensis* is a common tree species in tea gardens. Eventhough the tea landscape is vast, density of Albizzia chinenis is low in the data collected. The reason for this can be given as the large spacing between two individuals planted of the tree in the tea plantation. *Areca catechu* with good density is restricted to the homestead tea gardens. Good density of *Gliricidia sepium* is only observed near Pad II and Barekuri Gibbon Park area. In study area, forest area being few, wild trees are not showing dominance in graph even though they are forming good dense community.

Shrubs

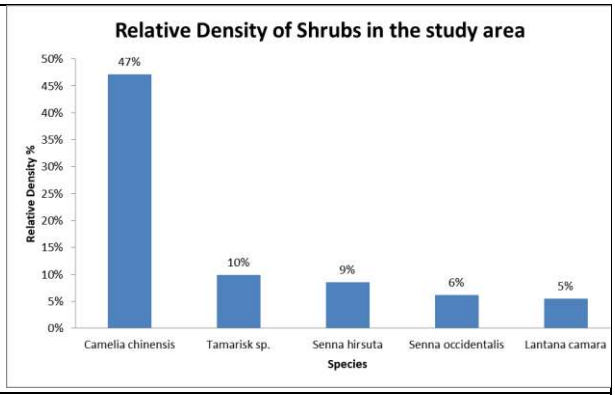
Relative frequency of Shrubs in study area

The Shrub community has shown an even distribution across the study area. *Eupatorium odoratum, Lantana camara, Senna hirsuta ans Senna occidentalis* are frequently distributed over the landscape. *Clerodendrum indicum* was mostly observed along the agriculture and forest.

[33] *https://www.cabi.org/isc/datasheet/25380#tosummaryOfInvasiveness*



Relative Frequency of Shrubs in study area



Relative Density of Shrubs in the study area

Figure 56 : Flora Season 2: Relative Frequency and Density of Shrubs in study area

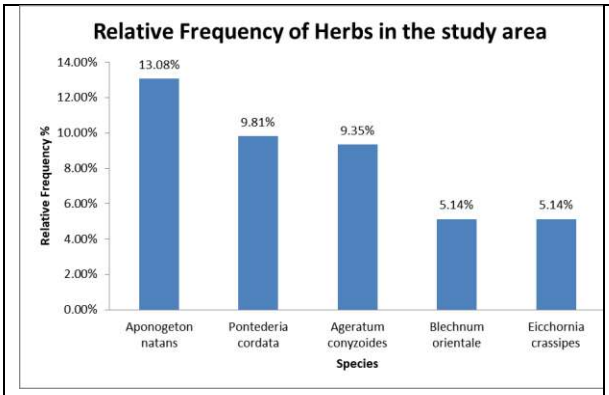
Relative density of Shrubs in the study area

Tea plant *(Camelia sinensis)* is observed in large quantities due to Tea plantation. Other species *Senna hirsuta, Senna occidentalis* and *Lantana camara* are showing even dominance in all landscapes whereas, *Tamrisk* occupies the periphery of all water bodies.

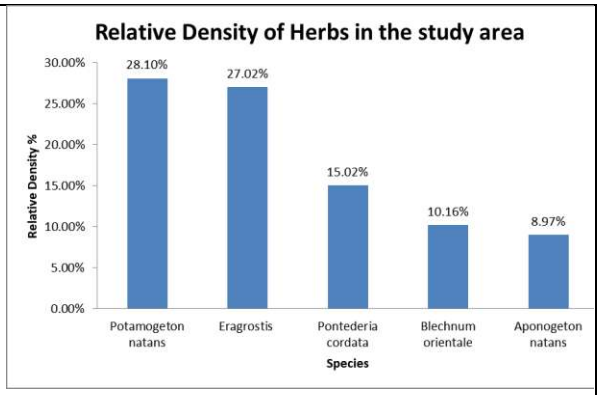
Herbs

Relative frequency of Herbs in study area

Ageratum conyzoides were recorded all habitats. Waterloving species like, *Pontederia cordata*, *Aponogeton natans* were observed where ever the water was accumulated in small pools. Other herbscommunity is evenly distributed in the study area.



Relative Frequency of Herbs in study area



Relative Density of Herbs in study area

Figure 57 : Flora Season 2: Relative Frequency and Density of Herbs in study area

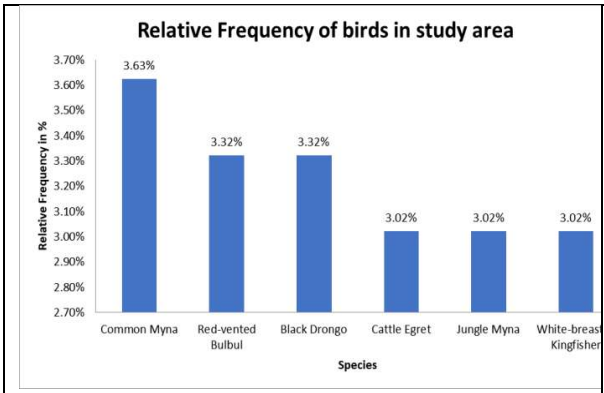
Relative density of Herbs in study area

Water loving species *Potamogeton natans* and *Pontederia cordata* are found in the agriculture plots where water was accumulated, and around the Maguri-Motapung beels (Wetland). Other herbcommunity showed the even dominance in all habitats.

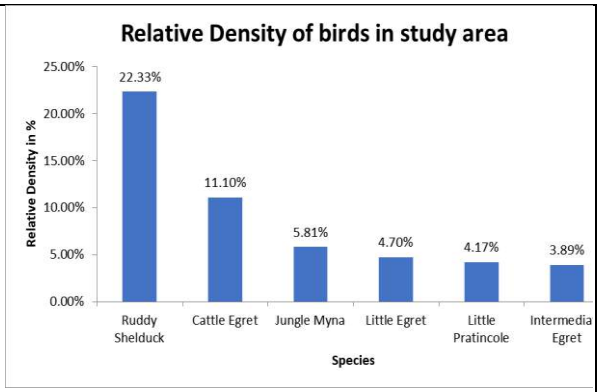
Herb diversity is high across the all habitats, but in terms of density herbs are low. The probable reasonfor the low density could be the removal of herbs species from the tea plantations and home stead gardens which covers the large area of study area.

Fauna- Season 2 (Winter)

Birds



Relative frequency of Birds in study area



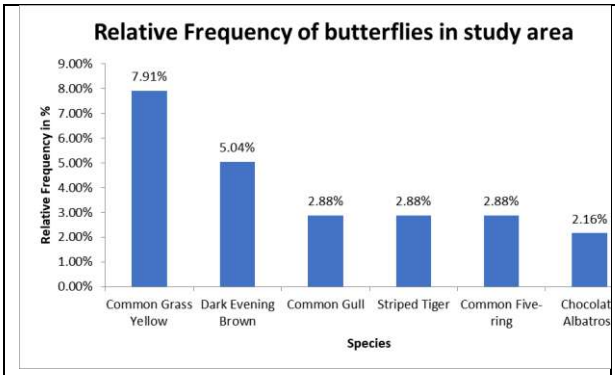
Relative density of Birds in the study area

Figure 58 : Fauna Season 2: Relative Frequency and Density of Birds in study area

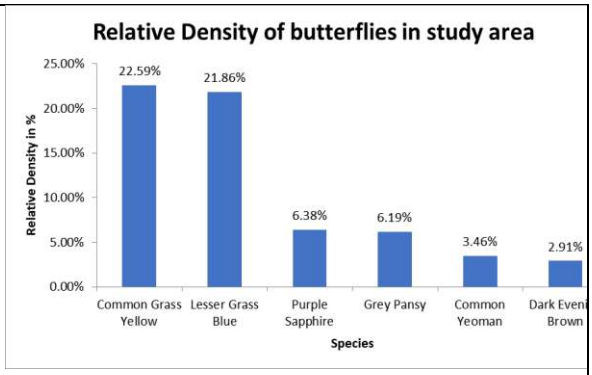
In Season two omnivores and insectivores' birds like Common myna (*Acridotheres tristis*), Black drongo (*Dicrurus macrocercus*), Cattle Egret (*Bubulcus ibis*), Red Vented Bulbul (*Pycnonotus cafer*), Jungle myna (*Acridotheres fuscus*) were common seen throughout the study area. Agriculture area, tea plantation and wetland provided steady microclimate and food supply for insect.

Huge flocks of Ruddy shelduck (*Tadorna ferruginea*), more than 500 individuals, were observed in Maguri Motapung Beel and also isolated pairs were observed at the other wetlands of the study area, hence showing the highest density in the season two. Ruddy shelduck (*Tadorna ferruginea*) is an extreme high-altitude migrant. Asian populations of this bird are mostly migratory in nature which migrates to winter at lower latitudinal and altitudinal freshwater or saline water sources, grasslands, marshlands, open steppe, upland plateaus and mountainous regions reaching up to 5000m in Himalayas in India.

Butterflies



Relative frequency of Butterflies in study area



Relative density of Butterflies in the study area

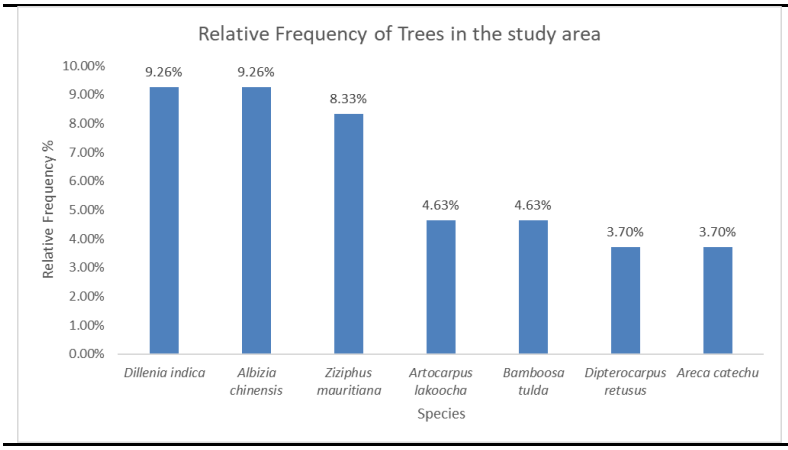
Figure 59 : Fauna Season 2: Relative Frequency and Density of Butterflies in study area

Common Grass yellow (*Eurema hecabe)* was found to be the one with highest frequency and highest density due to availability of flowering plants species such as *Sida acuta, Eupatorium odoratum, Leucas sp., Mikania micrantha, Sena tora, tectona grandis, and Leea spp.*

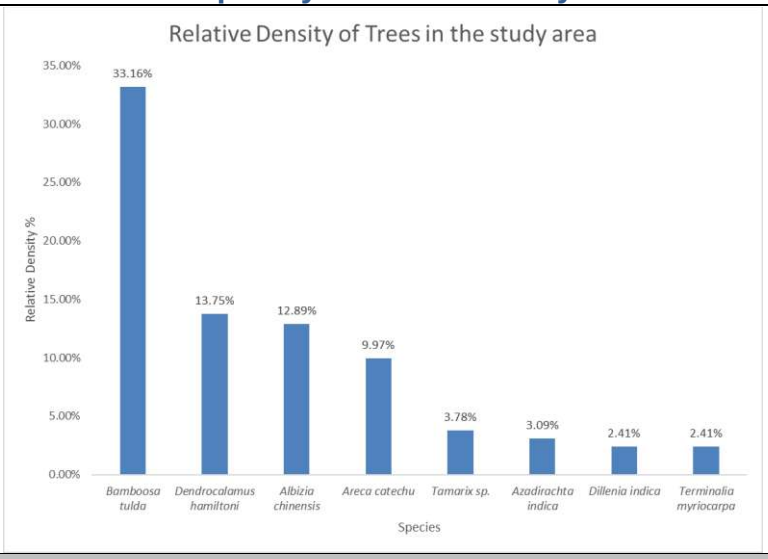
Many morphs of Dark Evening Brown (*Melanitis phedima*) were seen throughout the study area; as the host plants from family Poecea were in greater numbers in the study area. Purple Sapphire (*Heliophorus epicles*) was seen in abundantly in the Podumoni region of Bherjan-Borajan-Podumoni Wildlife Sanctuary.

Flora- Season 3 (Summer)

Trees



Relative Frequency of trees in study area



Relative Density of trees in the study area

Relative frequency of trees in study area

During summer season, *Axonopus compressus* species was found to have highest frequency and was observed in majority of the survey plots followed by *Albizia chinensis, Ziziphus mauritiana, Artocarpus lakoocha, Bamboosa tulda, Dipterocarpus retusus* and *Areca catechu*.

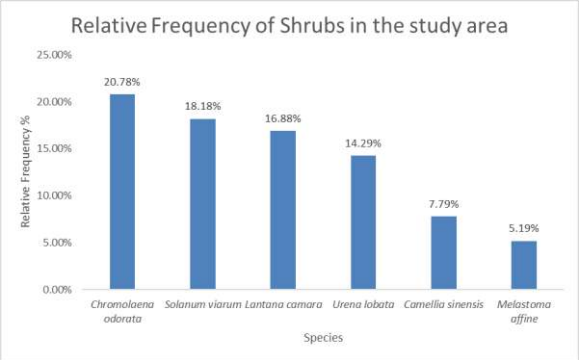
Relative density of trees in study area

Summer season survey showed highest relative density of *Bamboosa tulda*, followed by *Dendrocalamus hamiltoni* and *Albizia chinensis* varying upto 33.6%, 13.75% and 12.89% respectively. *Areca catechu* also was observed to have relative density of 9.97%.

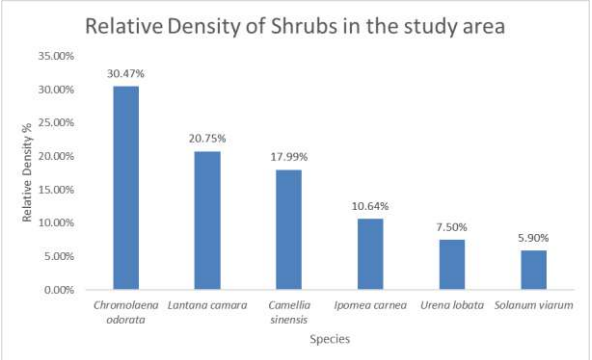
Shrubs

Relative frequency of Shrubs in study area

During summer season, Chromolaena odorata species was found to have highest frequency and was observed in majority of the survey plots followed by *Solanum viarum, Lantana camara, Urena lobate* and *Camellia sinensis*. Species such as *Melastoma affine* and *Rubus moluccanus* were also found equally frequent in the survey spots.



Relative Frequency of Shrubs in study area



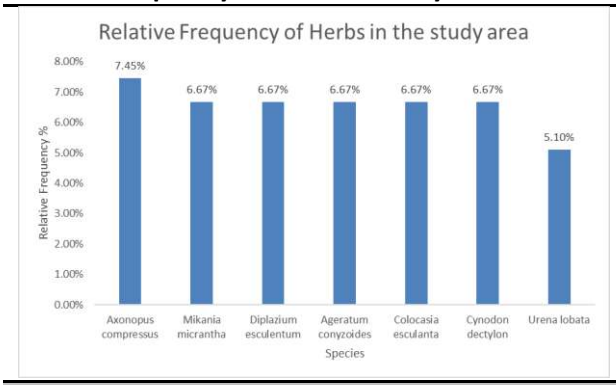
Relative Density of Shrubs in the study area

Relative density of Shrubs in the study area

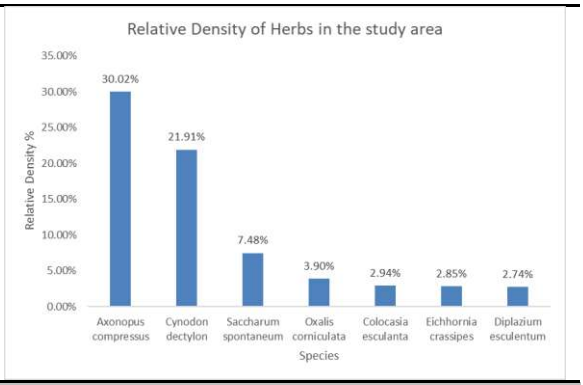
Summer season survey showed highest relative density of Chromolaena odorata, followed by Lantana camara and Camellia sinensis varying upto 30.47%, 20.75% and 17.99% respectively. Ipomea carnea also was observed to have relative density of 10.64%.

Herbs

Relative frequency of Herbs in study area



Relative Frequency of Herbs in study area



Relative Density of Herbs in study area

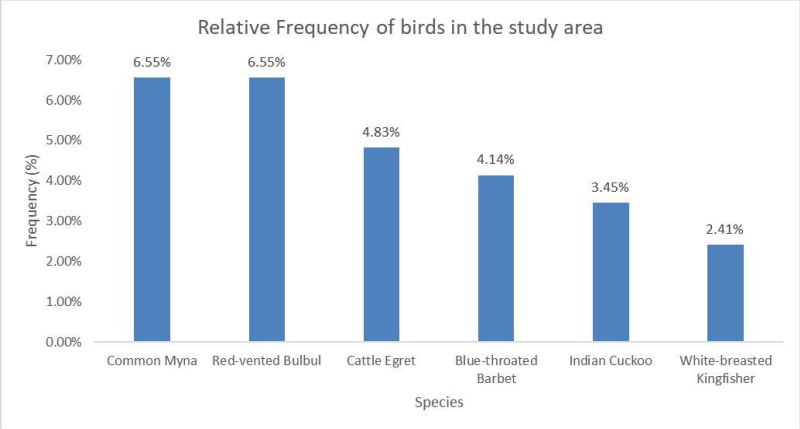
During summer season, *Axonopus compressus* species was found to have highest frequency and was observed in majority of the survey plots followed by *Mikania micrantha, Diplazium esculentum, Ageratum conyzoides, Colocasia esculanta,* and *Cynodon dectylon* with equally frequent in all the survey plots with relative frequency of 6.67%.

Relative density of Herbs in study area

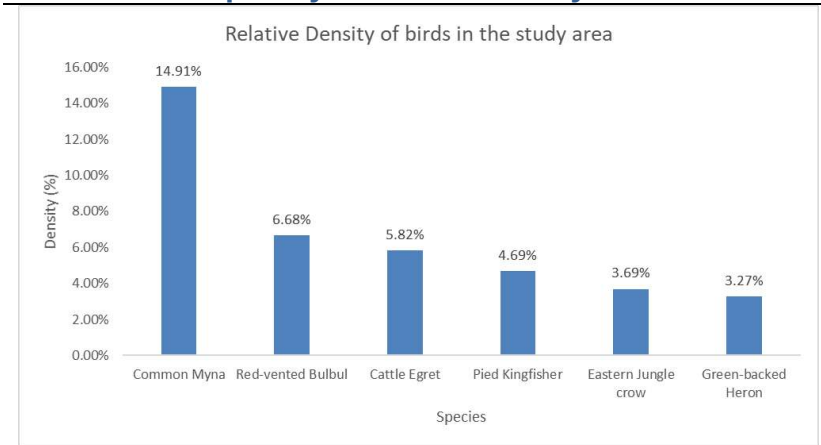
Summer season survey showed highest relative density of *Axonopus compressus*, followed by *Cynodon dectylon* with relative densities as 30.02% and 21.91% respectively. *Saccharum spontaneum* also was observed to have relative density of 7.48%.

Fauna- Season 3 (Summer)

Birds



Relative frequency of Birds in study area

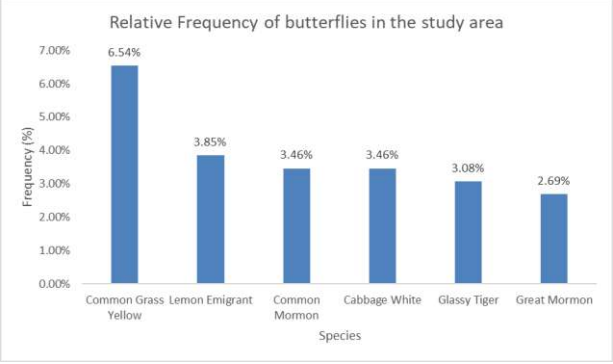


Relative density of Birds in the study area

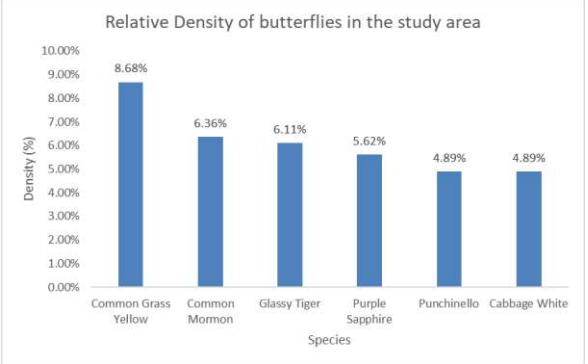
Common Myna (*Acridotheres tristis*) (6.55%), Red-vented Bulbul (*Pycnonotus cafer*) (6.55%) and Cattle Egret (*Bubulcus ibis*) (4.83%) showed highested relative frequencies and were observed in most of the survey plots. They also had highest relative densities with 14.91%, 6.68% and 5.82% respectively.

Blue-throated barbet (*Psilopogon asiaticus*) a common inhabitant of lowland and foothill tropical forests was also observed in the survey plots with relative frequency of 4.14%.

Butterflies



Relative frequency of Butterflies in study area



Relative density of Butterflies in the study area

During summer season, butterflies such as Common Grass Yellow (*Eurema hecabe*) were seen fluttering and feeding in most of the survey plots with the highest relative frequency of 6.54% and highest relative density of 8.68%. Lemon Emigrant (*Catopsilia pomona*), Common Mormon (*Papilio polytes*) and Cabbage White (*Pieris canidia*) were seen more frequently with relative frequencies 3.85%, 3.46% and 3.46% respectively. Butterflies such as Common Mormon (*Papilio polytes*) and Glassy tiger (*Parantica aglea*) had higher relative densities with 6.36% and 6.11% in the summer season. Purple sapphire (*Heliophorus epicles*) and Punchinello (*Zemeros flegyas*) was observed to have good density in the forested areas.

Biodiversity Impact Assessment Approach

The Mitigation Hierarchy

The mitigation hierarchy is a set of guidelines, established through the International Finance Corporation's Performance Standard 6, meant to help development projects prepare mitigation measures for impacts with the aim to reduce negative impacts on biodiversity. The hierarchy follows avoidance, minimization, restoration/rehabilitation, and offsets in order to compensate for development impacts and negative effects on the environment.

Stage of mitigation hierarchy has been provided as below:

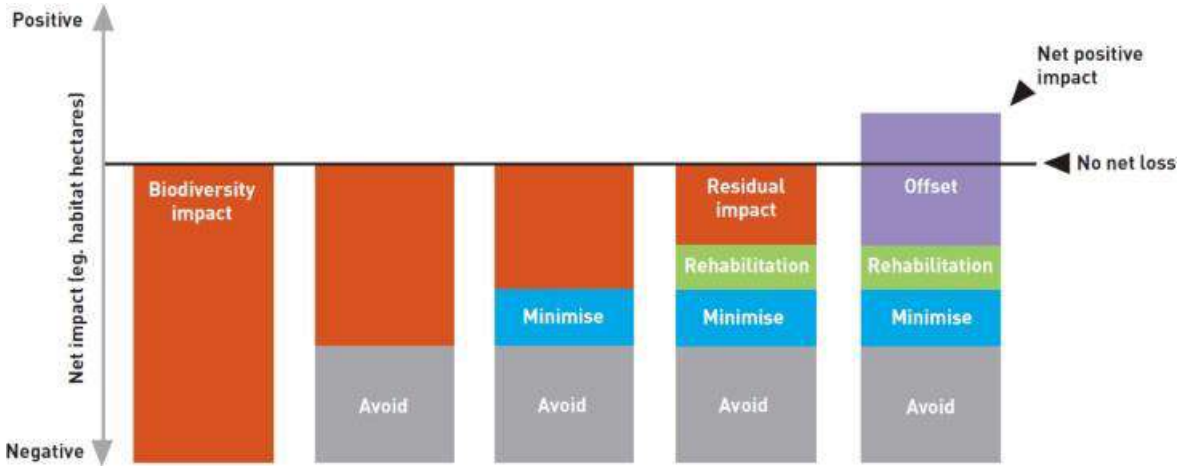


Figure 60 : Mitigation Hierarchy

Avoidance

This measure is based on the prevention of impacts so they do not occur or do not negatively affectenvironmentally sensitive areas.

Minimisation

This measure intends to reduce duration, intensity, and extension of impact.

Rehabilitation/ Restoration

This measure is focused on bringing back affected areas to their initial conditions.

Offset

When previous mitigation actions have been effectively implemented, the residual impact could bemanaged through an offset measure.

Impact Assessment Criteria

The activities associated with oil and gas exploration, development, production generates diverse range of environmental changes, and many times these changes are irreversible. The most common environmental problems associated with industrial activities are conversion of land, deforestation, soilerosion, disturbance to surface and ground water system of the area, visual intrusion, water, air, and

noise pollution, soil contamination, reduction of faunal and floral diversity and abundance due to habitat loss and degradation, increased risk of public health hazards and resource.

This report assessed and identified the potential impacts on the environment that could be anticipated from the planned oil & gas exploration drilling activity in ERD Surface Locations in Baghjan Petroleum Mining Lease (PML), Tinsukia District, Assam.

Biodiversity Impact Assessments are standard processes of analysing the impacts or potential impacts of projects on the existing environment. Through identifying the type and magnitude of impacts, mitigation measures can be developed accordingly. The methodology is adopted from IUCN Biodiversity Indicator and Reporting System (BIRS) report.[34]

The impact assessment process consisted of three steps:

A. **Identification of Potential Impacts:** A thorough secondary literature review was carried out to determine the possible impacts of the oil and gas exploration on biodiversity. The identified impacts were then screened and classified according to the phases and activities involved in the operations. During the primary survey, the study area was assessed against the pre- identified impacts and their relevance to the site.
B. **Categorization of Impacts:** The identified impacts were screened through likelihood, severity and potential of mitigation using biodiversity impact matrix. This step helps in justifying the significance of a particular impact.
C. **Biodiversity Risk Assessment:** This stage involves assessment of risk to biodiversity in the study area from exploration activities. The determination of the risk category will be based on two factors:
    - Biodiversity Importance Category (BIC) of site
    - Severity and Likelihood of the Potential Impact

This would lead to formation of biodiversity risk matrix to identify the level of risk to biodiversity due to this impact. The risk is then summed up based on their severity.

34 https://portals.iucn.org/library/sites/library/files/documents/2014-055.pdf

Identification of Potential Impacts

The impacts on biodiversity attributes are identified and evaluated considering the types and magnitude of exploration operation. In general, impact prediction methods argue that the foremost step in impact appraisal must consider and identify activities that are likely to bring significant changes in the environmental conditions of the exploration site. Both planned and unplanned operations of Baghjan PML - ERD Surface Locations were screened and analysed for all possible impacts. The broader types of impact on the biodiversity are identified under activities carried out for different phases:

Table 21 : PLANNED AND UNPLANNED OPERATIONS OF BAGHJAN PML - ERD SURFACE LOCATIONS

Phase of the project	Activities under each phase
Pre-drilling Phase	Removal of vegetation
	Emission of fugitive dust and deposition on vegetation
	Storage of construction materials
	Handling of oil, chemical and waste
	Operation of construction machinery/equipment
	Widening of approach road
	Vehicular movement
Drilling Phase	Spillage of chemical, spent mud, hazardous waste
	Operation of DG sets
	Vehicular movement
	Generation of Wastewater
	Alternation of existing illumination levels
	Removal of ground water
Decommissioning Phase	Increased noise generation
	Disposal of decommissioning waste materials
	Emission of fugitive dust and deposition on vegetation
	Improper closing of the well
	Disposal of construction waste
	Demobilization activity
	Vehicular movement

Biodiversity Impact Matrix

After the identification of relevant impact, the evaluation of severity of these impacts is carried outbased on two factors:

a) The likelihood of the impact on Habitat/ecosystems and/or species and

Species	• Globally threatened/Scheduled species as per the WPA, 1972 inthe area. • Presence of restricted-range species. • Invasive non-native species. • Species used by local communities.
Habitat/Ecosystem	• Operational site overlaps with conservation priority areas. • Habitat contributing to species ecology (critical habitats).

b) The magnitude of impact which accounts for the type of the impact and the potential to whichthis impact could be mitigated through targeted measures. The type of impact considers the following aspects:

Impact extent/scale	• Entire habitat loss • Partial habitat loss • Specific area affected in the habitat
Direct or indirectimpact	• Direct mortality of individuals due to site activities • Indirect mortality of individuals from reduced prey resources dueto pollution of watercourses
Frequency of impact	• Single event • Recurring • Constant
Duration of impact	• Short-term • Medium-term • Long-term • Permanent

C) The magnitude of impact can be categorised according to the following definitions:

Major / Irreversible orVery Difficult to Mitigate	An impact resulting in a permanent effect on the distribution and/or abundance of a habitat, species assemblage/community or population, in such a way as to alter the integrity of the feature and its conservation status. This type of effect would reduce the integrity of the feature and its conservation status.

Moderate / Difficult to Mitigate	An impact resulting in a long-term but reversible effect on the distribution and/or abundance of a habitat, species assemblage/community or population. This type of effect would have neutral long-term implications for the integrity of the feature or its conservation status.
Minor / Easily Mitigated or Reversed Naturally	An impact resulting in a short-term reversible effect on the distribution and/or abundance of a habitat, species assemblage/community or population.

The biodiversity impact matrix is used to analyze each impact and assign the category based on the severity. It plots Likelihood of Impacts on the Y-axis and Magnitude of Impacts on X-axis. Likelihood of Impacts is further broken down into three components: **Certain/Likely; Somewhat Likely and Unlikely**, whilst the magnitude of impact is as described in the definitions above.

		Magnitude of impact		
		Major / Irreversible or Very Difficult to Mitigate	**Moderate / Difficult to Mitigate**	**Minor / Easily Mitigated or Reversed Naturally**
Likelihood of Impact (In Absence of Action Plan)	**Certainly / Likely**	**(A) Very High**	**(B) High**	**(D) Low**
	Somewhat Likely	**(A) Very High**	**(C) Medium**	**(D) Low**
	Unlikely	**(B) High**	**(D) Low**	**(D) Low**

Biodiversity Indicator Reporting System (BIRS)

Figure 61 : IUCN's biodiversity measurement methodology Biodiversity Indicator Reporting System (BIRS)

The assessment of impact through Biodiversity Impact Matrix resulted in assigning the category to each impact relevant to the study area.

The output of the Biodiversity Impact Identification and Matrix for ERD surface locations is presented below:

Table 22 : BIODIVERSITY IMPACT IDENTIFICATION AND MATRIX

Impacts	Description	Activities	Phase	Likelihood of Impact	Magnitude of Impact	Impact category
Impact 1	There will be increase in the ambient noise levels[1] in and around the drill sites due to the project activities, which will lead to changes in abundance, disruption of species' communication, breeding, nesting and roosting patterns.	1) Heavy construction machinery 2) Vehicular Movement 3) Drilling activities 4) Diesel engines for power generation 5) Mud Pumps 6) Air Compressors	Operations Decommissioning	Certainly/ Likely	Moderate	High
Impact 2	Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.			Somewhat Likely	Moderate	Medium

Impacts	Description	Activities	Phase	Likelihood of Impact	Magnitude of Impact	Impact category
Impact 3	Air pollutants can affect wildlife through the disruption of endocrine functions, organ injury, increased vulnerability to stresses and diseases, lower reproductive success, and possible mortality.	1) Combustion of diesel in the diesel engines of power generators. 2) Flaring and burning of gas during the testing of well will lead to the release of pollutants including un-burnt hydrocarbons. 3) Dust and Air pollutants from vehicular exhaust. 4) Fugitive emission during Construction of waste pits, filling of site and handling of construction material, during drilling operations (loading, unloading, handling of drilling mud, chemical additives, cement and cement additives), from storages of volatile chemicals and fuels at site.	Predrilling phase Operations Decommissioning	Somewhat Likely	Moderate	Medium
Impact 4	Wastewater and formation water will be generated during drilling activity, and the domestic wastewater from the labor camps which may contain chemical and biological	1) Rig wash and dewatering of spent mud and washing of drill cuttings 2) Floor washings, pump, seal leakages, spillages will comprise of chemical	Operations Decommissioning	Somewhat Likely	Moderate	Medium

Impacts	Description	Activities	Phase	Likelihood of Impact	Magnitude of Impact	Impact category
	contaminants. If discharged untreated may adversely affect the surface water quality.	ingredients. 3) Domestic wastewater generation				
Impact 5	Surface run off from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is likely to be contaminated and have potential to impact water quality of the receiving waterbody. This will affect the ecological sensitive area of the waterbody like migratory and resident bird habitats, fish habitat, breeding and nursing ground for fishes, and also habitat Gangetic Dolphin. Degradation of water quality will affect the primary productivity of the river	Solid waste Generated During project 1) Organic Kitchen Waste from Labor camps 2) Drill Cuttings and Waste Drilling Mud contacting Barite, Bentonite and Traces of Heavy metal 3) Acid – Lead Batteries used during drilling of well 4) Used & Waste oil 5) Packaging wastes like paper, plastic, cardboards etc. 6) Decommissioning waste	Operations Decommissioning	Somewhat Likely	Moderate	Medium
Impact 6	Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, e-waste and municipal			Somewhat Likely	Moderate	Medium

Impacts	Description	Activities	Phase	Likelihood of Impact	Magnitude of Impact	Impact category
	waste affect the soil microbes and bacterial growth and can affect the soil quality.					
Impact 7	Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.			Somewhat Likely	Minor	Low
Impact 8	Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.			Somewhat Likely	Moderate	Medium
Impact 9	Kitchen Waste from Labor campsif not disposed properly can attract rodents, snakes, monkeys etc. which may lead to human-wildlife conflict on the site.			Somewhat Likely	Minor	Low
Impact 10	Change in Land use and species composition along with loss of native vegetation.	1) Removal of vegetation during construction of pads and Widening of approach	Predrilling phase	Likely	Major	Very high

Impacts	Description	Activities	Phase	Likelihood of Impact	Magnitude of Impact	Impact category
Impact 11	Faunal dispersal and loss of feeding ground.	road and new infrastructure for drilling activities 2) Removal of top soil from the land procured during construction of pads and Widening of approach road		Likely	Moderate	High
Impact 12	Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil.			Somewhat Likely	Minor	Low
Impact 13	Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings which may affect local floral and faunal species and ecosystems. This may either enhance or reduce biomass of plankton communities. It may also affect photosynthetic abilities of phytoplanktons.			Somewhat Likely	Moderate	Medium
Impact 14	Illumination with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like: 1) they might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals	Alternation of existing illumination levels for 4 months during drilling	Operations	Likely	Minor	Low

Impact 15	Decreased habitat use and increase in the roadkill of native Fauna/livestock.	Increase in Vehicular traffic	Predrilling phase Operations Decommissioning	Likely	Major	Very high
Impact 16	Damage to existing nearby flora			Likely	Major	Very high
Impact 17	Over use of ground water may lower the ground water table	Abstraction of ground water.	Operations	Somewhat Likely	Minor	Low
Impact 18	During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.	Ground water cuttingduring drilling activity	Operations	Somewhat Likely	Moderate	Medium
Impact 19	Alteration of onsite micro-drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas, which may affect habitats of reptiles, and mortality of floral species.	Well site and Access roads will be raised to a height of one and half a meter more than the high flood level of past ten-twenty years	Predrilling phase Operations	Somewhat Likely	Minor	Low

IN CASE OF EXTREME EVENTS VIZ. BLOWOUTS				
Impacts	**Description**	**Likelihood of Impact**	**Magnitude of Impact**	**Impact category**
Impact 20	Large amount of oil and associated pollutants will be discharged in the surrounding environment. (Such as Nitrogen, Sulphur dioxide, Carbon monoxide, HCOH (formaldehyde) etc.)	Likely	Moderate	High
Impact 21	Surrounding landscapes will be burned down due to explosion & blowout	Likely	Moderate	High
Impact 22	Sudden rise in the ambient temperature	Likely	Minor	Low
Impact 23	Oil spills may destroy nearby aquatic & terrestrial vegetation and dependant fauna	Likely	Major	Very high
Impact 24	Post blowout, inhalation or ingestion of toxic pollutants in mammals such as Gangetic River Dolphin, may to lead to physiological damage leading to death	Likely	Major	Very high
Impact 25	Inhalation or ingestion of toxic pollutants in the livestock post blowout may to lead to physiological damage leading to death.	Likely	Moderate	High
Impact 26	Avifauna can be affected due to external oiling, oil ingestion, and egg oiling and habitat changes. External oiling disrupts feather structure, causes matting of feathers, and produces eye and skin irritation.	Likely	Major	Very high
Impact 27	Oil exposure to Amphibians will affect their growth and avert the process of metamorphosis	Likely	Moderate	High
Impact 28	Oil layer on water will prevent absorption of atmospheric oxygen. Low dissolved oxygen levels will detoriate aquatic ecosystem.	Likely	Minor	Low

Impact 29	Oil layer will gradually sink in the river bed, increasing the risk of Hydrocarbons bioaccumulate in aqautic organisms and affect the food chain	Likely	Major	Very high
Impact 30	Oil spills or discharges may either enhance or reduce biomass of plankton communities. It may also affect photosynthetic abilities of phytoplanktons.	Likely	Minor	Low
Impact 31	Increase in the ambient noise levels, due to the blowout will be detrimental to terrestrial as well as aquatic fauna.	Likely	Minor	Low
Impact 32	Soil contaimination due to oil spill will render it infertile, in turn reducing its productivity	Likely	Moderate	High

Biodiversity Risk Assessment

The Biodiversity Risk Assessment involves the determination of risk to biodiversity from the

exploration. This stage will guide in formulation of corrective measures in Biodiversity Management Plan (BMP) and Biodiversity Action Plan (BAP) to reduce the risk at an acceptable level.

The purpose of the risk assessment is to identify the potential risk from exploration and categorize them in four categories: Critical; Severe; Moderate, Minor and Negligible.

The Biodiversity Importance Category is intrinsic and will remain the same irrespective of the sites operations but the impact measures are based on the mixture of likelihood of impacts and the possibility of mitigation. The Biodiversity Risk Matrix is used to define risk category for each impact.

Biodiversity Importance Category

Table 23 : Biodiversity Importance Category

Importance	Criterion
Category A	• Presence of Vulnerable, Threatened, Endangered and/or Scheduled species offlora and fauna. • Habitat of significant importance to endemic and/or restricted range species. • Habitat (including corridors) supporting nationally or globally significantconcentrations of migratory and/or congregatory species. • Highly threatened and/or unique ecosystems. • Areas subject to formal designation and or protection due to their specialhabitats and/or species assemblages. • Areas not subject to formal protection but which have high biodiversity value and are subject to informal community protection and veneration (e.g., sacredgroves, community biodiversity harvesting area). • Areas associated with key evolutionary processes.
Category B	• Area lacking the criteria identified in BIC A above, but dominated by nativevegetation and/or relatively undisturbed natural habitat. • Area adjacent (within 5 km) of a location satisfying one or more of the criteria in BIC A above.
Category C	• Site is heavily modified, intensely managed landscape such as long-establishedbrown field area, urban setting (including monoculture).

BIC for ERD surface locations

The ERD surface locations are such as PAD 1 is cropland/pastureland, for PAD 2 it is home backyard and for PAD 3 is Tea Plantation which are all modified habitats. There is no presence of ecological habitat or any important species within the ERD surface locations. The surrounding forest habitat provided habitat for several globally and nationally important floral and faunal species. The aquatic bodies in the surrounding area are habitat to several migratory birds. Considering these facts, the Biodiversity Importance Category for ERD surface locations can be considered as **Category B.**

Biodiversity Risk Matrix

The biodiversity risk is a principal tool for risk assessment against the potential impacts. The matrix plots Biodiversity Importance Category on y axis and against severity and likelihood of expected impacts on x axis.

Table 24 : Biodiversity Risk Matrix

Biodiversity Importance of Category (sensitivity of species, habitat or sustaining ecosystem)	Biodiversity Impact			
	Very High	High	Medium	Low
Category A	Critical	Severe	Moderate	Minor
Category B	Severe	Moderate	Minor	Minor
Category C	Minor	Minor	Minor	Negligible

The Output of the Biodiversity Risk Matrix for ERD surface locations is presented below:

Table 25 : BIODIVERSITY RISK MATRIX FOR ERD SURFACE LOCATIONS

Impacts	Description	Impact mitigation category	Biodiversity Risk
Impact 1	There will be Increase in the ambient noise levels in and around the drill sites due to the project activities, which will lead to changes in species abundance, disruption of species communication, breeding, nesting and roosting patterns.	High	**Moderate**
Impact 2	Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.	Medium	**Minor**
Impact 3	Air pollutants may affect wildlife through the disruption of endocrine function, organ injury, increased vulnerability to stresses and diseases; lower reproductive success, and possible mortality.	Medium	**Minor**
Impact 4	Wastewater and formation water will be generated during drilling activity, and the domestic wastewater from the labour camps which may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality.	Medium	**Minor**
Impact 5	Surface run off from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is likely to be contaminated and have potential to impact water quality of the receiving waterbody. This will affect the ecologically sensitive areas of the waterbody like migratory and resident bird habitats, fish habitat, breeding and nursing ground for fishes, and also habitat Gangetic Dolphin. Degradation of water quality may affect the primary productivity of the river.	Medium	**Minor**
Impact 6	Contamination of soil due spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, e-waste and municipal waste affect the soil microbes and bacterial growth and can affect the soil quality.	Medium	**Minor**

Impact 7	Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.	Low	**Minor**
Impact 8	Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste	Medium	**Minor**
Impact 9	Kitchen waste from labour camps if not disposed properly can attract rodents, snakes, monkeys etc. that may lead to human-wildlife conflict on the site.	Low	**Minor**
Impact 10	Change in Landuse and species composition along with loss of native vegetation.	Very high	**Severe**
Impact 11	Faunal dispersal and loss of feeding ground.	High	**Moderate**
Impact 12	Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil.	Low	**Minor**
Impact 13	Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings which may affect local floral and faunal species and ecosystems.	Medium	**Minor**
Impact 14	Illuminated with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like 1) They might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals	Low	**Minor**
Impact 15	Decreased habitat use and Increase in the roadkill of native fauna - early morning and late evening times on the transportation route.	Very high	**Severe**
Impact 16	Damage to existing nearby flora.	Very high	**Severe**
Impact 17	Over use of ground water may lower the ground water table.	Low	**Minor**

Impact 18	During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.	Medium	**Minor**
Impact 19	Alteration of onsite micro-drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas, which may affect habitat of reptiles, and mortality of floral species.	Low	**Minor**
IN CASE OF EXTREME EVENTS VIZ. BLOWOUTS			
Impact 20	Large amount of oil and associated pollutants will be discharged in the surrounding environment. (Such as Nitrogen, Sulphur dioxide, Carbon monoxide, HCOH (formaldehyde) etc.)	High	**Moderate**
Impact 21	Surrounding landscapes will be burned down due to explosion & blowout	High	**Moderate**
Impact 22	Sudden rise in the ambient temperature	Low	**Minor**
Impact 23	Oil spills may destroy nearby aquatic & terrestrial vegetation and dependant fauna	Very high	**Severe**
Impact 24	Post blowout, inhalation or ingestion of toxic pollutants in mammals such as Gangetic River Dolphin, may to lead to physiological damage leading to death	Very high	**Severe**
Impact 25	Inhalation or ingestion of toxic pollutants in the livestock post blowout may to lead to physiological damage leading to death.	High	**Moderate**
Impact 26	Avifauna can be affected due to external oiling, oil ingestion, and egg oiling and habitat changes. External oiling disrupts feather structure, causes matting of feathers, and produces eye and skin irritation.	Very high	**Severe**
Impact 27	Oil exposure to Amphibians will affect their growth and avert the process of metamorphosis	High	**Moderate**
Impact 28	Oil layer on water will prevent absorption of atmospheric oxygen. Low dissolved oxygen levels will detoriate aquatic ecosystem.	Low	**Minor**
Impact 29	Oil layer will gradually sink in the river bed, increasing the risk of Hydrocarbons bioaccumulate in aqautic organisms and affect the food chain	Very high	**Severe**
Impact 30	Oil spills or discharges may either enhance or reduce biomass of plankton communities. It may also affect photosynthetic abilities of phytoplanktons.	Low	**Minor**

Impact 31	Increase in the ambient noise levels, due to the blowout will be detrimental to terrestrial as well as aquatic fauna.	Low	**Minor**
Impact 32	Soil contaimination due to oil spill will render it infertile, in turn reducing its productivity	High	**Moderate**

Based on the mapping of the potential impacts against the Biodiversity Risk Matrix, the risk to biodiversity due to the operations can be defined as High, Medium or Low. This activity determines the level of initiatives to be taken at site to minimize the risk. To conclude the Biodiversity Risk for a site, the following conditions can be considered.

- *If one or more risks are at Critical or Severe, then the overall risk at site will be identified as **High***
- *If no risks with Critical or Severe, but one or more risks at the site as Moderate, then the overallrisk at site will be identified as **Medium***
- *If all risks on biodiversity at the site are at Minor or Negligible, then the overall risk at site will beidentified as **Low***

As three of the identified risks, i.e. Impact 10, Impact 15, Impact 16 fall in the **Severe category** in the biodiversity risk matrix, it can be concluded that the overall risk for the given study on Biodiversity is **'HIGH'.**

In case of extreme events such as blowouts, as four of the identified risks, i.e. Impact 23, Impact 24, Impact 26, and Impact 29 fall in the **Severe category** in the biodiversity risk matrix, along with above mentioned three impacts, it can be concluded that the overall risk for the given study on Biodiversity is **'HIGH'.**

Mitigation Measures

- Consideration of alternate routes for transportation of heavy vehicles to avoid movement through Bherjan Forest area.
- Monitoring of RET species including Gangetic Dolphin in Dibru Saikhowa National Park & Maguri Motapung Beel should be carried out during the drilling phase
- Native Plantation activities should be carried out in the ERD surface well periphery.
- Offset native plantation should be considered in the nearby area.

Detailed mitigation measures with action plans according to the threat categories identified, will be suggested in the next project deliverable- Comprehensive Biodiversity Management Plan, which will be encompassing the implementation as well as monitoring framework.

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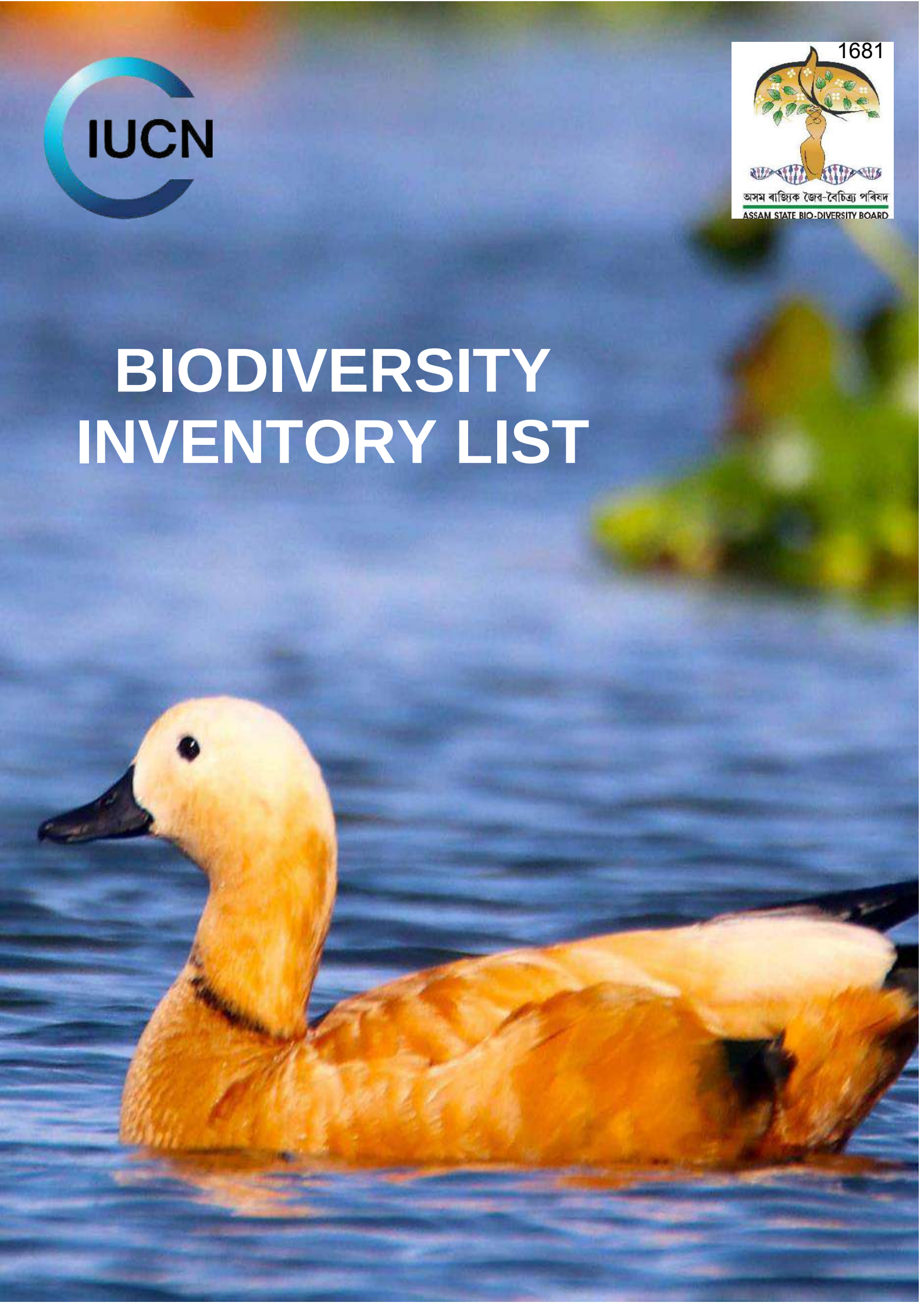

Biodiversity Inventory List

Inventory of flora observed in study area in Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Table 26 : Inventory of flora observed in study area in Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
1	*Aesculus assamica*	East Himalayan Horse Chestnut	Raman bih	Sapindaceae	–	–	Tree			✓
2	*Aesculus indica*	Indian Horse Chestnut	–	Sapindaceae	LC	–	Tree			✓
3	*Ageratina adenophora*	Cat wood	–	Compositae	–	–	Tree			✓
4	*Albizia chinensis*	Chinese albizia	Sau koroi	Fabaceae	-	-	Tree	✓	✓	✓
5	*Albizia procera*	White siris	Siris	Fabaceae	LC	-	Tree	✓	✓	✓
6	*Alstonia scholaris*	Devil tree	Satiana	Apocynaceae	LC	-	Tree	✓	✓	✓
7	*Angiopteris evecta*	King fern	–	Marattiaceae	–	–	Tree			✓
8	*Areca catechu*	Areca palm	Tamul	Arecaceae	-	-	Tree	✓	✓	✓
9	*Artocarpus chama*	Chapalish	Cham kathal	Moraceae	–	–	Tree			✓
10	*Artocarpus heterophyllus*	Jackfruit	Kothal	Moraceae	-	-	Tree	✓	✓	✓
11	*Artocarpus lacucha*	Lakoocha	Bohot	Moraceae	–	–	Tree			✓
12	*Azadirachta indica*	Margosa/Neem	–	Meliaceae	LC	–	Tree			✓
13	*Bambusa tulda*	Indian Timber Bamboo	Jati-banh	Poaceae	–	–	Tree			✓
14	*Bauhinia variegata*	Camel foot tree	–	Fabaceae	–	–	Tree		✓	✓
15	*Bischofia javanica*	Bishop Wood	Urium	Phyllanthaceae	LC	-	Tree	✓	✓	✓
16	*Bixa orellana*	Lipstick tree	Sendur gos	Bixaceae	LC	-	Tree	✓	✓	
17	*Bombax ceiba*	Cotton tree	Simalu	Bombacaceae	LC	-	Tree	✓	✓	✓

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
18	*Callicarpa arborea*	Beautyberry tree	-	Lamiaceae	-	-	Tree	✓	✓	
19	*Caryota urens*	Fish tail palm	Sowat gos	Arecaceae	LC	-	Tree	✓	✓	✓
20	*Cassia fistula*	Golden shower tree	Sonaru	Fabaceae	LC	-	Tree	✓	✓	
21	*Chukrasia tabularis*	Chitta gong wood	Boga-poma	Meliaceae	LC	-	Tree	✓	✓	
22	*Cibotium sp.*	Man Fern	–	Cibotiaceae	–	–	Tree			✓
23	*Cinnamomum tamala*	Indian Bay Leaf	Mahpat	Lauraceae	LC	–	Tree			✓
24	*Citrus limon*	Lemon	Nemu	Rutaceae	-	-	Tree	✓	✓	✓
25	*Citrus maxima*	Pomelo	Robab tenga	Rutaceae	LC	-	Tree	✓	✓	✓
26	*Cordia dichotoma*	Indian Cherry	Bahubara	Boraginaceae	LC	–	Tree			✓
27	*Delonix regia*	Royal poinciana	Krishnasura	Fabaceae	LC	-	Tree	✓	✓	✓
28	*Dendrocalamus hamiltoni*	Tama Bamboo	Kekowa-bans	Poaceae	–	–	Tree			✓
29	*Dillenia indica*	Elephant apple	Ou tenga	Dilleniaceae	LC	-	Tree	✓	✓	✓
30	*Dimocarpus longan*	Dragon's eye	Asphol	Sapindaceae	NT	–	Tree			✓
31	*Dipterocarpus macrocarpus*	Hollong tree	Hollong	Dipterocarpaceae	-	-	Tree	✓	✓	✓
32	*Dipterocarpus retusus*	Rusty Leaf Garjan	–	Dipterocarpaceae	EN	–	Tree			✓
33	*Duabanga grandiflora*	Duabanga	Thora	Lythraceae	–	–	Tree		✓	✓
34	*Dysoxylum gotadhora*	Cup-Calyx White Cedar	Bandor-dima	Meliaceae	–	–	Tree			✓
35	*Erythrina sp.*	Indian Coral Tree	Madaar	Fabaceae	LC	-	Tree	✓	✓	✓
36	*Eucalyptus globulus*	Blue gum tree	–	Myrtaceae	–	–	Tree			✓
37	*Ficus asperrima*	Forest Sandpaper Fig	-	Moraceae	LC	-	Tree	✓	✓	✓
38	*Ficus elastica*	Rubber tree	Atha bor	Moraceae	–	–	Tree			✓
39	*Ficus racemosa*	Cluster fig	-	Moraceae	LC	-	Tree	✓	✓	✓
40	*Ficus religiosa*	Sacred fig	Ahot gos	Moracaea	-	-	Tree	✓	✓	✓
41	*Garcinia sp.*	Malabar tamarind	Thekera	Clusiaceae	-	-	Tree	✓	✓	
42	*Garuga pinnata*	Grey Downy Balsam	Pama	Burseraceae	-	-	Tree	✓	✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
43	*Glochidion sp.*	Cheese trees	-	Phyllanthaceae	-	-	Tree	✓	✓	
44	*Gmelina arborea*	White Teak	Gomari	Verbenaceae	LC	-	Tree	✓	✓	✓
45	*Lagerstroemia speciosa*	Queen's crepe-myrtle	Azar	Lythraceae	-	-	Tree	✓	✓	✓
46	*Macaranga denticulata*	Blistery Macaranga	-	Euphorbiaceae	-	-	Tree	✓	✓	
47	*Magnolia champaca*	Champak	Titasopa	Magnoliacea	LC	-	Tree	✓	✓	
48	*Magnolia grandiflora*	Southern Magnolia	–	Magnoliacea	LC	–	Tree			✓
49	*Magnolia griffithii*	–	Bar-gahori-sopa	Magnoliacea	DD	–	Tree			✓
50	*Magnolia hodgsonii*	Hodgson magnolia	Borhomthuri	Magnoliacea	LC	-	Tree	✓	✓	
51	*Mallotus sp.*	–	–	Euphorbiaceae	–	–	Tree			✓
52	*Melia azedarach*	Chinaberry	Ghora-nim	Meliaceae	LC	-	Tree	✓	✓	
53	*Mesua ferrea*	Ceylond ironwood	Nahor	Clusiacea	-	-	Tree	✓	✓	✓
54	*Murraya koenigii*	Curry leaf tree	Narasingha	Meliaceae	-	-	Tree	✓	✓	✓
55	*Neolamarkia cadamba*	Burflower tree	Kadam	Rubiaceae	–	–	Tree	✓	✓	✓
56	*Oroxylum indicum*	Indian trumpet flower	Bhatghila	Bignoniaceae	-	-	Tree	✓	✓	
57	*Phyllanthus assamicus*	Assam Leaf-flower	-	Phyllanthaceae	-	-	Tree		✓	
58	*Pongamia pinnata*	Indian Beech Tree	Koroch	Fabaceae	LC	-	Tree	✓	✓	
59	*Pritchardia pacifica*	Fan palm	-	Arecaceae	-	-	Tree		✓	
60	*Robinia pseudoacacia*	White Locust Tree	–	Fabaceae	LC	–	Tree			✓
61	*Shorea robusta*	Sal tree	Sal	Dipterocarpaceae	LC	-	Tree	✓	✓	✓
62	*Syzygium cumini*	Java Plum	–	Myrtaceae	–	–	Tree			✓
63	*Tectona grandis*	Teak	Sagun	Verbenaceae	-	-	Tree	✓	✓	
64	*Terminalia bellirica*	Baheda	Bhomora	Combretaceae	-	-	Tree	✓	✓	
65	*Terminalia myriocarpa*	East-Indian Almond	–	Combretaceae	–	–	Tree		✓	✓
66	*Ziziphus mauritiana*	Indian jujube	Bogori	Rhamnaceae	-	-	Tree	✓	✓	✓
67	*Actephila excels*	Nilgiri Actephila	-	Phyllanthaceae	-	-	Shrub	✓	✓	
68	*Bambusa sp.*	-	-	Poaceae	-	-	Shrub	✓	✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
69	*Brassaiopsis sp.*	-	-	Araliaceae	-	-	Shrub	✓	✓	
70	*Calamus tenuis*	Palm	Bet	Arecaceae	LC	-	Shrub	✓	✓	✓
71	*Camellia sinensis*	Tea plant	Cha	Theaceae	–	–	Shrub			✓
72	*Chromolaena odorata*	Goatweed	–	Compositae	–	–	Shrub			✓
73	*Cleodendrum infortunatum*	Hill glory flower	Dhapatita	Verbenanceae	-	-	Shrub	✓	✓	✓
74	*Cleome gynandra*	Spiderwisp	-	Cleomaceae	-	-	Shrub	✓	✓	
75	*Diploclisia sp.*	-	-	Menespermaceae	-	-	Shrub	✓	✓	
76	*Eupatorium odoratum*	Siam weed	Jarmoni ban	Asteraceae	-	Yes	Shrub	✓	✓	
77	*Flueggea suffruticosa*	–	–	Phyllanthaceae	–	–	Shrub			✓
78	*Globba sp.*	-	-	Zingiberaceae	-	-	Shrub	✓	✓	
79	*Ipomea carnea*	Bush morning glory	Bih Kolmou	Convolvulaceae	-	-	Shrub	✓	✓	✓
80	*Lantana camera*	West Indian lantana	-	Verbenaceae	-	Yes	Shrub	✓	✓	✓
81	*Leea indica*	Bandicoot Berry	Kukur jihwa	Vitaceae	LC	-	Shrub	✓	✓	
82	*Lippia alba*	Bushy matgrass	Pahu-kuta	Verbenanceae	-	-	Shrub	✓		
83	*Manihot esculenta*	Bitter cassava	Simalu alu	Euphorbiaceae	DD	-	Shrub	✓	✓	
84	*Melastoma malabarthricum*	Malabar melastoma	Phutkola	Melastomaceae	-	-	Shrub	✓	✓	
85	Mezoneuron cucullatum	Hooded-flowered brasiletto	-	Fabaceae	-	-	Shrub		✓	
86	*Mussanda roxburgii*	East Himalayan mussanda	Sonarupa	Rubiaceae	-	-	Shrub	✓	✓	
87	*Mycetia nutans*	-	-	Rubiaceae	-	-	Shrub		✓	
88	*Myriophyllum tuberculatum*	Red Watermillifoil	-	Haloragaceae	-	-	Shrub	✓	✓	
89	*Pandanus sp.*	-	-	Pandanaceae	-	-	Shrub	✓		
90	*Pandanus unguifer Hook.*	-	-	Pandanaceae	-	-	Shrub		✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
91	*Pothos scandens*	Climbing Aroid	-	Araceae	-	-	Shrub	✓	✓	
92	*Rhaphidophora decursiva*	Creeping Philodendron	-	Araceae	-	-	Shrub	✓		
93	*Rubus buergeri*	–	–	Rosaceae	–	–	Shrub			✓
94	*Schefflera arboricola*	Dwarf Umbrella tree	-	Araliaceae	-	-	Shrub	✓		
95	*Schefflera venulosa*	-	-	Araliaceae	-	-	Shrub		✓	
96	*Senna alata*	Candle stick senna	Kharpat	Fabaceae	LC	-	Shrub	✓	✓	
97	*Senna hispida*	Hairy senna		Fabaceae	-	-	Shrub	✓	✓	
98	*Senna occidentalis*	Stinking weed	Bor medelua	Fabaceae	-	-	Shrub	✓	✓	
99	*Smilax sp.*	-	-	Smilacaceae	-	-	Shrub	✓	✓	
100	*Solanum diaphyllum*	twoleaf nightshade	-	Solanaceae	-	-	Shrub	✓	✓	
101	*Solanum torvum*	Turkey berry	Hati bhekuri	Solanaceae	-	Yes	Shrub	✓	✓	
102	*Solanum viarum*	Tropical soda apple	Tit bhekuri	Solanaceae	LC	Yes	Shrub	✓	✓	✓
103	*Sterculia hamiltonina*	Hamiltonian starculia	-	Malvaceae	-	-	Shrub	✓	✓	
104	*Tamarix sp.*	-	-	Tamariaceae	-	-	Shrub	✓	✓	✓
105	*Thunbergia coccinea*	Scarlet Clock Vine	Chonga lota	Acanthaceae	-	-	Shrub	✓	✓	
106	*Thunbergia laurifolia*	Laurel Clock Vine	-	Acanthaceae	-	-	Shrub		✓	
107	*Urena lobata*	-	-	Malvaceae	-	-	Shrub	✓	✓	✓
108	*Vallisneria spiralis*	Vallisneria	-	Hydrocharitaceae	-	-	Shrub	✓		
109	*Cynadon dactylon*	Scutuch grass	Dubori bon	Poaceae	-	-	Herb	✓	✓	
110	*Polygonum hydropiper*	-	Patharua bihalagani	Polygonaceae	LC	-	Herb	✓	✓	
111	*Acampe rigida (Orchid)*	Stiff Acampe	-	Orchidaceae	-	-	Herb	✓	✓	
112	*Achyranthes aspera*	Devil's horsewhip	Hati-huria	Piperaceae	-	-	Herb	✓	✓	
113	*Acmella repens*	-	-	Compositae	-	-	Herb			✓
114	*Acorus calamus*	Sweet flag	-	Acoraceae	-	-	Herb	✓	✓	
115	*Ageratina adenophora*	Catweed	-	Compositae	-	-	Herb			✓

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
116	*Ageratum conyzoides*	Goatweed	-	Compositae	LC	Yes	Herb			✓
117	*Ageratum conyzoids*	Billy goat weed	-	Asteraceae	LC	Yes	Herb	✓	✓	
118	*Alpina nigra*	Black Galangal	-	Zingiberaceae	-	-	Herb			✓
119	*Alternanthera sp.(Button like)*	Joy weed, Copperleaf	-	Amaranthaceae	-	-	Herb	✓	✓	
120	*Alternanthera sessilis*	Dwarf copperleaf	Matikaduri	Amaranthaceae	-	Yes	Herb	✓	✓	
121	*Amaranthus palmeri*	Palmer's Amaranth	-	Amaranthaceae	-	-	Herb			✓
122	*Amaranthus spinosus*	Spiny amaranth	Hati khutura	Amaranthaceae	-	-	Herb	✓	✓	✓
123	*Amaranthus viridis*	Green Amaranth	-	Amaranthaceae	-	-	Herb	✓	✓	
124	*Amorphophallus campanulatus*	Elephant Foot Yam	-	Araceae	-	-	Herb	✓	✓	
125	*Aponogeton natans*	Floating lace plant	-	Aponogetonaceae	LC	-	Herb		✓	
126	*Arundo donax*	Giant Reed	-	Poaceae	-	-	Herb			✓
127	*Asplenium nidus*	Bird's-nest Fern	-	Aspleniaceae	-	-	Herb	✓		
128	*Auriculate dichrocephala*	Bicolor button weed	-	Compositae	-	-	Herb			✓
129	*Axonopus compressus*	Blanket Grass	-	Poaceae	-	-	Herb			✓
130	*Bidens pilosa*	Beggarticks	-	Asteraceae	-	Yes	Herb	✓	✓	✓
131	*Bidens sp.*	-	-	Asteraceae	-	-	Herb	✓		
132	*Bistorta amplexicaulis*	Red Mountain Fleeceflower	-	Polygonaceae	-	-	Herb			✓
133	*Boehmaria sp.*	-	-	Urticaceae	-	-	Herb		✓	
134	*Bromelia sp.*	-	-	Bromeliaceae	-	-	Herb			✓
135	*Caladium bicolor*	Heart of Jesus	-	Araceae	-	-	Herb			✓
136	*Cardiospermum*	Balloon Vine	-	Sapindaceae	LC	-	Herb	✓	✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
	halicacabum									
137	*Centella asiatica*	Indian Pennywort	-	Apiaceae	LC	-	Herb	✓	✓	✓
138	*Centratherum punctatum*	Brazilian Bachelor's Button	-	Asteraceae	-	-	Herb	✓	✓	
139	*Ceratophyllum demersum*	Coon tail	-	Ceratophyllaceae	LC	Yes	Herb	✓	✓	
140	*Circaea alpina*	Himalayan Enchanter's Nightshade	-	Onagraceae	-	-	Herb			✓
141	*Cleome rutidospermum*	Fringed spiderflower	-	Capparaceae	-	-	Herb	✓	✓	
142	*Cleome viscosa*	Yellow Spider flower	-	Cleomaceae	-	-	Herb	✓	✓	
143	*Clerodendrum chinense*	Chinese Glory Bower	-	Verbenaceae	LC	-	Herb	✓	✓	
144	*Clerodendrum colebrookeanum*	East Indian Glory Bower	Nephaphu	Verbenaceae	-	-	Herb	✓	✓	
145	*Clerodendrum indicum*	-	-	-	-	-	Herb		✓	
146	*Colocasia esculenta*	Wild taro	-	Araceae	LC	-	Herb	✓	✓	✓
147	*Commelina cyanea*	scurvy weed	-	Commelinaceae	-	-	Herb			✓
148	*Commelina virginica*	Virginia dayflower	-	Commelinaceae	-	-	Herb			✓
149	*Crassocephalum crepidioides*	Ebolo Plant	-	Compositae	-	-	Herb			✓
150	*Cuphea carthagenensis*	Colombian Waxweed	-	Lythraceae	-	-	Herb			✓
151	*Cuphea sp.*	False heather	-	Lythraceae	-	-	Herb	✓	✓	
152	*Cyclosorus dentatus*	-	-	Pteridiaceae	-	-	Herb			✓
153	*Cynodon dactylon*	Bermuda grass	Doob	Poaceae	-	-	Herb	✓		✓
154	*Cyperus sp.*	-	-	Cyperaceae	-	-	Herb			✓
155	*Dichanthium annulatum*	Sheda grass, Blue stem	-	Poaceae	-	-	Herb	✓	✓	
156	*Diplazium esculentum*	Vegetable fern	-	Athyriaceae	LC	-	Herb			✓

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
157	*Eclipta prostrata*	False daisy	-	Compositae	LC	-	Herb		✓	
158	*Eicchornia crassipes*	Common water hyacinth	Jal Kumbhi	Pontederiaceae	-	Yes	Herb	✓	✓	✓
159	*Eleusine indica*	Indian goosegrass	Bobosa- bon	Poaceae	-	-	Herb	✓	✓	✓
160	*Equisetum sp.*	Horse tail	-	Equisetaceae	-	-	Herb			✓
161	*Eragrostis sp.*	Bunch grass	-	Poaceae	-	-	Herb	✓	✓	
162	*Gynura sp.*	-	-	Asteraceae	-	-	Herb	✓	✓	
163	*Heliotropium indicum*	Indian Heliotrope	-	Boraginaceae	-	-	Herb			✓
164	*Heteranthera limosa*	Duck Salad	-	Pontederiaceae	-	-	Herb			✓
165	*Hydrilla verticillata*	Hydrilla	-	Hydrocharitaceae	LC	Yes	Herb	✓	✓	✓
166	*Hydrocotyle sibthorpioides*	Lawn marsh pennywort		Araliaceae	-	-	Herb	✓	✓	✓
167	*Impatiens balsamina*	Balsams	Keruphul	Balsaminaceae	-	-	Herb	✓	✓	
168	*Impatiens textoris*	-	-	Balsaminaceae	-	-	Herb			✓
169	*Imperata cylindrica*	Cogon grass	-	Poaceae	-	-	Herb		✓	
170	*Ipomoea aquatica*	Water spinach	-	Convolvulaceae	LC	Yes	Herb		✓	✓
171	*Ipomoea carnea*	Pink morning glory	-	Convolvulaceae	-	-	Herb		✓	
172	*Kyllinga sp.*	Green Water Sedge	-	Cyperaceae	LC	-	Herb	✓	✓	
173	*Leea indica*	Bandicoot Berry	Kukur jihwa	Vitaceae	LC	-	Herb	✓		
174	*Lemna perpusilla*	Tiny duckweed	-	Araceae	LC	-	Herb		✓	
175	*Leonurus japonicus*	Oriental Motherwort	-	Lamiaceae	-	-	Herb			✓
176	*Leonurus sibiricus*	Honey weed	-	Lamiaceae	-	-	Herb	✓	✓	
177	*Leucas aspera*	Common leucas	Doron	Lamiaceae	-	-	Herb	✓	✓	✓
178	*Lindernia crustacea*	Malaysian Lindernia	-	Lindernaceae	LC	-	Herb	✓	✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
179	*Lippia alba*	Bushy Lippia	Pitiona, Hierba negra	Verbenaceae	-	-	Herb	✓	✓	
180	*Ludwigia perennis*	Perennial water primrose	Bon Jalakia	Onagraceae	LC	-	Herb	✓	✓	
181	*Luisia trichorrhiza*	Hairy-Root Luisia	-	Orchidaceae	-	-	Herb	✓	✓	
182	*Marsilea quadrifolia*	Clover fern	-	Marseliaceae	LC	-	Herb			✓
183	*Mazus sp.*	-	-	Mazaceae	-	-	Herb	✓	✓	
184	*Mikania micrantha*	Climbing Hempweed	-	Compositae	-	-	Herb			✓
185	*Mimosa pudica*	Touch me not	Lajuki lota	Fabaceae	-	Yes	Herb	✓	✓	✓
186	*Musa x paradisica*	Banana	-	Musaceae	-	-	Herb	✓	✓	
187	*Myriophyllum sp.*	-	-	Haloragaceae	-	-	Herb			✓
188	*Najas graminea*	Ricefield water-nymph	-	Hydrocharitaceae	LC	-	Herb		✓	
189	*Najas indica*	Guppy grass	-	Hydrocharitaceae	LC	-	Herb		✓	
190	*Najas marina*	Holly leaved Naiad	-	Hydrocharitaceae	LC	-	Herb		✓	
191	*Nelumbo nucifera*	Sacred Lotus	Kamal	Padam	DD	-	Herb	✓	✓	
192	*Nymphaea nouchali*	Blue lotus	-	Nymphaeaceae	LC	-	Herb		✓	
193	*Oldenlandia corymbosa*	Diamond flower	Daman pappar	-	-	-	Herb	✓	✓	
194	*Oxalis corniculata*	Creeping Wood Sorrel	-	Oxalidaceae	-	-	Herb			✓
195	*Pennisetum sp.*	-	-	Poaceae	-	-	Herb			✓
196	*Peperomia pellucida*	Slate Pencil Plant, Silverbush	-	Pononoa	-	-	Herb	✓	✓	
197	*Persicaria hydropiper*	Water Pepper	-	Polygonaceae	LC	-	Herb			✓
198	*Persicaria maculosa*	Redshank	-	Polygonaceae	LC	-	Herb			✓
199	*Persicaria sp.*	Asiatic waterpepper	-	Polygonaceae	-	-	Herb	✓	✓	
200	*Persicaria virginiana*	-	-	Polygonaceae	-	-	Herb			✓

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
201	*Phragmites karka*	Tall Reed	Nala dala	Poaceae	-	-	Herb		✓	
202	*Phyla nudiflora*	Frog fruit	Jal pipali	Verbenaceae	-	-	Herb	✓	✓	
203	*Phyllanthus rotundifolius*	-	-	Phyllanthaceae	-	-	Herb		✓	
204	*Phyllanthus urinaria*	Chamber Bitter, Shatterstone	Hajarmani	Bhui Amlakhi	-	-	Herb	✓	✓	
205	*Piper betle*	Betel leaf	Pan	Piperaceae	-	-	Herb	✓	✓	
206	*Piper betleoides*	-	-	Piperaceae	-	-	Herb		✓	
207	*Pistia stratiotes*	Water lettuce, Nile Cabbage	Barpuni	Araceae	LC	-	Herb	✓	✓	✓
208	*Pluchea odorata*	Sweet Scent Plant	-	Compositae	-	-	Herb			✓
209	*Pollia sp.*		-	Commelinaceae	-	-	Herb		✓	
210	*Pontederia cordata*	Pickerel Weed	-	Pontederiaceae	-	-	Herb	✓	✓	
211	*Potamogeton crispus*	Curled Pondweed	-	Potamogetonaceae	LC	Yes	Herb		✓	
212	*Potamogeton natans*	Broad leaved Pondweed	-	Potamogetonaceae	LC	-	Herb		✓	
213	*Potamogeton nodosus*	Loddon Pondweed	-	Potamogetonaceae	LC	-	Herb		✓	
214	*Remusatia sp.*	-	-	Arecaceae	-	-	Herb			✓
215	*Rhaphidophora decursiva*	Creeping Philodendron	-	Araceae	-	-	Herb		✓	
216	*Rhaphidophora hookeri*	-	-	-	-	-	Herb		✓	
217	*Rorippa benghalensi*	-	-	Brassicaceae	-	-	Herb			✓
218	*Rotala indica*	Indian toothcup	-	Lythraceae	LC	-	Herb		✓	
219	*Ruppia maritima*	Beaked tassleweed	-	Ruppiaceae	LC	-	Herb		✓	
220	*Sabia lanceolata*	-	-	Sabiaceae	-	-	Herb		✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
221	*Saccharum ravennae*	Ravenna grass	-	Poaceae	-	-	Herb		✓	
222	*Saccharum spontaneum*	Kans grass	-	Poaceae	LC	-	Herb			✓
223	*Scophuria dulcis*	Sweet broom	Madhumeharri, bon chini	Plantaginaceae	-	-	Herb	✓	✓	
224	*Senna tora*	Sickle pod	Medelua	Fabaceae	-	-	Herb	✓	✓	
225	*Sida acuta*	Common wireweed	Boriala	Malvaceae	-	-	Herb	✓	✓	✓
226	*Sida rhombifolia*	Arrowleaf sida	Boriala	Malvaceae	-	-	Herb	✓	✓	✓
227	*Smilax zeylanica*	Kumarika	-	Smilacaceae	-	-	Herb			✓
228	*Solanum nigrum*	Black nightshade	Pichkati	Solanaceae	-	-	Herb	✓	✓	
229	*Soliva sessilis*	Field Burrweed	-	Compositae	-	-	Herb			✓
230	*Spermacoce tenuire*	Slender False Buttonweed	-	Rubiaceae	-	-	Herb			✓
231	*Spilanthes acmella*	Paracress	Bon narji	Asteraceae	-	-	Herb	✓	✓	
232	*Spilanthes paniculata*	Paracress	-	Compositae	-	-	Herb		✓	
233	*Spirodela sp.*	Duck weed	-	Araceae	-	-	Herb		✓	
234	*Stenochlaena milnei*	-	-	Blechnaceae	-	-	Herb			✓
235	*Tectaria sp.*	-	-	Tectariaceae	-	-	Herb			✓
236	*Trapa natans*	Water Chestnut	-	Lythraceae	LC	Yes	Herb		✓	✓
237	*Trianthema portulaceastrum*	Water primrose	-	Onagraceae	-	-	Herb		✓	
238	*Typhonium trilobatum*	Bengal Arum	-	Araceae	-	-	Herb			✓
239	*Urena lobata*	Pink Burr	-	Malvaceae	-	-	Herb			✓
240	*Utricularia aurea*	Golden Bladder wort	-	Lentibulariaceae	LC	-	Herb		✓	
241	*Vallisneria spiralis*	Vallisneria	-	Hydrocharitaceae	-	-	Herb		✓	
242	*Xanthium strumarium*	Rough cocklebur	-	Compositae	-	-	Herb			✓
243	*Acrostichum heterophy*	-	-	Pteridaceae	-	-	Pteridophy		✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
	llum						tes			
244	*Adiantum capillus-veneris*	Southern Maidenhair Fern	-	Pteridaceae	LC	-	Pteridophytes		✓	
245	*Amblovenatum opulentum*	-	-	Thelypteridaceae	-	-	Pteridophytes		✓	
246	*Angiopteris evecta*	King fern	-	Marattiaceae	-	-	Pteridophytes	✓	✓	✓
247	*Araiostegia divaricata*	-	-	Davalliaceae	-	-	Pteridophytes		✓	
248	*Asplenium nidus*	See bird's-nest fern	-	Aspleniaceae	-	-	Pteridophytes	✓	✓	✓
249	*Azolla sp.*	-	-	Azollaceae	-	-	Pteridophytes	✓		✓
250	*Blechnum sp.*	Hard fern	-	Blechnaceae	-	-	Pteridophytes	✓		✓
251	*Blechnum orientale*	Centipede Fern	-	Blechnaceae	-	-	Pteridophytes		✓	
252	*Bolbitis heteroclita*	El Nino Fern	-	Dryopteridaceae	-	-	Pteridophytes		✓	
253	*Christella parasitica*	Parasitic maiden fern	-	Thelypteridaceae	-	-	Pteridophytes		✓	
254	*Cyathea gigantea*	-	-	Cyatheaceae	-	-	Pteridophytes	✓	✓	✓
255	*Cyathea spinulosa*	Tree fern	-	Cyatheaceae	-	-	Pteridophytes		✓	✓
256	*Cyclosorus interruptus*	Hottentot fern	-	Thelypteridaceae	-	-	Pteridophytes		✓	
257	*Dicranopteris linearis*	Old World forked fern	-	Gleicheniaceae	LC	-	Pteridophytes		✓	
258	*Diplazium dilatatum*	-	-	Athyriaceae	-	-	Pteridophy		✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
							tes			
259	*Diplazium esculentum*	Vegetable fern	Linguda	Athyriaceae	LC	-	Pteridophytes		✓	
260	*Drymoglossum heterophylum*	Dragon scale	-	Polypodiaceae	-	-	Pteridophytes	✓		✓
261	*Gleichenia sp.*	Forked climbing fern	-	Gleicheniaceae	-	-	Pteridophytes	✓		✓
262	*Lygodium flexuosum*	Climbing fern	-	Lygodiaceae	-	-	Pteridophytes	✓	✓	✓
263	*Lygodium japonicum*	Japanese climbing fern		Lygodiaceae	-	-	Pteridophytes		✓	
264	*Marselia sp.*	Clover fern	-	Marseliaceae	-	-	Pteridophytes	✓		✓
265	*Microlepia speluncae*	-	-	Dennstaedtiaceae	-	-	Pteridophytes		✓	
266	*Microsorum pteropus*	Java fern	-	Polypodiaceae	LC	-	Pteridophytes		✓	
267	*Microsorum punctatum*	Fishtail fern	-	Polypodiaceae	-	-	Pteridophytes		✓	
268	*Pityrogramma calomelanos*	Silverback fern	-	Pteridaceae	-	-	Pteridophytes		✓	
269	*Pteris vitata*	Chinese brake fern	-	Pteridiaceae	-	-	Pteridophytes	✓		✓
270	*Pteris biaurita*	Thinleaf brake	-	Pteridaceae	-	-	Pteridophytes		✓	
271	*Pteris ensiformis*	Slender brake	-	Pteridaceae	-	-	Pteridophytes		✓	
272	*Pteris longipinnula*	-	-	Pteridaceae	-	-	Pteridophytes		✓	
273	*Pteris semipinnata*	-	-	Pteridaceae	-	-	Pteridophy		✓	

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN	GISD	Habit	Season 1	Season 2	Season 3
							tes			
274	*Pteris vittata*	Chinese brake	-	Pteridaceae	LC	-	Pteridophytes		✓	
275	*Pyrrosia lanceolata*	-	-	Polypodiaceae	-	-	Pteridophytes		✓	
276	*Pyrrosia piloselloides*	Dragonscale fern	-	Polypodiaceae	-	-	Pteridophytes		✓	
277	*Salvinia sp.*	-	-	Salviniaceae	-	-	Pteridophytes	✓	✓	✓
278	*Selaginella sp.*	Peacock fern	-	Selaginellaceae	-	-	Pteridophytes	✓		✓
279	*Selaginella monospora*	-	-	Selaginellaceae	-	-	Pteridophytes		✓	
280	*Selaginella semicordata*	-	-	Selaginellaceae	-	-	Pteridophytes		✓	
281	*Sphenomeris chinensis*	Lace Fern	-	Lindsaeaceae	-	-	Pteridophytes		✓	
282	*Stenochlaena palustris*	Climbing Swamp Fern	-	Blechnaceae	-	-	Pteridophytes		✓	
283	*Vittaria elongata*	Tape fern	-	Pteridaceae	-	-	Pteridophytes		✓	

Inventory of bird species observed in study area - Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Table 27 : Inventory of bird species observed in study area - Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
1	Accipitriformes	Accipitridae	Black-eared Kite	*Milvus migrans lineatus*	LC	R	-			✓
2	Accipitriformes	Accipitridae	Black-winged Kite	*Elanus caeruleus*	LC	R	-		✓	✓
3	Accipitriformes	Accipitridae	Crested serpent eagle	*Spilornis cheela*	LC	R	-			✓
4	Accipitriformes	Accipitridae	Eurasian Marsh Harrier	*Circus aeruginosus*	LC	WV	-		✓	
5	Accipitriformes	Accipitridae	Slender-billed Vulture	*Gyps tenuirostris*	CR	R	I		✓	✓
6	Accipitriformes	Accipitridae	Himalayan Griffon	*Gyps himalayensis*	NT	WV	IV		✓	
7	Accipitriformes	Accipitridae	Lesser Fish-eagle	*Icthyophaga humilis*	NT	R	I		✓	✓
8	Accipitriformes	Accipitridae	Long-legged Buzzard	*Buteo rufinus*	LC	WV	-		✓	
9	Accipitriformes	Accipitridae	Oriental Honey-buzzard	*Pernis ptilorhynchus*	LC	R	-	✓	✓	
10	Accipitriformes	Accipitridae	Shikra	*Accipiter badius*	LC	R	-	✓	✓	
11	Accipitriformes	Accipitridae	White-rumped Vulture	*Gyps bengalensis*	CR	R	I		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
12	Accipitriformes	Pandionidae	Osprey	*Pandion haliaetus*	LC	WV	I	✓		
13	Anseriformes	Anatidae	Bar-headed Goose	*Anser indicus*	LC	WV	IV		✓	
14	Anseriformes	Anatidae	Common Pochard	*Aythya ferina*	VU	WV	IV		✓	
15	Anseriformes	Anatidae	Common Teal	*Anas crecca*	LC	WV	IV		✓	
16	Anseriformes	Anatidae	Cotton pygmy goose	*Nettapus coromandelianus*	LC	R	IV	✓	✓	
17	Anseriformes	Anatidae	Eastern Spot-billed Duck	*Anas zonorhyncha*	LC	WV	IV			✓
18	Anseriformes	Anatidae	Ferruginous Duck	*Aythya nyroca*	NT	WV	IV		✓	
19	Anseriformes	Anatidae	Greylag Goose	*Anser anser*	LC	WV	IV		✓	
20	Anseriformes	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	R	IV		✓	✓
21	Anseriformes	Anatidae	Lesser Whistling-duck	*Dendrocygna javanica*	LC	R	IV	✓	✓	✓
22	Anseriformes	Anatidae	Mallard	*Anas platyrhynchos*	LC	R	IV		✓	
23	Anseriformes	Anatidae	Northern Shoveler	*Spatula clypeata*	LC	R	-		✓	
24	Anseriformes	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	LC	WV	IV		✓	✓
25	Anseriformes	Anatidae	Eurasian Wigeon	*Mareca penelope*	LC	WV	IV		✓	
26	Bucerotiformes	Bucerotidae	Oriental Pied Hornbill	*Anthracoceros albirostris*	LC	R	-	✓	✓	✓
27	Caprimulgiformes	Apodidae	Asian palm swift	*Cypsiurus balasiensis*	LC	R	IV	✓	✓	✓
28	Charadriifo	Charadriida	Little Ringed Plover	*Charadrius dubius*	LC	R	IV		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
	rmes	e								
29	Charadriiformes	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	LC	R	-	✓	✓	✓
30	Charadriiformes	Glareolidae	Little Pratincole	*Glareola lactea*	LC	R	IV		✓	
31	Charadriiformes	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	LC	R	IV	✓	✓	✓
32	Charadriiformes	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	R	IV		✓	✓
33	Charadriiformes	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	LC	R	IV			✓
34	Charadriiformes	Scolopacidae	Black-tailed Godwit	*Limosa limosa*	NT	WV	-		✓	
35	Charadriiformes	Scolopacidae	Common Greenshank	*Tringa nebularia*	LC	WV	-		✓	✓
36	Charadriiformes	Scolopacidae	Common Redshank	*Tringa totanus*	LC	WV	-	✓		
37	Charadriiformes	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	WV	IV		✓	✓
38	Charadriiformes	Scolopacidae	Common Snipe	*Gallinago gallinago*	LC	WV	IV		✓	
39	Charadriiformes	Scolopacidae	Temminck's Stint	*Calidris temminckii*	LC	WV	-		✓	
40	Charadriiformes	Scolopacidae	Wood Sandpiper	*Tringa glareola*	LC	WV	IV		✓	
41	Ciconiiformes	Ciconiidae	Asian Openbill	*Anastomus oscitans*	LC	R	IV	✓	✓	✓
42	Ciconiiformes	Ciconiidae	Black Stork	*Ciconia nigra*	LC	WV	IV		✓	
43	Ciconiiformes	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	VU	R	-	✓	✓	
44	Columbiformes	Columbidae	Eastern Spotted Dove	*Spilopelia chinensis*	LC	R	IV	✓	✓	✓

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
45	Columbiformes	Columbidae	Eurasian Collared-dove	*Streptopelia decaocto*	LC	R	IV	✓	✓	✓
46	Columbiformes	Columbidae	Grey-capped Emerald Dove	*Chalcophaps indica*	LC	R	IV	✓		✓
47	Columbiformes	Columbidae	Laughing Dove	*Spilopelia senegalensis*	LC	R	IV		✓	✓
48	Columbiformes	Columbidae	Rock Dove	*Columba livia*	LC	R	IV	✓	✓	
49	Columbiformes	Columbidae	Yellow-footed Green Pigeon	*Treron phoenicopterus*	LC	R	IV	✓		✓
50	Coraciiformes	Alcedinidae	Common Kingfisher	*Alcedo atthis*	LC	R	IV		✓	
51	Coraciiformes	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	LC	R	IV	✓	✓	✓
52	Coraciiformes	Alcedinidae	Stork-billed kingfisher	*Pelargopsis capensis*	LC	R	IV			✓
53	Coraciiformes	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	LC	R	IV	✓	✓	✓
54	Coraciiformes	Coraciidae	Indian Roller	*Coracias benghalensis*	LC	R	IV	✓	✓	✓
55	Coraciiformes	Meropidae	Blue-tailed Bee-eater	*Merops philippinus*	LC	SW	-	✓		
56	Coraciiformes	Meropidae	Chestnut headed bee-eater	*Merops leschenaulti*	LC	R	-			✓
57	Coraciiformes	Meropidae	Green bee-eater	*Merops orientalis*	LC	R	-	✓		
58	Cuculiformes	Cuculidae	Great Coucal	*Centropus sinensis*	LC	R	IV			✓
59	Cuculiformes	Cuculidae	Green-billed Malkova	*Phaenicophaeus tristis*	LC	R	-	✓	✓	✓
60	Cuculiformes	Cuculidae	Indian Cuckoo	*Cuculus micropterus*	LC	R	IV	✓		✓
61	Cuculiform	Cuculidae	Large Hawk-cuckoo	*Hierococcyx*	LC	WV	IV		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
	es			*sparverioides*						
62	Cuculiformes	Cuculidae	Lesser Coucal	*Centropus bengalensis*	LC	R	-	✓	✓	✓
63	Cuculiformes	Cuculidae	Western Koel	*Eudynamys scolopaceus*	LC	R	IV			✓
64	Falconiformes	Falconidae	Common Krestel	*Falco tinnunculus*	LC	R	IV			✓
65	Falconiformes	Falconidae	Eurasian hobby	*Falco subbuteo*	LC	WV	IV			✓
66	Galliformes	Phasianidae	Kalij Pheasant	*Lophura leucomelanos*	LC	R	I		✓	
67	Galliformes	Phasianidae	Red Junglefowl	*Gallus gallus*	LC	R	IV		✓	✓
68	Galliformes	Phasianidae	Swamp Francolin	*Francolinus gularis*	VU	R	-		✓	✓
69	Gruiformes	Rallidae	Common Moorhen	*Gallinula chloropus*	LC	R	-	✓	✓	✓
70	Gruiformes	Rallidae	Purple Swamphen	*Porphyrio porphyrio*	LC	R	-		✓	✓
71	Gruiformes	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	R	IV	✓	✓	
72	Passeriformes	Acrocephalidae	Acrocephalus	-	-	-	-		✓	
73	Passeriformes	Aegithinidae	Common Iora	*Aegithina tiphia*	LC	R	IV		✓	
74	Passeriformes	Alaudidae	Bengal Bushlark	*Mirafra assamica*	LC	R	IV		✓	
75	Passeriformes	Artamidae	Ashy woodswallow	*Artamus fuscus*	LC	R	-			✓
76	Passeriformes	Campephagidae	Scarlet Minivet	*Pericrocotus flammeus*	LC	WV	IV		✓	
77	Passeriformes	Cisticolidae	Common tailorbird	*Orthotomus sutorius*	LC	R	-	✓	✓	✓

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
78	Passeriformes	Cisticolidae	Dark-necked Tailorbird	*Orthotomus atrogularis*	LC	R	-			✓
79	Passeriformes	Cisticolidae	Yellow-bellied Prinia	*Prinia flaviventris*	LC	R	-		✓	
80	Passeriformes	Corvidae	Eastern Jungle crow	*Corvus macrorhynchos*	LC	R	-	✓	✓	✓
81	Passeriformes	Corvidae	House Crow	*Corvus splendens*	LC	R	V	✓		
82	Passeriformes	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	LC	R	-	✓	✓	✓
83	Passeriformes	Dicruridae	Ashy drongo	*Dicrurus leucophaeus*	LC	R	IV	✓	✓	
84	Passeriformes	Dicruridae	Black Drongo	*Dicrurus macrocercus*	LC	R	IV		✓	✓
85	Passeriformes	Dicruridae	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	LC	R	IV		✓	
86	Passeriformes	Dicruridae	Hair-crested Drongo	*Dicrurus hottentottus*	LC	R	IV	✓	✓	✓
87	Passeriformes	Dicruridae	Lesser Racquet-tailed Drongo	*Dicrurus remifer*	LC	R	IV		✓	
88	Passeriformes	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	LC	R	IV	✓		
89	Passeriformes	Hirundinidae	Asian House Martin	*Delichon dasypus*	LC	R	-	✓		
90	Passeriformes	Hirundinidae	Barn Swallow	*Hirundo rustica*	LC	WV	-	✓	✓	
91	Passeriformes	Hirundinidae	Collared Sand Martin	*Riparia riparia*	LC	WV	-		✓	✓
92	Passeriformes	Hirundinidae	Plain Martin	*Riparia chinensis*	LC	R	-	✓	✓	
93	Passeriformes	Hirundinidae	Wire-tailed swallow	*Hirundo smithii*	LC	R	-			✓
94	Passerifor	Laniidae	Brown Shrike	*Lanius cristatus*	LC	WV	-		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
	mes									
95	Passeriformes	Laniidae	Long-tailed Shrike	*Lanius schach*	LC	WV	-		✓	✓
96	Passeriformes	Leiotrichidae	Common Babbler	*Argya caudata*	LC	R	IV			✓
97	Passeriformes	Locustellidae	Striated Grassbird	*Megalurus palustris*	LC	R	-			✓
98	Passeriformes	Monarchidae	Black-naped Monarch	*Hypothymis azurea*	LC	R	-		✓	
99	Passeriformes	Motacillidae	Citrine Wagtail	*Motacilla citreola*	LC	WV	-		✓	✓
100	Passeriformes	Motacillidae	Grey Wagtail	*Motacilla cinerea*	LC	WV	-		✓	
101	Passeriformes	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	LC	R	IV	✓	✓	✓
102	Passeriformes	Motacillidae	Richard's Pipit	*Anthus richardi*	LC	WV	IV		✓	
103	Passeriformes	Motacillidae	Rosy Pipit	*Anthus roseatus*	LC	WV	IV		✓	
104	Passeriformes	Motacillidae	White Wagtail	*Motacilla alba*	LC	WV	-		✓	
105	Passeriformes	Motacillidae	Yellow Wagtail	*Motacilla flava*	LC	WV	-		✓	
106	Passeriformes	Muscicapidae	Bluethroat	*Cyanecula svecica*	LC	WV	-		✓	
107	Passeriformes	Muscicapidae	Common Stonechat	*Saxicola torquatus*	LC	WV	-		✓	
108	Passeriformes	Muscicapidae	Indian robin	*Saxicoloides fulicatus*	LC	R	IV			✓
109	Passeriformes	Muscicapidae	Large Niltava	*Niltava grandis*	LC	WV	-		✓	
110	Passeriformes	Muscicapidae	Lesser Shortwing	*Brachypteryx leucophris*	LC	WV	-		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
111	Passeriformes	Muscicapidae	Oriental Magpie Robin	*Copsychus saularis*	LC	R	-	✓	✓	✓
112	Passeriformes	Muscicapidae	Red-throated Flycatcher	*Ficedula albicilla*	LC	R	IV			✓
113	Passeriformes	Muscicapidae	Rusty-bellied Shortwing	*Brachypteryx hyperythra*	NT	WV	-		✓	
114	Passeriformes	Muscicapidae	Small Niltava	*Niltava macgrigoriae*	LC	WV	-		✓	
115	Passeriformes	Muscicapidae	Verditer Flycatcher	*Eumyias thalassinus*	LC	WV	IV		✓	
116	Passeriformes	Muscicapidae	White-rumped Shama	*Kittacincla malabarica*	LC	R	-		✓	✓
117	Passeriformes	Nectariniidae	Crimson Sunbird	*Aethopyga siparaja*	LC	R	IV		✓	✓
118	Passeriformes	Nectariniidae	Little Spiderhunter	*Arachnothera longirostra*	LC	R	-		✓	
119	Passeriformes	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	LC	R	IV			✓
120	Passeriformes	Oriolidae	Black-hooded Oriole	*Oriolus xanthornus*	LC	R	IV	✓	✓	✓
121	Passeriformes	Oriolidae	Maroon Oriole	*Oriolus traillii*	LC	R	IV			✓
122	Passeriformes	Paridae	Great Tit	*Parus major*	LC	R	IV	✓	✓	✓
123	Passeriformes	Passeridae	Eurasian Tree Sparrow	*Passer montanus*	LC	R	-	✓	✓	✓
124	Passeriformes	Phylloscopidae	Blyth's Leaf-warbler	*Phylloscopus reguloides*	LC	WV	-		✓	
125	Passeriformes	Phylloscopidae	Greenish Warbler	*Phylloscopus trochiloides*	LC	WV	-			✓
126	Passeriformes	Phylloscopidae	Grey-hooded warbler	*Phylloscopus xanthoschistos*	LC	R	-			✓
127	Passerifor	Phylloscopi	Smoky Warbler	*Phylloscopus*	LC	WV	IV		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
	mes	dae		*fuligiventer*						
128	Passeriformes	Phylloscopidae	Tickell's Leaf-warbler	*Phylloscopus affinis*	LC	WV	-		✓	
129	Passeriformes	Phylloscopidae	Whistler's Warbler	*Phylloscopus whistleri*	LC	WV	-		✓	
130	Passeriformes	Ploceidae	Baya weaver	*Ploceus philippinus*	LC	R	IV	✓		✓
131	Passeriformes	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	LC	R	IV	✓	✓	✓
132	Passeriformes	Pycnonotidae	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC	R	IV		✓	✓
133	Passeriformes	Pycnonotidae	White-throated Bulbul	*Alophoixus flaveolus*	LC	R	IV	✓	✓	✓
134	Passeriformes	Rhipiduridae	White-throated Fantail	*Rhipidura albicollis*	LC	R	-			✓
135	Passeriformes	Scotocercidae	Brownish-flanked Bush-warbler	*Horornis fortipes*	LC	WV	-		✓	
136	Passeriformes	Scotocercidae	Grey-bellied Tesia	*Tesia cyaniventer*	LC	WV	-		✓	
137	Passeriformes	Stenostiridae	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	LC	WV	IV		✓	
138	Passeriformes	Sturnidae	Indian Pied Starling	*Gracupica contra*	LC	R	IV	✓	✓	✓
139	Passeriformes	Sturnidae	Brahminy Starling	*Sturnia pagodarum*	LC	R	IV		✓	✓
140	Passeriformes	Sturnidae	Chestnut tailed Starling	*Sturnia malabarica*	LC	R	IV	✓	✓	✓
141	Passeriformes	Sturnidae	Common Hill Myna	*Gracula religiosa*	LC	R	IV	✓		✓
142	Passeriformes	Sturnidae	Common Myna	*Acridotheres tristis*	LC	R	IV	✓	✓	✓
143	Passeriformes	Sturnidae	Great Myna	*Acridotheres grandis*	LC	R	IV		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
144	Passeriformes	Sturnidae	Jungle Myna	*Acridotheres fuscus*	LC	R	IV	✓	✓	✓
145	Pelecaniformes	Ardeidae	Black Bittern	*Ixobrychus flavicollis*	LC	R	IV	✓		
146	Pelecaniformes	Ardeidae	Cattle Egret	*Bubulcus ibis*	LC	R	IV	✓	✓	✓
147	Pelecaniformes	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC	R	IV	✓		
148	Pelecaniformes	Ardeidae	Great White Egret	*Ardea alba*	LC	R	IV		✓	
149	Pelecaniformes	Ardeidae	Indian Pond-heron	*Ardeola grayii*	LC	R	-	✓	✓	✓
150	Pelecaniformes	Ardeidae	Intermediate Egret	*Ardea intermedia*	LC	R	IV	✓	✓	✓
151	Pelecaniformes	Ardeidae	Little Egret	*Egretta garzetta*	LC	R	IV	✓	✓	✓
152	Pelecaniformes	Ardeidae	Little Heron	*Butorides striata*	LC	R	-	✓		✓
153	Pelecaniformes	Ardeidae	Purple heron	*Ardea purpurea*	LC	R	-	✓		✓
154	Pelecaniformes	Ardeidae	Yellow Bittern	*Ixobrychus sinensis*	LC	R	IV	✓		✓
155	Pelecaniformes	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	LC	R	IV		✓	
156	Piciformes	Megalaimidae	Lineated Barbet	*Psilopogon lineatus*	LC	R	IV	✓	✓	✓
157	Piciformes	Megalaimidae	Blue-throated Barbet	*Psilopogon asiaticus*	LC	R	IV	✓	✓	✓
158	Piciformes	Picidae	Eurasian Wryneck	*Jynx torquilla*	LC	WV	IV			✓
159	Piciformes	Picidae	Greater Flameback	*Chrysocolaptes guttacristatus*	LC	R	IV			✓
160	Piciformes	Picidae	Grey-headed Woodpecker	*Picus canus*	LC	R	IV		✓	

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status	Migration status	WPA Schedule	Presence in Season 1	Presence in Season 2	Presence in Season 3
161	Podicipediformes	Podicipedidae	Great Crested Grebe	*Podiceps cristatus*	LC	WV	IV		✓	
162	Podicipediformes	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	LC	R	IV		✓	✓
163	Psittaciformes	Psittacidae	Blossom Headed Parakeet	*Himalayapsitta roseata*	NT	R	IV			✓
164	Psittaciformes	Psittacidae	Red-breasted Parakeet	*Psittacula alexandri*	NT	R	IV	✓		✓
165	Psittaciformes	Psittacidae	Rose-ringed parakeet	*Alexandrinus krameri*	LC	R	IV	✓	✓	✓
166	Strigiformes	Strigidae	Asian Barred Owlet	*Glaucidium cuculoides*	LC	R	IV	✓	✓	✓
167	Strigiformes	Strigidae	Brown Boobook	*Ninox scutulata*	LC	R	IV		✓	
168	Suliformes	Anhingidae	Oriental Darter	*Anhinga melanogaster*	NT	R	IV		✓	✓
169	Suliformes	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	LC	WV	IV		✓	
170	Suliformes	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R	IV		✓	✓
171	Suliformes	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LC	R	IV	✓	✓	✓

Inventory of butterflies observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Table 28 : Inventory of butterflies observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
1	Angled Red Forester	*Lethe chandica*	Nymphalidae	-	-		✓	
2	Assam Chain Swordtail	*Graphium aristeus*	Papilionidae	-	II			✓
3	Bamboo Treebrown	*Lethe europa*	Nymphalidae	-	-	✓	✓	
4	Banded Treebrown	*Lethe confusa*	Nymphalidae	-	-			✓
5	Bispot Banded Ace	*Halpe porus*	Hesperiidae	-	-	✓		
6	Blackvein Sergeant	*Athyma ranga*	Nymphalidae	-	II	✓	✓	✓
7	Blue Admiral	*Kaniska canace*	Nymphalidae	-	-			✓
8	Blue Baron	*Euthalia telchinia*	Nymphalidae	-	I			✓
9	Blue Imperial	*Ticherra acte*	Lycaenidae	-	-			✓
10	Blue King Crow	*Euploea klugii*	Nymphalidae	-	IV			✓
11	Blue Tiger	*Tirumala limniace*	Nymphalidae	-	-	✓	✓	✓
12	Blue-spotted Crow	*Euploea midamus*	Nymphalidae	-	II			✓
13	Chinese Bushbrown	*Mycalesis gotama*	Nymphalidae	-	II		✓	
14	Chocolate Albatross	*Appias lyncida*	Pieridae	-	II	✓	✓	✓
15	Chocolate Demon	*Ancistroides nigrita*	Hesperiidae	-	-		✓	✓
16	Chocolate Pansy	*Junonia iphita*	Nymphalidae	-	-	✓	✓	✓
17	Chocolate Tiger	*Parantica melaneus*	Nymphalidae	-	-		✓	✓
18	Clear Sailer	*Neptis nata*	Nymphalidae	-	II		✓	✓
19	Colour Sergeant	*Athyma inara*	Nymphalidae	-	-	✓		✓
20	Commander	*Moduza procris*	Nymphalidae	-	-		✓	✓
21	Common Acacia Blue	*Surendra quercetorum*	Lycaenidae	-	-			✓
22	Common Albatross	*Appias albina*	Pieridae	-	II			✓
23	Common Awlking	*Choaspes benjaminii*	Hesperiidae	-	-			✓
24	Common Batwing	*Atrophaneura varuna*	Papilionidae	LC	-	✓	✓	

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
25	Common Birdwing	*Troides helena*	Papilionidae	-	-			✓
26	Common Bluebottle	*Graphium sarpedon*	Papilionidae	-	-	✓		✓
27	Common Castor	*Ariadne merione*	Nymphalidae	-	-	✓	✓	✓
28	Common Cerulean	*Jamides celeno*	Lycaenidae	-	-			✓
29	Common Ciliate Blue	*Anthene emolus*	Lycaenidae	-	-			✓
30	Common Crow	*Euploea core*	Nymphalidae	-	-	✓		✓
31	Common Duffer	*Discophora sondaica*	Nymphalidae	-	I	✓		✓
32	Common Evening Brown	*Melanitis leda*	Nymphalidae	-	-		✓	✓
33	Common Five-ring	*Ypthima baldus*	Nymphalidae	-	-		✓	✓
34	Common Forester	*Lethe isana*	Nymphalidae	-	-		✓	
35	Common Four-ring	*Ypthima huebneri*	Nymphalidae	-	-	✓	✓	✓
36	Common Gem	*Poritia hewitsoni*	Lycaenidae	-	II		✓	
37	Common Grass Yellow	*Eurema hecabe*	Pieridae	-	-	✓	✓	✓
38	Common Gull	*Cepora nerissa*	Pieridae	-	II	✓	✓	
39	Common Jay	*Graphium doson*	Papilionidae	-	-	✓		
40	Common Jester	*Symbrenthia lilaea*	Nymphalidae	-	-		✓	✓
41	Common Lascar	*Pantoporia hordonia*	Nymphalidae	-	-	✓	✓	✓
42	Common Leopard	*Phalanta phalantha*	Nymphalidae	LC	-		✓	✓
43	Common Mormon	*Papilio polytes*	Papilionidae	-	-	✓	✓	✓
44	Common Palmfly	*Elymnias hypermnestra*	Nymphalidae	-	-	✓	✓	✓
45	Common Peacock	*Papilio bianor*	Papilionidae	-	-	✓		
46	Common Pierrot	*Castalius rosimon*	Lycaenidae	-	I	✓		
47	Common Rose	*Pachliopta aristolochiae*	Papilionidae	LC	-	✓	✓	✓
48	Common Sailer	*Neptis hylas*	Nymphalidae	-	-		✓	✓
49	Common Sergeant	*Athyma perius*	Nymphalidae	-	-	✓	✓	
50	Common Snow flat	*Tagiades japetus*	Hesperiidae	-	-	✓		
51	Common Tit	*Hypolycaena erylus*	Lycaenidae	-	-		✓	
52	Common Yeoman	*Cirrochroa tyche*	Nymphalidae	-	-	✓	✓	✓

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
53	Constable	*Dichorragia nesimachus*	Nymphalidae	-	-	✓		✓
54	Danaid Eggfly	*Hypolimnas misippus*	Nymphalidae	LC	I	✓	✓	✓
55	Dark Blue Tiger	*Tirumala septentrionis*	Nymphalidae	-	-			✓
56	Dark Evening Brown	*Melanitis phedima*	Nymphalidae	-	-		✓	
57	Dark Palm-Dart	*Telicota bambusae*	Hesperiidae	-	-		✓	
58	Dark Velvet Bob	*Koruthaialos butleri*	Hesperiidae	-	-		✓	
59	Dark-branded Bushbrown	*Mycalesis mineus*	Nymphalidae	-	-	✓	✓	✓
60	Double-branded Blue Crow	*Euploea sylvester*	Nymphalidae	-	-			✓
61	Double-branded Bushbrown	*Mycalesis adamsonii*	Nymphalidae	-	II		✓	
62	Eastern Striped Albatross	*Appias olferna*	Pieridae	-	II	✓	✓	✓
63	Elbowed Pierrot	*Caleta elna*	Lycaenidae	-	-	✓	✓	
64	Extra Lascar	*Pantoporia sandaka*	Nymphalidae	-	-		✓	
65	Five-bar Swordtail	*Graphium antiphates*	Papilionidae	-	-			✓
66	Fluffy Tit	*Zeltus amasa*	Lycaenidae	-	-	✓	✓	✓
67	Fulvous Pied Flat	*Pseudocoladenia dan*	Hesperiidae	-	-			✓
68	Glassy Tiger	*Parantica aglea*	Nymphalidae	-	-	✓	✓	✓
69	Great Eggfly	*Hypolimnas bolina*	Nymphalidae	-	-	✓		
70	Great evening brown	*Melanitis zitenius*	Nymphalidae	-	II	✓		
71	Great Mormon	*Papilio memnon*	Papilionidae	-	-	✓		✓
72	Great Orange-tip	*Hebomoia glaucippe*	Pieridae	-	-	✓	✓	
73	Great Swift	*Pelopidas assamensis*	Hesperiidae	-	IV			✓
74	Great Windmill	*Byasa dasarada*	Papilionidae	LC	-			✓
75	Green Flash	*Artipe eryx*	Lycaenidae	LC	II			✓
76	Grey Count	*Tanaecia lepidea*	Nymphalidae	-	II	✓	✓	✓
77	Grey Pansy	*Junonia atlites*	Nymphalidae	-	-	✓	✓	✓
78	Indian Ace	*Halpe homolea aucma*	Hesperiidae	-	-	✓		
79	Indian Cabbage White	*Pieris canidia*	Pieridae	-	-	✓		✓
80	Indian Nawab	*Charaxes bharata*	Nymphalidae	-	-	✓		✓

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
81	Indian Purple Emperor	*Mimathyma ambica*	Nymphalidae	-	-			✓
82	Indian Wanderer	*Pareronia hippia*	Pieridae	-	-	✓	✓	
83	Knight	*Lebadea martha*	Nymphalidae	-	-	✓		✓
84	Large Cabbage White	*Pieris brassicae*	Pieridae	-	-			✓
85	Large Four-Lineblue	*Nacaduba pactolus*	Lycaenidae	-	-		✓	
86	Large Yeoman	*Cirrochroa aoris*	Nymphalidae	-	-		✓	✓
87	Lemon Emigrant	*Catopsilia pomona*	Pieridae	-	-	✓	✓	✓
88	Leopard Lacewing	*Cethosia cyane*	Nymphalidae	-	-	✓		
89	Lesser Batwing	*Atrophaneura aidoneus*	Papilionidae	LC	-		✓	
90	Lesser Grass Blue	*Zizina otis*	Lycaenidae	-	-	✓	✓	
91	Lesser Gull	*Cepora nadina*	Pieridae	-	II		✓	
92	Light Straw Ace	*Pithauria stramineipennis*	Hesperiidae	-	-	✓		
93	Lime Swallowtail	*Papilio demoleus*	Papilionidae	NA	-	✓		✓
94	Long-branded Blue Crow	*Euploea algea*	Nymphalidae	-	-	✓		✓
95	Long-branded Bushbrown	*Mycalesis visala*	Nymphalidae	-	-	✓	✓	✓
96	Magpie Crow	*Euploea radamanthus*	Nymphalidae	-	IV			✓
97	Malayan	*Megisba malaya*	Lycaenidae	-	II			✓
98	Map Butterfly	*Cyrestis thyodamas*	Nymphalidae	-	-		✓	✓
99	Metallic Cerulean	*Jamides alecto*	Lycaenidae	-	II	✓		
100	Opaque Six-Lineblue	*Nacaduba beroe*	Lycaenidae	-	-		✓	
101	Orchid Tit	*Hypolycaena othona*	Lycaenidae	-	I	✓		
102	Pale Four-Lineblue	*Nacaduba hermus*	Lycaenidae	-	II		✓	
103	Pale Green Awlet	*Burara gomata*	Hesperiidae	-	-		✓	✓
104	Pale Wanderer	*Pareronia avatar*	Pieridae	-	II		✓	
105	Paris Peacock	*Papilio paris*	Papilionidae	-	-			✓
106	Parnara Swift spp	*Parnara spp.*	Hesperiidae	-	-		✓	
107	Peacock Pansy	*Junonia almana*	Nymphalidae	LC	-	✓	✓	✓
108	Pioneer	*Belenois aurota*	Papilionidae	-	-	✓		✓

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
109	Plain Hedge Blue	*Celastrina lavendularis*	Lycaenidae	-	-			✓
110	Plain Tiger	*Danaus chrysippus*	Nymphalidae	LC	-	✓	✓	✓
111	Psyche	*Leptosia nina*	Pieridae	-	-	✓	✓	✓
112	Punchinello	*Zemeros flegyas*	Riodinidae	-	-	✓	✓	✓
113	Purple Sapphire	*Heliophorus epicles*	Lycaenidae	-	-	✓	✓	✓
114	Red Helen	*Papilio helenus*	Papilionidae	-	-	✓	✓	✓
115	Red Lacewing	*Cethosia biblis*	Nymphalidae	-	-		✓	✓
116	Red-base Jezebel	*Delias pasithoe*	Pieridae	-	-		✓	
117	Rustic	*Cupha erymanthis*	Nymphalidae	-	-	✓	✓	
118	Saronis Sunbeam	*Curetis saronis*	Lycaenidae	-	-		✓	✓
119	Small Branded Swift	*Pelopidas mathias*	Hesperiidae	LC	-		✓	
120	Small Green Awlet	*Burara amara*	Hesperiidae	-	-	✓		
121	Small Paint-brush Swift	*Baoris chapmani*	Hesperiidae	-	-			✓
122	Smaller Dartlet	*Oriens goloides*	Hesperiidae	-	-	✓	✓	
123	Spangle	*Papilio protenor*	Papilionidae	-	-			✓
124	Spotted Demon	*Notocrypta feisthamelii*	Hesperiidae	-	-			✓
125	Straight Swift	*Parnara guttatus*	Hesperiidae	-	-	✓	✓	✓
126	Striped Blue Crow	*Euploea mulciber*	Nymphalidae	-	IV			✓
127	Striped Tiger	*Danaus genutia*	Nymphalidae	-	-	✓	✓	✓
128	Suffused Snow flat	*Tagiades gana*	Hesperiidae	-	-	✓		
129	Sylhet Oakblue	*Arhopala silhetensis*	Lycaenidae	-	II		✓	
130	Tailless Lineblue	*Prosotas dubiosa*	Lycaenidae	-	-	✓		
131	Tamil Oakblue	*Arhopala bazaloides*	Lycaenidae	LC	II		✓	✓
132	Tawny Coster	*Acraea terpsicore*	Nymphalidae	-	-		✓	✓
133	Tawny Rajah	*Charaxes bernardus*	Nymphalidae	-	II		✓	
134	Three-spot Grass Yellow	*Eurema blanda*	Pieridae	-	-	✓		✓
135	Tiger Hopper	*Ampittia subvittatus*	Hesperiidae	-	-			✓
136	Tiger Palmfly	*Elymnias nesaea*	Nymphalidae	-	-			✓

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
137	Tree Yellow	*Gandaca harina*	Pieridae	-	-			✓
138	Tropical Fritillary	*Argynnis hyperbius*	Nymphalidae	-	-			✓
139	Veined Pierrot	Tarucus venosus	Lycaenidae	-	-	✓		
140	Wax Dart	*Cupitha purreea*	Hesperiidae	-	-		✓	
141	Wizard	*Rhinopalpa polynice*	Nymphalidae	-	II		✓	
142	Yamfly	*Loxura atymnus*	Lycaenidae	-	-	✓	✓	
143	Yellow-crested Spangle	*Papilio elephenor*	Papilionidae	-	II		✓	

Inventory of Mammals observed in study area- Season 1 (Monsoon) & Season 2 (Winter)

Table 29 : Inventory of Mammals observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Common Name	Scientific Name	Family	IUCN	WPA Schedule	Season 1	Season 2	Season 3
1	Western Hoolock Gibbon	*Hoolock hoolock*	Hylobatidae	EN	I	✓	✓	✓
2	Rhesus Macaque	*Macaca mulatta*	Cercopithecidae	LC	II	✓	✓	✓
3	Hoary-bellied Squirrel	*Callosciurus pygerythrus*	Sciuridae	LC	-	✓	✓	✓
4	Indian Flying Fox	*Pteropus giganteus*	Pteropodidae	LC	V	✓	✓	
5	Assamese Macaque	*Macaca assamensis*	Cercopithecidae	NT	II		✓	
6	Northern Pig-tailed Macaque	*Macaca leonina*	Cercopithecidae	VU	II		✓	
7	Golden Jackal	*Canis aureus*	Canidae	LC	II		✓	
8	Mongoose Sp.	-	Herpestidae	-	-		✓	
9	Asian Elephant	*Elephas maximus*	Elephantidae	EN	I		✓	✓
10	Ganges River Dolphin	*Platanista gangetica gangetica*	Platanistidae	EN	I		✓	✓

Inventory of Herpetofauna observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Table 30 : Inventory of Herpetofauna observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule	Season 1	Season 2	Season 3
1	Oriental garden lizard	*Calotes versicolor*	Agamidae	-	-	✓		✓
2	Skittering frog	*Euphlyctis cyanophlyctis*	Dicroglossidae	LC	-	✓		
3	Gecko Sp.	-	-	-	-	✓		
4	Skink Sp.	-	-	-	-	✓		
5	Checkered Keelback	*Fowlea piscator*	Colubridae	LC	II		✓	✓
6	Keeled Indian Mabuya	*Eutropis carinata*	Scincidae	LC	-		✓	
7	Cope's Assam Frog	*Hydrophylax leptoglossa*	Ranidae	LC				✓
8	Wart Frog	*Minervarya sp.*	Dicroglossidae	-	-			✓
9	Narrow-mouthed Frog	*Microhyla sp.*	Microhylidae	-	-			✓
10	Bhamo Frog	*Humerana humeralis*	Ranidae	LC				✓
11	-	*Fejervarya sp.*	Dicroglossidae	-	-			✓
12	Snake sp.	-	-	-	-			✓
13	Assam roofed turtle	*Pangshura sylhetensis*	Geoemydidae	CR	-			✓
14	Roux's Forest Lizard	*Monilesaurus rouxii*	Agamidae	LC	-			✓

Inventory of Fishes observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Table 31 : Inventory of Fishes observed in study area- Season 1 (Monsoon), Season 2 (Winter) & Season 3 (Summer)

Sr. No.	Common Name	Scientific name	Family	IUCN Status	WPA	Season 1	Season 2	Season 3
1	Elongate glassy perchlet	*Chanda nama*	Ambassidae	LC	-	✓	✓	✓
2	Spotted Snakehead	*Channa punctata*	Channidae	LC	-	✓	✓	✓
3	Snakehead Murrel	*Channa striata*	Channidae	LC	-	✓	✓	✓
4	Wagur	*Clarias magur*	Clariidae	LC	-	✓	✓	✓
5	Grass carp	*Ctenopharyngodon idella*	Cyprinidae	-	-	✓	✓	✓
6	Gangetic leaffish	*Nandus nandus*	Nandidae	LC	-	✓	✓	✓
7	Catla	*Gibelion catla*	Cyprinidae	LC	-	✓	✓	✓
8	Indian River Shad	*Gudusia chapra*	Clupeidae	LC	-	✓	✓	✓
9	Singee	*Heteropneustes fossilis*	Heteropneustidae	LC	-	✓	✓	✓
10	Spiny Eel	*Mastacembelus armatus*	Mastacembelidae	LC	-	✓	✓	✓
11	Gangetic mudeel	*Monopterus cuchia*	Synbranchidae	LC	-	✓	✓	✓
12	-	*Mystus cavasius*	Bagridae	LC	-	✓	✓	✓
13	Spotfin Swamp Barb	*Puntius sophore*	Cyprinidae	LC	-	✓	✓	✓
14	Reba Carp	*Cirrhinus reba*	Cyprinidae	LC	-	✓	✓	✓
15	Dwarf gourami	*Trichogaster lalius*	Osphronemidae	LC	-	✓	✓	✓
16	-	*Wallago attu*	Siluridae	VU	-	✓	✓	✓
17	-	*Xenentodon cancila*	Belonidae	LC	-	✓	✓	✓
18	-	*Leiodon cutcutia*	Tetraodontidae	LC	-		✓	
19	Giant Murrel	*Channa marulius*	Channidae	LC	-		✓	✓

Inventory of Primary observations at Dibru - Saikhowa National Park – Flora

Table 32 : Primary observations at Dibru - Saikhowa National Park - Flora

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN Status	Invasive
Trees						
1	*Aesculus assamica*	East Himalayan Horse Chestnut	Raman bih	Sapindaceae	-	-
2	*Aesculus indica*	Indian Horse Chestnut	-	Sapindaceae	LC	-
3	*Ageratina adenophora*	Cat wood	-	Compositae	-	-
4	*Areca catechu*	Areca palm	Tamul	Arecaceae	-	-
5	*Artocarpus chama*	Chapalish	Cham kathal	Moraceae	-	-
6	*Artocarpus lakoocha*	Lakoocha	Bohot	Moraceae	-	-
7	*Bamboosa tulda*	Indian Timber Bamboo	Jati-banh	Poaceae	-	-
8	*Bischofia javanica*	Bishop Wood	Urium	Phyllanthaceae	LC	-
9	*Bombax ceiba*	Cotton tree	Simalu	Bombacaceae	LC	-
10	*Caryota urens*	Fish tail palm	Sowat gos	Arecaceae	LC	-
11	*Cinnamon tamala*	Indian Bay Leaf	Mahpat	Lauraceae	LC	-
12	*Cordia dichotoma*	Indian Cherry	Bahubara	Boraginaceae	LC	-
13	*Dillenia indica*	Elephant apple	Ou tenga	Dilleniaceae	LC	-
14	*Dimocarpus longan*	Dragon's eye	Asphol	Sapindaceae	NT	–
15	*Dipterocarpus retusus*	Rusty Leaf Garjan	-	Dipterocarpaceae	EN	-
16	*Duabanga grandiflora*	Duabanga	Thora	Lythraceae	–	–
17	*Dysoxylum gotadhora*	Cup-Calyx White Cedar	Bandor-dima	Meliaceae	-	-
18	*Ficus racemosa*	Cluster fig	-	Moraceae	LC	-
19	*Gmelina arborea*	White Teak	Gomari	Verbenaceae	LC	-
20	*Lagerstroemia speciosa*	Queen's crepe-myrtle	Azar	Lythraceae	-	-
21	*Magnolia grandiflora*	Southern Magnolia	-	Magnoliacea	LC	-
22	*Magnolia griffithii*	-	Bar-gahori-sopa	Magnoliacea	DD	-
23	*Magnolia hogsonii*	Hodgson magnolia	Borhomthuri	Magnoliacea	LC	-
24	*Mesua ferrea*	Ceylond ironwood	Nahor	Clusiacea	-	-

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN Status	Invasive
25	*Neolamarkia cadamba*	Burflower tree	Kadam	Rubiaceae	-	-
26	*Syzygium cumini*	Java Plum	-	Myrtaceae	-	-
27	*Terminalia myriocarpa*	East-Indian Almond	-	Combretaceae	-	-
28	*Ziziphus mauritiana*	Indian jujube	Bogori	Rhamnaceae	-	-
Shrubs						
1	*Urena lobata*	-	-	Malvaceae	-	-
2	*Calamus tenius*	Palm	Bet	Arecaceae	LC	-
3	*Chromolaena odorata*	Goatweed	-	Compositae	-	-
4	*Clerodendrum indicum*					
5	*Lantana camara*	West Indian lantana	-	Verbenaceae	-	Yes
6	*Melastoma malabarthricum*	Malabar melastoma	Phutkola	Melastomaceae	-	-
7	*Mezoneuron cucullatum*	Hooded-flowered brasiletto	-	Fabaceae	-	-
8	*Rubus buergeri*	-	-	Rosaceae	-	-
9	*Senna hirsuta*					
10	*Senna occidentalis*	Stinking weed	Bor medelua	Fabaceae	-	-
11	*Solanum viarum*	Tropical soda apple	Tit bhekuri	Solanaceae	LC	Yes
12	*Tamarix sp.*	-	-	Tamariaceae	-	-
Herbs						
1	*Acmella repens*	-	-	Compositae	-	-
2	*Ageratum conyzoides*	Goatweed	-	Compositae	LC	Yes
3	*Alpina nigra*	Black Galangal	-	Zingiberaceae	-	-
4	*Amaranthus spinosus*	Spiny amaranth	Hati khutura	Amaranthaceae	-	-
5	*Aponogeton natans*	Floating lace plant	-	Aponogetonaceae	LC	No
6	*Arundo donax*	Giant Reed	-	Poaceae	-	-
7	*Colocasia esculanta*	Taro	-	Araceae	-	-
8	*Commelina cyanea*	Scurvy weed	-	Commelinaceae	-	-

Sr. No.	Scientific Name	English Common Name	Assamese Name	Family	IUCN Status	Invasive
9	*Cynodon dectylon*	Bermuda grass	Doob	Poaceae	-	-
10	*Diplazium esculentum*	Vegetable fern	-	Athyriaceae	LC	-
11	*Eicchornia crassipes*	Water Hyacinth	Jal Kumbhi	Pontederiaceae	LC	-
12	*Eichhornia crassipes*	Common water hyacinth	Jal Kumbhi	Pontederiaceae	-	Yes
13	*Equisetum sp.*	Horse tail	-	Equisetaceae	-	-
14	*Mikania micrantha*	Climbing Hempweed	-	Compositae	-	-
15	*Mimosa pudica*	Touch me not	Lajuki lota	Fabaceae	-	-
16	*Piper betleoides*	-	-	Piperaceae	-	-
17	*Pontederia cordata*	Pickerel Weed	-	Pontederiaceae	-	-
18	*Potamogeton natans*	Broad leaved Pondweed	-	Potamogetonaceae	LC	No
19	*Saccharum spontaneum*	Kans grass	-	Poaceae	LC	-
20	*Sida acuta*	Common wireweed	Boriala	Malvaceae	-	-
21	*Sida rhombifolia*	Arrowleaf sida	Boriala	Malvaceae	-	-
22	*Smilax zeylanica*	Kumarika	-	Smilacaceae	-	-
23	*Solanum nigrum*	Black nightshade	Pichkati	Solanaceae	-	-
24	*Stenochlaena milnei*	-	-	Blechnaceae	-	-
25	*Stephania sp.*	–	–	Menispermaceae	–	–
26	*Urena lobata*	Pink Burr	-	Malvaceae	-	-

Inventory of Primary observations at Dibru - Saikhowa National Park – Birds

Table 33 : Primary observations at Dibru - Saikhowa National Park – Birds

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	Migration status	WPA Schedule
1	Asian Openbill	*Anastomus oscitans*	Ciconiidae	LC	R	IV
2	Asian Pied Starlings	*Gracupica contra*	Sturnidae	LC	R	IV
3	Bar-headed Goose	*Anser indicus*	Anatidae	LC	WV	IV
4	Barn Swallow	*Hirundo rustica*	Hirundinidae	LC	WV	-
5	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC	R	IV
6	Black Stork	*Ciconia nigra*	Ciconiidae	LC	WV	IV
7	Black-hooded Oriole	*Oriolus xanthornus*	Oriolidae	LC	R	IV
8	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	LC	R	IV
9	Blue-throated Barbet	*Psilopogon asiaticus*	Megalaimidae	LC	R	IV
10	Brown Shrike	*Lanius cristatus*	Laniidae	LC	WV	-
11	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC	R	IV
12	Chestnut headed bee-eater	*Merops leschenaulti*	Meropidae	LC	R	-
13	Citrine Wagtail	*Motacilla citreola*	Motacillidae	LC	WV	-
14	Common Babbler	*Argya caudata*	Leiotrichidae	LC	R	IV
15	Common Greenshank	*Tringa nebularia*	Scolopacidae	LC	WV	-
16	Common Kingfisher	*Alcedo atthis*	Alcedinidae	LC	R	IV
17	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC	WV	IV
18	Common Stonechat	*Saxicola torquatus*	Muscicapidae	LC	WV	-
19	Crested serpent eagle	*Spilornis cheela*	Accipitridae	LC	R	-
20	Crimson Sunbird	*Aethopyga siparaja*	Nectariniidae	LC	R	IV
21	Eastern Jungle crow	*Corvus macrorhynchos*	Corvidae	LC	R	-
22	Eastern Spot-billed Duck	*Anas zonorhyncha*	Anatidae	LC	WV	IV
23	Eastern Spotted Dove	*Anas zonorhyncha*	Anatidae	LC	WV	IV
24	Eurasian Collared-dove	*Streptopelia decaocto*	Columbidae	LC	R	IV

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	Migration status	WPA Schedule
25	Eurasian Tree Sparrow	*Passer montanus*	Passeridae	LC	R	-
26	Eurasian Wigeon	*Mareca penelope*	Anatidae	LC	WV	IV
27	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	LC	WV	IV
28	Great Coucal	*Centropus sinensis*	Cuculidae	LC	R	IV
29	Great Crested Grebe	*Podiceps cristatus*	Podicipedidae	LC	WV	IV
30	Great Myna	*Acridotheres grandis*	Sturnidae	LC	R	IV
31	Great Tit	*Parus major*	Paridae	LC	R	IV
32	Green-backed Heron	*Butorides striata*	Ardeidae	LC	R	IV
33	Green-billed Malkova	*Phaenicophaeus tristis*	Cuculidae	LC	R	-
34	Grey Wagtail	*Motacilla cinerea*	Motacillidae	LC	WV	-
35	Grey-headed Woodpecker	*Picus canus*	Picidae	LC	R	IV
36	Grey-hooded warbler	*Phylloscopus xanthoschistos*	Phylloscopidae	LC	R	-
37	Slender-billed Vulture	*Gyps tenuirostris*	Accipitridae	CR	R	I
38	Hair-crested Drongo	*Dicrurus hottentottus*	Dicruridae	LC	R	IV
39	Himalayan Griffon	*Gyps himalayensis*	Accipitridae	NT	WV	IV
40	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	LC	R	IV
41	Indian Cuckoo	*Cuculus micropterus*	Cuculidae	LC	R	IV
42	Indian Pond-heron	*Ardeola grayii*	Ardeidae	LC	R	-
43	Indian robin	*Saxicoloides fulicatus*	Muscicapidae	LC	R	IV
44	Indian Roller	*Coracias benghalensis*	Coraciidae	LC	R	IV
45	Indian Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	LC	R	IV
46	Intermediate Egret	*Ardea intermedia*	Ardeidae	LC	R	IV
47	Jungle Myna	*Acridotheres fuscus*	Sturnidae	LC	R	IV
48	Lesser Adjutant	*Leptoptilos javanicus*	Ciconiidae	VU	R	-
49	Lesser Fish-eagle	*Icthyophaga humilis*	Accipitridae	NT	R	I
50	Lesser Whistling-duck	*Dendrocygna javanica*	Anatidae	LC	R	IV
51	Lineated Barbet	*Dendrocygna javanica*	Anatidae	LC	R	IV
52	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	LC	R	IV

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	Migration status	WPA Schedule
53	Little Egret	*Egretta garzetta*	Ardeidae	LC	R	IV
54	Little Pratincole	*Glareola lactea*	Glareolidae	LC	R	IV
55	Little Ringed Plover	*Charadrius dubius*	Charadriidae	LC	R	IV
56	Mallard	*Anas platyrhynchos*	Anatidae	LC	R	IV
57	Oriental Darter	*Anhinga melanogaster*	Anhingidae	NT	R	IV
58	Oriental Pied Hornbill	*Anthracoceros albirostris*	Bucerotidae	LC	R	-
59	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	LC	R	IV
60	Red Junglefowl	*Gallus gallus*	Phasianidae	LC	R	IV
61	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	LC	R	IV
62	Red-whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	LC	R	IV
63	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	LC	WV	IV
64	Rufous Treepie	*Dendrocitta vagabunda*	Corvidae	LC	R	-
65	Callered Sand Martin	*Riparia riparia*	Hirundinidae	LC	WV	-
66	Red-throated Flycatcher	*Ficedula albicilla*	Muscicapidae	LC	R	IV
67	Tickell's Leaf-warbler	*Phylloscopus affinis*	Phylloscopidae	LC	WV	-
68	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC	R	IV
69	White-rumped Vulture	*Gyps bengalensis*	Accipitridae	CR	R	I
70	White-throated Bulbul	*Alophoixus flaveolus*	Pycnonotidae	LC	R	IV
71	Wire-tailed swallow	*Hirundo smithii*	Hirundinidae	LC	R	-
72	Yellow Wagtail	*Motacilla flava*	Motacillidae	LC	WV	-

Inventory of primary observations at Dibru - Saikhowa National Park - Fauna - Butterflies, mammals and herpetofauna

Table 34 : Primary observations at Dibru - Saikhowa National Park - Fauna - Butterflies, mammals and herpetofauna

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule
Butterflies					
1	Assam Chain Swordtail	*Graphium aristeus*	Papilionidae	-	II
2	Saronis Sunbeam	*Curetis saronis*	Lycaenidae	-	-
3	Blue Admiral	*Kaniska canace*	Nymphalidae	-	-
4	Blue Imperial	*Ticherra acte*	Lycaenidae	-	-
5	Blue King Crow	*Euploea klugii*	Nymphalidae	-	IV
6	Blue Tiger	*Tirumala limniace*	Nymphalidae	-	-
7	Blue-spotted Crow	*Euploea midamus*	Nymphalidae	-	II
8	Asian Cabbage White	*Pieris canidia*	Pieridae	-	-
9	Chocolate Albatross	*Appias lyncida*	Pieridae	-	II
10	Chocolate Demon	*Ancistroides nigrita*	Hesperiidae	-	-
11	Chocolate Tiger	*Parantica melaneus*	Nymphalidae	-	-
12	Clear Sailer	*Neptis nata*	Nymphalidae	-	II
13	Commander	*Moduza procris*	Nymphalidae	-	-
14	Common Birdwing	*Troides helena*	Papilionidae	LC	-
15	Common Bluebottle	*Graphium sarpedon*	Papilionidae	-	-
16	Common Castor	*Ariadne merione*	Nymphalidae	-	-
17	Common Cerulean	*Jamides celeno*	Lycaenidae	-	-
18	Common Ciliate Blue	*Anthene emolus*	Lycaenidae	-	-
19	Common Crow	*Euploea core*	Nymphalidae	LC	-
20	Common Five-ring	*Ypthima baldus*	Nymphalidae	-	-
21	Common Four-ring	*Ypthima baldus*	Nymphalidae	-	-

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule
22	Common Grass Yellow	*Eurema hecabe*	Pieridae	-	-
23	Common Jester	*Symbrenthia lilaea*	Nymphalidae	-	-
24	Common Leopard	*Phalanta phalantha*	Nymphalidae	LC	-
25	Common Mormon	*Papilio polytes*	Papilionidae	-	-
26	Indian Nawab	*Charaxes bharata*	Nymphalidae	-	-
27	Common Sailer	*Neptis hylas*	Nymphalidae	-	-
28	Common Yeoman	*Cirrochroa tyche*	Nymphalidae	-	-
29	Danaid Eggfly	*Hypolimnas misippus*	Nymphalidae	LC	I
30	Dark Evening Brown	*Melanitis phedima*	Nymphalidae	-	-
31	Dark-branded Bushbrown	*Mycalesis mineus*	Nymphalidae	-	-
32	Double-branded Blue Crow	*Euploea sylvester*	Nymphalidae	-	-
33	Eastern Striped Albatross	*Appias olferna*	Pieridae	-	II
34	Glassy Tiger	*Parantica aglea*	Nymphalidae	-	-
35	Great Mormon	*Papilio memnon*	Papilionidae	-	-
36	Grey Pansy	*Junonia atlites*	Nymphalidae	-	-
37	Indian Purple Emperor	*Mimathyma ambica*	Nymphalidae	-	-
38	Large Four-Lineblue	*Nacaduba pactolus*	Lycaenidae	-	-
39	Lemon Emigrant	*Catopsilia pomona*	Pieridae	-	-
40	Lesser Grass Blue	*Zizina otis*	Lycaenidae	-	-
41	Lime Swallowtail	*Papilio demoleus*	Papilionidae	-	-
42	Long-branded Blue Crow	*Euploea algea*	Nymphalidae	-	-
43	Long-branded Bushbrown	*Mycalesis visala*	Nymphalidae	-	-
44	Magpie Crow	*Euploea radamanthus*	Nymphalidae	-	IV
45	Malayan	*Megisba malaya*	Lycaenidae	-	II
46	Map Butterfly	*Cyrestis thyodamas*	Nymphalidae	-	-
47	Peacock Pansy	*Junonia almana*	Nymphalidae	LC	-
48	Pioneer	*Belenois aurota*	Pieridae	-	-
49	Plain Hedge Blue	*Celastrina lavendularis*	Lycaenidae	-	-

Sr.No.	Common Name	Scientific Name	Family	IUCN Status	WPA Schedule
50	Plain Tiger	*Danaus chrysippus*	Nymphalidae	LC	-
51	Punchinello	*Zemeros flegyas*	Riodinidae	-	-
52	Purple Sapphire	*Heliophorus epicles*	Lycaenidae	-	-
53	Red-base Jezebel	*Delias pasithoe*	Pieridae	-	-
54	Rustic	*Cupha erymanthis*	Nymphalidae	-	-
55	Spangle	*Papilio protenor*	Papilionidae	-	-
56	Striped Blue Crow	*Euploea mulciber*	Nymphalidae	-	IV
57	Striped Tiger	*Danaus genutia*	Nymphalidae	-	-
58	Tamil Oakblue	*Prosotas dubiosa*	Lycaenidae	-	-
59	Tawny Coster	*Arhopala bazaloides*	Lycaenidae	LC	II
60	Tiger Palmfly	*Elymnias nesaea*	Nymphalidae	-	-
61	Tree Yellow	*Gandaca harina*	Pieridae	-	-
62	Wizard	*Rhinopalpa polynice*	Nymphalidae	-	II
63	Yellow-crested Spangle	*Papilio elephenor*	Papilionidae	-	II
Mammals					
1	Asian Elephant	*Elephas maximus*	Elephantidae	EN	I
2	Ganges River Dolphin	*Platanista gangetica gangetica*	Platanistidae	EN	I
3	Golden Jackal	*Canis aureus*	Canidae	LC	II
4	Hoary-bellied Squirrel	*Callosciurus pygerythrus*	Sciuridae	LC	-
5	Rhesus Macaque	*Macaca mulatta*	Cercopithecidae	LC	II
Herpetofauna					
1	Checkered Keelback	*Fowlea piscator*	Colubridae	LC	II
2	Assam roofed turtle	*Pangshura sylhetensis*	Geoemydidae	CR	-
3	Roux's Forest Lizard	*Monilesaurus rouxii*	Agamidae	LC	-

Inventory of Fishes found in Maguri Motapung Beel through secondary findings

Table 35 : Fishes found in Maguri Motapung Beel through secondary findings

Sr. No.	Species	Order	Family	Assamese Name	IUCN Status
1	*Xenentodon cancila* (Ham.-Buch.)	Beloniformes	Belonidae	Kokila	LC
2	*Gudusia chapra* (Ham.-Buch.)	Clupeiformes	Clupeidae	Koroti	LC
3	*Gibelion catla* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Bhokua	LC
4	*Chagunius chagunio* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Keintah puthi	LC
5	*Cirrhinus reba* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Lachim	LC
6	*Labeo bata* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Bhangone	LC
7	*Labeo rohita* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Rou	LC
8	*Labeo gonius* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Kuri	LC
9	*Osteobrama cotio* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Hato	LC
10	*Puntius sophore* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Puthi	LC
11	*Puntius javanicus* (Bleeker)	Cypriniformes	Cyprinidae	Java puthi	NE
12	*Rasbora daniconius* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Darikona	LC
13	*Danio devario (Ham- Buch)*	Cypriniformes	Cyprinidae	Darikona	LC
14	*Davario assamensis* (Barman)	Cypriniformes	Cyprinidae	-	LC
15	*Amblypharyngodon mola (Ham-Buch)*	Cypriniformes	Cyprinidae	Moa	LC
16	*Systomus sarana* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Puthi	LC
17	*Cirrhinus mrigala* (Ham.-Buch.)	Cypriniformes	Cyprinidae	Mirika	LC
18	*Ctenopharyngodon idella* (Valenciennes)	Cypriniformes	Cyprinidae	Grass Carp	NE
19	*Hypopthalmichthys molitrix* (Valenciennes)	Cypriniformes	Cyprinidae	Silver carp	NE
20	*Cyprinus carpio* (Linnaeus)	Cypriniformes	Cyprinidae	Common carp	NE
21	*Hypopthalmichthys nobilis*	Cypriniformes	Cyprinidae	Big head carp	NE
22	*Lepidocephalichthys guntea (Ham- Buch)*	Cypriniformes	Cobitidae	Batia	LC
23	*Canthophyrs gongota* (Hamilton)	Cypriniformes	Cobitidae	Kukur batia	LC
24	*Chanda nama* (Ham.-Buch.)	Perciformes	Ambassidae	Chanda	LC

Sr. No.	Species	Order	Family	Assamese Name	IUCN Status
25	*Anabas testudineus* (Bloch)	Perciformes	Anabantidae	Kawoi	DD
26	*Channa orientalis* (Bloch & Schneider)	Perciformes	Channidae	Chengeli	LC
27	*Channa punctata* (Bloch)	Perciformes	Channidae	Goroi	LC
28	*Channa gachua* (Ham.-Buch.)	Perciformes	Channidae	Cheng	LC
29	*Channa striata* (Bloch)	Perciformes	Channidae	Sol	LC
30	*Channa marulius* (Hamilton)	Perciformes	Channidae	Sal	LC
31	*Glossogobius giuris* (Ham.-Buch.)	Perciformes	Gobiidae	Patimutura	LC
32	*Trichogaster fasciata* (Schneider)	Perciformes	Osphronemidae	Kholihona	LC
33	*Trichogaster lalius* (Ham.-Buch.)	Perciformes	Osphronemidae	Kholihona	LC
34	*Mystus cavasius* (Ham.-Buch.)	Siluriformes	Bagridae	Singora	LC
35	*Mystus tengara* (Ham.-Buch.)	Siluriformes	Bagridae	Singora	LC
36	*Mystus carcio* (Hamilton)	Siluriformes	Bagridae	Singora	LC
37	*Sperata seenghala* (Sykes)	Siluriformes	Bagridae	Ari	LC
38	*Clarias magur* (Linnaeus)	Siluriformes	Clariidae	Magur	EN
39	*Heteropneustes fossilis* (Bloch)	Siluriformes	Heteropneustidae	Singhi	LC
40	*Pachypterus atherinoides* (Bloch)	Siluriformes	Schilbeidae	Bordowa	LC
41	*Wallago attu* (Schneider)	Siluriformes	Siluridae	Barali	LC
42	*Hara hara* (Hamilton)	Siluriformes	Sisoridae	Hatihoka	LC
43	*Monopterus cuchia* (Ham.-Buch.)	Synbranchiformes	Synbranchidae	Kuchia	LC
44	*Mastacembelus armatus* (Lacepede)	Synbranchiformes	Mastacembelidae	Bami/Gosi	LC
45	*Macrognathus aral* (Bloch & Schneider)	Synbranchiformes	Mastacembelidae	Turi	LC
46	*Macrognathus pancalus* (Ham.-Buch.)	Synbranchiformes	Mastacembelidae	Turi	LC
47	*Notopterus notopterus* (Ham.-Buch.)	Osteoglossiformes	Notopteridae	Kandhuli	LC
48	*Chitala chitala* (Pallas)	Osteoglossiformes	Notopteridae	Chital	NT

Inventory of Molluscan species found in Maguri Motapung Beel and Dibru River through secondary findings

Table 36 : List of Molluscan species found in Maguri Motapung Beel and Dibru River through secondary findings

Sr. No.	Molluscan Species	Family	IUCN Status	Maguri Motapung Beel	Dibru River
1	*Angulyagra microchaetophora*	Viviparidae	LC	+	-
2	*Corbicula assamensis*	Cyrenidea	LC	+	+
3	*Corbicula striatella*	Cyrenidea	LC	+	+
4	*Filopaludina bengalensis*	Viviparidae	LC	+	+
5	*Filopaludina micron*	Viviparidae	-	+	-
6	*Gyraulus convexiusculus*	Planorbidae	LC	+	-
7	*Helicorbis cantori*	Planorbidae	LC	+	-
8	*Idiopoma dissimilis*	Viviparidae	LC	+	-
9	*Indonaia andersoniana*	Unionidae	LC	-	+
10	*Indonaia caerulea*	Unionidae	LC	-	+
11	*Indonaia lima*	Unionidae	-	+	+
12	*Indonaia occata*	Unionidae	LC	-	+
13	*Indonaia olivaria*	Unionidae	LC	-	-
14	*Indonaia pachysoma*	Unionidae	-	+	-
15	*Indonaia theobaldi*	Unionidae	-	-	+
16	*Indoplanorbis exustus*	Planorbidae	LC	+	-
17	*Lamellidens phenchooganjensis*	Unionidae	LC	+	+
18	*Lamellidens corrianus*	Unionidae	LC	+	+
19	*Lamellidens marginalis*	Unionidae	LC	+	+
20	*Mekongia crassa*	Viviparidae	LC	+	-
21	*Melanoides tuberculata*	Thiaridae	LC	+	-
22	*Mieniplotia scabra*	Thiaridae	LC	+	-
23	*Musculium indicum*	Sphaeriidae	LC	+	-
24	*Parreysia corbis*	Unionidae	DD	+	+

Sr. No.	Molluscan Species	Family	IUCN Status	Maguri Motapung Beel	Dibru River
25	*Parreysia favidens*	Unionidae	LC	-	+
26	*Parreysia sikkimensis*	Unionidae	LC	-	+
27	*Parreysia smaragdites*	Unionidae	LC	+	+
28	*Pila olea*	Ampullariidae	DD	+	-
29	*Pisidium sp.*	Sphaeriidae	LC	+	-
30	*Radix rufescens*	Lymnaeidae	-	+	+
31	*Sphaerium austeni*	Sphaeriidae	NT	+	-
32	*Tarebia granifera*	Thiaridae	LC	+	+
33	*Tarebia lineata*	Thiaridae	LC	+	+

List of species found in secondary findings

Table 37 : List of species found in secondary findings

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
1	Grey-headed Fish-eagle	*Icthyophaga ichthyaetus*	Bird	Accipitridae	NT	-
2	White-rumped Vulture	*Gyps bengalensis*	Bird	Accipitridae	CR	I
3	Slender-billed Vulture	*Gyps tenuirostris*	Bird	Accipitridae	CR	I
4	Red-headed Vulture	*Sarcogyps calvus*	Bird	Accipitridae	CR	IV
5	Cinereous Vulture	*Aegypius monachus*	Bird	Accipitridae	NT	IV
6	Pallid Harrier	*Circus macrourus*	Bird	Accipitridae	NT	IV
7	Greater Spotted Eagle	*Clang clanga*	Bird	Accipitridae	VU	IV
8	Yellow-breasted Bunting	*Emberiza aureola*	Bird	Emberizidae	CR	IV
9	Firethroat	*Calliope pectardens*	Bird	Muscicapidae	NT	IV
10	Slender-billed Babbler	*Argya longirostris*	Bird	Leiotrichidae	VU	-
11	Jerdon's Babbler	*Chrysomna altirostre*	Bird	Timaliidae	VU	IV
12	Red-breasted Goose	*Branta ruficollis*	Bird	Anatidae	VU	IV
13	Ferruginous Duck	*Aythya nyroca*	Bird	Anatidae	NT	IV
14	Lesser White-fronted Goose	*Anser erythropus*	Bird	Anatidae	VU	IV
15	White-winged Duck	*Asarcornis scutulata*	Bird	Anatidae	EN	IV
16	Falcated Duck	*Mareca falcata*	Bird	Anatidae	NT	IV
17	Oriental Darter	*Anhinga melanogaster*	Bird	Anhingidae	NT	IV
18	White-bellied Heron	*Ardea insignis*	Bird	Ardeidae	CR	I
19	Great Hornbill	*Buceros bicornis*	Bird	Bucerotidae	NT	I
20	Spotted Greenshank	*Tringa guttifer*	Bird	Scolopalidae	EN	
21	Eurasian Curlew	*Numenius arguata*	Bird	Scolopalidae	NT	IV
22	Black-necked Stork	*Ephippiorhychus asiaticus*	Bird	ciconiidae	NT	IV
23	Painted stork	*Mycteria leucocephala*	Bird	ciconiidae	NT	IV
24	Lesser Adjutant	*Leptoptilos javanicus*	Bird	ciconiidae	VU	IV
25	Greater Adjutant	*Leptoptilos dubius*	Bird	ciconiidae	EN	IV

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
26	Swamp Francolin	*Francolinus gularis*	Bird	Prasianidae	VU	IV
27	Mole Shrew	*Anourosorex squamipes*	Mammal	Soricidae	LC	-
28	Indian Flying Fox	*Pteropus giganteus*	Mammal	Pteropodidae	LC	-
29	Greater Slow Loris	*Nyticebus councaug*	Mammal	Lorisidae	EN	I
30	Southern Pig-tailed Macaque	*Macaca nemestrina*	Mammal	Cercopithecidae	VU	II
31	Rhesus Macaque	*Macaca mulatta*	Mammal	Cercopithecidae	LC	II
32	Assamese Macaque	*Macaca assamensis*	Mammal	Cercopithecidae	NT	II
33	Capped Langur	*Trachypithecus pileatus*	Mammal	Cercopithecidae	EN	I
34	Western Hoolock Gibbon	*Hoolock hoolock*	Mammal	Hylobaticade	EN	I
35	Chinese Pangolin	*Manis Pentadactyla*	Mammal	Manidae	CR	I
36	Golden Jackal	*Canis aureus*	Mammal	Canidae	LC	II
37	Dhole	*Coun alpinus*	Mammal	Canidae	EN	II
38	Sloth bear	*Melurus ursinus*	Mammal	Ursidae	VU	II
39	Jungle Cat	*Felis chaus*	Mammal	Felidae	LC	II
40	Leopard Cat	*Prionailurus bengalensis*	Mammal	Felidae	LC	I
41	Tiger	*Panthera tigris*	Mammal	Felidae	EN	I
42	Leopard	*Panthera pardus*	Mammal	Felidae	VU	I
43	Asian Elephant	*Elephas maximus*	Mammal	Elephantidae	EN	I
44	Wild Pig	*Sus scrofa*	Mammal	Suidae	LC	III
45	Southern Red Muntjac	*Muntiacus muntjak*	Mammal	Cervidae	LC	III
46	Hog Deer	*Axis porcinus*	Mammal	Cervidae	EN	III
47	Sambar	*Rusa unicolor*	Mammal	Cervidae	VU	III
48	Gaur	*Bos gaurus*	Mammal	Bovidae	VU	I
49	Wild Water Buffalo	*Bubalus arnee*	Mammal	Bovidae	EN	I
50	Indian Hare	*Lepus nigricollis*	Mammal	Leporidae	LC	IV
51	Red Giant Flying Squirrel	*Petaurista petaurista*	Mammal	Sciuridae	LC	II
52	Particoloured Flying Squirrel	*Hylopetes alboniger*	Mammal	Sciuridae	LC	-
53	Pallas's Squirrel	*Callosciurus erythraeus*	Mammal	Sciuridae	LC	-

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
54	Hoary-bellied Squirrel	*Callosciurus pygerythrus*	Mammal	Sciuridae	LC	-
55	Black Giant Squirrel	*Ratufa bicolor*	Mammal	Sciuridae	NT	II
56	Malayan Porcupine	*Hystrix brachyura*	Mammal	Hystricidae	LC	II
57	Gangetic Dolphin	*Platanista gangetica*	Mammal	Planistidae	EN	I
58	Feral Horse	*Equus caballus*	Mammal	Equidae	-	-
59	Gharial	*Gavialis gangeticus*	Reptile	Garialidae	CR	I
60	Southeast Asian Box Turtle	*Cuora amboinensis*	Reptile	Geoemydidae	EN	-
61	Asian Leaf Turtle	*Cyclemys dentata*	Reptile	Geoemydidae	NT	-
62	Spotted Pond Turtle	*Geoclemys hamiltonii*	Reptile	Geoemydidae	EN	I
63	Brown Roofed Turtle	*Pangshura smithii*	Reptile	Geoemydidae	NT	-
64	Assam Roofed Turtle	*Pangshura sylhetensis*	Reptile	Geoemydidae	CR	-
65	Indian Tent Turtle	*Pangshura tentoria*	Reptile	Geoemydidae	LC	-
66	Indian Softshell Turtle	*Nilssonia gangetica*	Reptile	Trionychidae	EN	I
67	Indian Peacock Softshell Turtle	*Nilssonia hurum*	Reptile	Trionychidae	EN	I
68	Indian Narrow-headed Softshell Turtle	*Chitra indica*	Reptile	Trionychidae	EN	-
69	Bengal Monitor Lizard	*Varanus bengalensis*	Reptile	Varanidae	NT	I
70	Common Water Monitor	*Varanus salvator*	Reptile	Varanidae	LC	I
71	Indian Rock Python	*Python molurus*	Reptile	Pythonidae	NT	I
72	Vine Snake	*Ahaetulla sp*	Reptile	Colubridae	-	IV
73	Rat snake	*Ptyas mucosa*	Reptile	Colubridae	LC	II
74	Banded Krait	*Bungarus fasciatus*	Reptile	Elapidae	LC	IV
75	King cobra	*Ophiophagus hannah*	Reptile	Elapidae	VU	II
76	Chocolate Demon	*Ancistroides nigrita(Latreille, 1824)*	Butterfly	Hesperiidae	-	
77	Pale Green Awlet	*Bibasis gomata(Moore, 1865)*	Butterfly	Hesperiidae	-	
78	Rice Swift	*Borbo cinnara(Walace, 1866)*	Butterfly	Hesperiidae	-	
79	Colon Swift	*Caltoris cahira (Moore, 1877)*	Butterfly	Hesperiidae	-	
80	Large Branded Swift	*Pelopidas sinensis(Mabille, 1877)*	Butterfly	Hesperiidae	-	
81	Chestnut Bob	*Lambrix salsala(Moore)*	Butterfly	Hesperiidae	-	

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
82	Straight Swift	*Pelopidas guttatus(Bremer & Grey, 1852)*	Butterfly	Hesperiidae	-	
83	Common Hedge Blue	*Acytolepis puspa*	Butterfly	Lycaenidae	-	I
84	Indian Red Flash	*Baspa melampus(Stoll, 1781)*	Butterfly	Lycaenidae	-	
85	Elbowed Perrot	*Pycnophal illumina (Hewitson 1876)*	Butterfly	Lycaenidae	-	
86	Common Perrot	*Castalius rosimon rosimon(Fabricius, 1775)*	Butterfly	Lycaenidae	LC	I
87	Lime Blue	*Chilades laius(Cramer, 1782)*	Butterfly	Lycaenidae	-	
88	Purple Sapphires	*Heliophorus epicles indicus(Godart, 1823)*	Butterfly	Lycaenidae	-	
89	Royal Cerulean	*Jamides celeno (Druce, 1873)*	Butterfly	Lycaenidae	-	I
90	Glistening Cerulean	*Lampides kankena (C. Felder 1862)*	Butterfly	Lycaenidae	LC	I
91	Pea blue	*Lampides boeticus (Linnaeus, 1767)*	Butterfly	Lycaenidae	-	
92	Yam fly	*Loxura atymnus (Cramer, 1782).*	Butterfly	Lycaenidae	-	
93	Common gem	*Poritia hewitsoni hewitsoni (Moore, 1865)*	Butterfly	Lycaenidae	-	I
94	Banded Line Blue	*Prosotas Aluta Coelestis*	Butterfly	Lycaenidae	-	
95	Dark Grass Blue	*Pseudozizeeria maha (Kollar, 1848)*	Butterfly	Lycaenidae	-	
96	Common Acacia Blue	*Surendra quercetorum (Moore, 1858)*	Butterfly	Lycaenidae	-	
97	Plumbago Blue	*Syntarucusplinius (Fabricius, 1793)*	Butterfly	Lycaenidae	-	
98	Blue Imperial	*Jalmenus evagoras*	Butterfly	Lycaenidae	-	
99	Copper Flash	*Rapala pheretima pet osiris (Hewitson, 1863)*	Butterfly	Lycaenidae	-	
100	Punchinello	*zemeros flegyas(Cramer, 1780)*	Butterfly	Lycaenidae	-	
101	Fluffy Tip	*Zeltus amasa (Hewitson, 1865)*	Butterfly	Lycaenidae	-	
102	Lesser Grass Blue	*Zizina otis (Fabricius, 1787)*	Butterfly	Lycaenidae	-	
103	Tiny Grass Blue	*Zizula hylax (Fabricius, 1775)*	Butterfly	Lycaenidae	-	
104	Common Caster	*Ariadne merioneassama(Cramer, 1779)*	Butterfly	Nymphalidae	-	
105	Unbroken Sergeant	*Athyma pravara (Moore, 1857)*	Butterfly	Nymphalidae	-	
106	Leopard lacewing	*Cethosia cyane(Drury, 1770)*	Butterfly	Nymphalidae	-	
107	Tawny Rajah	*Charaxes bernardus(Fabricius) 1793*	Butterfly	Nymphalidae	-	
108	Large Yeoman	*Cirrochora aoris(Doubleday, 1847)*	Butterfly	Nymphalidae	-	
109	Common Yeoman	*Cirrochroa tyche(Felder, 1861)*	Butterfly	Nymphalidae	-	

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
110	Common Map	*Cyrestis thyodamas*	Butterfly	Nymphalidae	-	
111	Common Tiger	*Danaus genutia(Cramer, 1779)*	Butterfly	Nymphalidae	-	
112	Plain Tiger	*Cyrestis thyodamas (Boisduval, 1836)*	Butterfly	Nymphalidae	-	
113	Autumn Leaf	*Doleschallia bisaltide(Cramer, 1779)*	Butterfly	Nymphalidae	-	
114	Common Palm fly	*Elymnias hypermnestra*	Butterfly	Nymphalidae	-	
115	Magpie Crow	*Euploea radamanthus(Fabricius, 1793)*	Butterfly	Nymphalidae	-	
116	Double Branded Crow	*Euploea sylvester(Fabricius, 1793)*	Butterfly	Nymphalidae	-	
117	Circe	*Hestina nama(Moore, 1858)*	Butterfly	Nymphalidae	-	
118	Great Egg fly	*Hypolimnas bolina(Linnaeus, 1758)*	Butterfly	Nymphalidae	-	
119	Orange Oak leaf	*Kallima inachus*	Butterfly	Nymphalidae	-	
120	Blue Admiral	*Kaniska canace(Boisduval, 1846)*	Butterfly	Nymphalidae	-	
121	Yellow Jack Sailor	*Lasippa viraja*	Butterfly	Nymphalidae	-	
122	Burmese Lascar	*Lasippa heliodore*	Butterfly	Nymphalidae	-	
123	Ark Duke	*Lexias pardalis (Moore, 1878)*	Butterfly	Nymphalidae	-	
124	Common Evening Brown	*Melanitisl eda ismene(Linnaeus, 1758)*	Butterfly	Nymphalidae	-	
125	Dark Evening Brown	*Melanitis phedima*	Butterfly	Nymphalidae	-	
126	Commander	*Moduza procris procris(Cramer, 1777)*	Butterfly	Nymphalidae	-	
127	Common Bush Brown	*mycalesis perseus*	Butterfly	Nymphalidae	LC	
128	Common Sailor	*Neptis hylas(Linnaeus, 1758)*	Butterfly	Nymphalidae	LC	
129	SulleedSialer	*Neptis soma*	Butterfly	Nymphalidae	LC	I
130	Yerburis'sSailer	*Neptis soma*	Butterfly	Nymphalidae	LC	
131	Nigger	*Orsotriaena medus*	Butterfly	Nymphalidae	LC	
132	Common Lascar	*Pantoporia hordonia*	Butterfly	Nymphalidae	LC	
133	Grassy Tiger	*parantica aglea*	Butterfly	Nymphalidae	LC	
134	Common Sergeant	*Athyma perius*	Butterfly	Nymphalidae	-	
135	Black Veined Sergeant	*Athyma ranga ranga(Moore, 1857)*	Butterfly	Nymphalidae	-	
136	Common Leopard	*Phalanta phalantha (Drury, 1773)*	Butterfly	Nymphalidae	-	
137	CommonNawab	*Polyura athamas*	Butterfly	Nymphalidae	-	

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
138	Peacock Pancy	*Junonia almanac(Linnaeus, 1758)*	Butterfly	Nymphalidae	-	
139	Grey Pancy	*Junonia atlites(Linnaeus, 1763)*	Butterfly	Nymphalidae	LC	
140	Chocolate Soldier	*Precisi phita(Cramer, 1779)*	Butterfly	Nymphalidae	LC	
141	Common Jester	*Symbrenthia lilaea*	Butterfly	Nymphalidae	LC	
142	Common Earl	*Tanaecia lepidea*	Butterfly	Nymphalidae	-	
143	Grey Count	*Tanaecia lepidea*	Butterfly	Nymphalidae	-	
144	Blue Tiger	*Trumala limniace*	Butterfly	Nymphalidae	-	
145	Dark band bush brown	*Vanessa indica(Herbst, 1794)*	Butterfly	Nymphalidae	-	
146	Common Five ring	*Ypthima baldus(Fabricius, 1775)*	Butterfly	Nymphalidae	-	
147	Common Four ring	*Ypthima huebneri*	Butterfly	Nymphalidae	-	
148	Yellow Coaster	*Acraea issoria(Hübner, 1819)*	Butterfly	Nymphalidae	-	
149	Glassy Bluebottle	*Graphium cloanthus*	Butterfly	Papilionidae	-	
150	Common jay	*Graphium doson*	Butterfly	Papilionidae	-	
151	Common Bluebottle	*Graphium doson*	Butterfly	Papilionidae	LC	
152	White Dragon tail	*Lampropteracurius(Fabricius, 1787)*	Butterfly	Papilionidae	LC	
153	Five bar swordtail	*Lamproptera curius*	Butterfly	Papilionidae	-	
154	Rest Best	*Princeps alcmeron*	Butterfly	Papilionidae	-	
155	Common Raven	*Princeps caster(Westwood, 1842)*	Butterfly	Papilionidae	-	
156	Lime Butterfly	*Papilio demoleus*	Butterfly	Papilionidae	-	
157	Great Mormon	*Papilio memnon*	Butterfly	Papilionidae	-	
158	Yellow Helen	*Papilio nephelus*	Butterfly	Papilionidae	-	
159	Common peacock	*Princeps polyctor(Boisduval, 1836)*	Butterfly	Papilionidae	-	
160	Common Mormon	*Papilio polytes*	Butterfly	Papilionidae	-	
161	Strangle	*Princepsprotenoreuprotenor*	Butterfly	Papilionidae	-	
162	Golden Bird wing	*Troides aeacus(Linnaeus, 1758)*	Butterfly	Papilionidae	-	
163	Common Birdwing	*Troides helenacereberus(Linnaeus, 1758)*	Butterfly	Papilionidae	EN	
164	Chocolate Albatross	*Appias lyncidaelenora(Cramer, [1779])*	Butterfly	Pieridae	-	
165	Common Emigrant	*Catopsilia pomona(Fabricius, 1775)*	Butterfly	Pieridae	-	

Sr. No.	Common Name	Scientific Name	Taxa	Family	IUCN	WPA
166	Lesser Gull	*Cepora nadina(Lucas, 1852)*	Butterfly	Pieridae	-	
167	Red based jezebel	*Delias pasithoe*	Butterfly	Pieridae	-	
168	Red spot Jezebel	*Delias descombesi*	Butterfly	Pieridae	-	
169	One Spot Grass Yellow	*Euremaandersonii(Moore, 1886)*	Butterfly	Pieridae	LC	
170	Three Spot Grass Yellow	*Eurema andersonii*	Butterfly	Pieridae	LC	
171	Small Grass Yellow	*Euremabrigitta rubella (Stoll, 1780)*	Butterfly	Pieridae	-	
172	Common Grass Yellow	*Eurema hecabe (Linnaeus, 1758)*	Butterfly	Pieridae	LC	
173	Chocolate Gras Yellow	*Eurema sari (Horsfield, 1829)*	Butterfly	Pieridae	-	
174	Tree Yellow	*Gandaca harina,(Horsfield, 1829)*	Butterfly	Pieridae	-	
175	Great orange tip	*Hebomoia glaucippe(Linnaeus, 1758)*	Butterfly	Pieridae	-	
176	Psyche	*Leptosia nina nina(Fabricius, 1793)*	Butterfly	Pieridae	LC	
177	Pale Wanderer	*Pareronia avatar avatar(Moore, 1857)*	Butterfly	Pieridae	LC	
178	Large Cabbage White	*Pieris brassicae nepalensis(Linnaeus, 1758)*	Butterfly	Pieridae	LC	
179	India Cabbage White	*Pieris canidia(Sparrman, 1768)*	Butterfly	Pieridae	-	
180	Dark Clouded Yellow	*Colias croceus*	Butterfly	Pieridae	-	

List of bird species in the study area through secondary literature

Table 38 : List of bird species in the study area through secondary literature

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
1	Accipitridae	Accipitridae	Osprey	*Pandion haliaetus*	LC
2	Accipitridae	Accipitridae	Jerdon'baza	*Aviceda jerdoni*	LC
3	Accipitridae	Accipitridae	Black baza	*Aviceda leuphotes*	LC
4	Accipitridae	Accipitridae	Oriental honey-buzzard	*Pernis ptilorhyncus*	LC
5	Accipitridae	Accipitridae	White-eyed Buzzard	*Butastur teesa*	LC
6	Accipitridae	Accipitridae	Black shouldered Kite	*Elanus caeruleus*	LC
7	Accipitridae	Accipitridae	Black Kite	*Milvus migrans*	LC
8	Accipitridae	Accipitridae	Brahminy kite	*Haliastur indus*	LC
9	Accipitridae	Accipitridae	White -Tailed Eagle	*Haliaeetus albicilla*	LC
10	Accipitridae	Accipitridae	Pallas's fish Eagle	*Haliaeetus leucoryphus*	LC
11	Accipitridae	Accipitridae	Lesser Fish Eagle	*Ichthyophaga humilis*	NT
12	Accipitridae	Accipitridae	Grey-headed Fish-eagle	*Icthyophaga ichthyaetus*	NT
13	Accipitridae	Accipitridae	Bonelli'eagle	*Aquila fasciata*	LC
14	Accipitridae	Accipitridae	Booted Eagle	*Hieraaetus pennatus*	LC
15	Accipitridae	Accipitridae	Rufous -bellied Eagle	*Lophotriorchis kienerii*	NT
16	Accipitridae	Accipitridae	Black Eagle	*Ictinaetus malayensis*	LC
17	Accipitridae	Accipitridae	White -rumpled Vulture	*Gyps bengalensis*	CR
18	Accipitridae	Accipitridae	Slender-Billed Vulture	*Gyps tenuirostris*	CR
19	Accipitridae	Accipitridae	Himalayan Griffon	*Gyps himalayensis*	NT
20	Accipitridae	Accipitridae	Red headed Vulture	*Sarcogyps calvus*	CR

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
21	Accipitridae	Accipitridae	Western Marsh-harrier	*Circus aeruginosus*	LC
22	Accipitridae	Accipitridae	Hen Harrier	*Circus cyaneus*	LC
23	Accipitridae	Accipitridae	Eurasian Sparrowhawk	*Accipiter nisus*	LC
24	Accipitridae	Accipitridae	Mountain Hawk Eagle	*Nisaetus nipalensis*	NT
25	Accipitridae	Accipitridae	Cinereous Vulture	*Aegypius monachus*	NT
26	Accipitridae	Accipitridae	Short -toed snaked Eagle	*Circaetus gallicus*	LC
27	Accipitridae	Accipitridae	Crested serpent Eagle	*Spilornis cheela*	LC
28	Accipitridae	Accipitridae	Pallid Harrier	*Circus macrourus*	NT
29	Accipitridae	Accipitridae	Pied Harrier	*Circus melanoleucos*	LC
30	Accipitridae	Accipitridae	Crested goshawk	*Accipiter trivirgatus*	LC
31	Accipitridae	Accipitridae	Shikra	*Accipiter badius*	LC
32	Accipitridae	Accipitridae	Besra	*Accipiter virgatus*	LC
33	Accipitridae	Accipitridae	Japanese Sparrow hawk	*Accipiter gularis*	LC
34	Accipitridae	Accipitridae	Common Buzzard	*Buteo buteo*	LC
35	Accipitridae	Accipitridae	Greater Spotted Eagle	*Aquila clanga*	VU
36	Accipitridae	Accipitridae	Changeable Hawk Eagle	*Nisaetus cirrhatus*	LC
37	Passeriformes	Alaudidae	Bengal Bush lark	*Mirafra assamica*	LC
38	Passeriformes	Alaudidae	Sand Lark	*Calandrella raytal*	LC
39	Passeriformes	Alaudidae	Oriental Skylark	*Alauda gulgula*	LC
40	Passeriformes	Campephagidae	Long tailed Minivet	*Pericrocotus ethologu*	LC
41	Passeriformes	Campephagidae	Short -billed Minivet	*Pericrocotus brevirostris*	LC
42	Passeriformes	Campephagidae	Large Woodshrike	*Tephrodornis virgatus*	LC
43	Passeriformes	Campephagidae	Common Woodshrike	*Tephrodornis pondicerianus*	LC
44	Passeriformes	Campephagidae	Scarlet minivet	*Pericrocotus flammeus*	LC
45	Passeriformes	Campephagidae	Bar-winged Flycatcher-shrike	*Hemipus picatus*	LC
46	Passeriformes	Chloropseidae	Blue-Winged Leafbird	*Chloropsis cochinchinensis*	LC

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
47	Passeriformes	Chloropseidae	Golden -fronted Leaf bird	*Chloropsis aurifrons*	LC
48	Passeriformes	Chloropseidae	Orange-bellied Leaf bird	*Chloropsis hardwickii*	LC
49	Passeriformes	Cisticolidae	Zitting Cisticola	*Cisticola juncidis*	LC
50	Passeriformes	Cisticolidae	Bright-headed Cristicola	*Cisticola exilis*	LC
51	Passeriformes	Cisticolidae	Rufous-vented Prinia	*Prinia burnesii*	LC
52	Passeriformes	Cisticolidae	Grey-bresasted Prinia	*Prinia hodgsonii*	LC
53	Passeriformes	Cisticolidae	Yellow-bellied Prinia	*Prinia flaviventris*	LC
54	Passeriformes	Cisticolidae	Plain Prinia	*Prinia inornata*	LC
55	Passeriformes	Cisticolidae	Graceful Prinia	*Prinia gracilis*	LC
56	Passeriformes	Cisticolidae	Ashy Prinia	*Prinia socialis*	LC
57	Passeriformes	Cisticolidae	JunglePrinia	*Prinia sylvatica*	LC
58	Passeriformes	Corvidae	Common green Magpie	*Cissa chinensis*	LC
59	Passeriformes	Corvidae	*Rufous Tree pie*	*Dendrocitta vagabunda*	LC
60	Passeriformes	Corvidae	*Grey Tree pie*	*Dendrocitta formosae*	LC
61	Passeriformes	Corvidae	*House crow*	*Corvus splendens*	LC
62	Passeriformes	Corvidae	*Large -billed crow*	*Corvus macrorhynchos*	LC
63	Passeriformes	Corvidae	*Ashy wood swallow*	*Artamus fuscus*	LC
64	Passeriformes	Corvidae	*Black-hooded Oriole*	*Oriolus xanthornus*	LC
65	Passeriformes	Corvidae	*Maroon Oriole*	*Oriolus traillii*	LC
66	Passeriformes	Corvidae	*Large Cuckooshrike*	*Coracina macei*	LC
67	Passeriformes	Corvidae	*Black-winged Cuckooshrike*	*Coracina melaschistos*	LC
68	Passeriformes	Corvidae	*Rosy Minivet*	*Pericrocotus roseus*	LC
69	Passeriformes	Corvidae	*Small Minivet*	*Pericrocotus cinnamomeus*	LC
70	Passeriformes	Dicruridae	*Black Drongo*	*Dicrurus macrocercus*	LC
71	Passeriformes	Dicruridae	*Ashy Drongo*	*Dicrurus leucophaeus*	LC
72	Passeriformes	Dicruridae	*Crow -billed Drongo*	*Dicrurus annectans*	LC

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
73	Passeriformes	Dicruridae	*Bronzed Drongo*	*Dicrurus aeneus*	LC
74	Passeriformes	Dicruridae	*Lesser racked -tailed Drongo*	*Dicrurus remifer*	LC
75	Passeriformes	Dicruridae	*Spangled Drongo*	*Dicrurus hottentottus*	LC
76	Passeriformes	Dicruridae	*Greater racket -tailed Drongo*	*Dicrurus paradiseus*	LC
77	Passeriformes	Emberizidae	*Chestnut-eared Bunting*	*Emberiza fucata*	LC
78	Passeriformes	Emberizidae	*Little Bunting*	*Emberiza pusilla*	LC
79	Passeriformes	Emberizidae	*Yellow -breasted Bunting*	*Emberiza aureola*	VU
80	Passeriformes	Emberizidae	*Black-faced Bunting*	*Emberiza spodocephala*	LC
81	Passeriformes	Eurylaimidae	*Long -Tailed Broadbill*	*Psarisomus dalhousiae*	LC
82	Passeriformes	Eurylaimidae	*Silver-breasted Broadbill*	*Serilophus lunatus*	LC
83	Passeriformes	Fringillidae	*Common rose finch*	*Carpodacus erythrinus*	LC
84	Passeriformes	Hirundinidae	*Pale Martin*	*Riparia diluta*	LC
85	Passeriformes	Hirundinidae	*Sand Martin*	*Riparia riparia*	LC
86	Passeriformes	Hirundinidae	*Plain Martin*	*Riparia paludicola*	LC
87	Passeriformes	Hirundinidae	*Barn Swallow*	*Hirundo rustica*	LC
88	Passeriformes	Hirundinidae	*Red romped Swallow*	*Hirundo daurica*	LC
89	Passeriformes	Hirundinidae	*Striated Swallow*	*Hirundo striolata*	NA
90	Passeriformes	Irenidae	*Asian Fairy Bluebird*	*Irena puella*	LC
91	Passeriformes	Laniidae	*Brown Shrike*	*Lanius cristatus*	LC
92	Passeriformes	Laniidae	*Long-tailed Shrike*	*Lanius schach*	LC
93	Passeriformes	Laniidae	*Grey backed Shrike*	*Lanius tephronotu*	LC
94	Passeriformes	Monarchidae	*Blacked -napped Monarch*	*Hypothymis azurea*	LC
95	Passeriformes	Monarchidae	*Asian Paradise-flycatcher*	*Terpsiphone paradisi*	LC
96	Passeriformes	Monarchidae	*Common Lora*	*Aegithina tiphia*	LC
97	Passeriformes	Motacillidae	*Forest Wagtail*	*Dendronanthus indicus*	LC
98	Passeriformes	Motacillidae	*Citrine Wagtail*	*Motacilla citreola*	LC

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
99	Passeriformes	Motacillidae	*Yellow Wagtail*	*Motacilla flava*	LC
100	Passeriformes	Motacillidae	*Grey Wagtail*	*Motacilla cinerea*	LC
101	Passeriformes	Motacillidae	*Richard 's Pipit*	*Anthus richardi*	LC
102	Passeriformes	Motacillidae	*Rosy Pipit*	*Anthus roseatus*	LC
103	Passeriformes	Motacillidae	*Paddy field Pipit*	*Anthus rufulus*	LC
104	Passeriformes	Muscicapidae	*Blue Rock Thrush*	*Monticola solitarius*	LC
105	Passeriformes	Muscicapidae	*Chestnut-bellied Rock Thrush*	*Monticola rufiventris*	LC
106	Passeriformes	Muscicapidae	*Blue Whistling Thrush*	*Myophonus caeruleus*	LC
107	Passeriformes	Muscicapidae	*Orange-headed Thrush*	*Zoothera citrina*	LC
108	Passeriformes	Muscicapidae	*Dark-sided Thrush*	*Zoothera marginata*	LC
109	Passeriformes	Muscicapidae	*Scaly Thrush*	*Zoothera dauma*	LC
110	Passeriformes	Muscicapidae	*Tickell's Thrush*	*Turdus unicolor*	LC
111	Passeriformes	Muscicapidae	*Black-breasted Thrush*	*Turdus dissimilis*	LC
112	Passeriformes	Muscicapidae	*Chestnut Thrush*	*Turdus rubrocanus gouldi*	LC
113	Passeriformes	Muscicapidae	*Lesser Short wing*	*Brachypteryx leucophrys*	LC
114	Passeriformes	Muscicapidae	*Little Pied Flycatcher*	*Ficedula westermanni*	LC
115	Passeriformes	Muscicapidae	*Slaty-blue Flycatcher*	*Ficedula tricolor*	LC
116	Passeriformes	Muscicapidae	*Blue-throat*	*Luscinia svecica*	LC
117	Passeriformes	Muscicapidae	*Fire throat*	*Luscinia pectardens*	NT
118	Passeriformes	Muscicapidae	*Black Redstart*	*Phoenicurus ochruros*	LC
119	Passeriformes	Muscicapidae	*Siberian Stonechat*	*Saxicola maurus*	LC
120	Passeriformes	Muscicapidae	*common Stonechat*	*Saxicola Torquatus*	LC
121	Passeriformes	Muscicapidae	*Grey bush chart*	*Saxicola ferrea*	LC
122	Passeriformes	Muscicapidae	*Large Niltava*	*Niltava grandis*	LC
123	Passeriformes	Muscicapidae	*Ferruginous Flycatcher*	*Muscicapa ferruginea*	LC
124	Passeriformes	Muscicapidae	*Red-throated Flycatcher*	*Ficedula parva*	LC

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
125	Passeriformes	Muscicapidae	*Snow-browed Flycatcher*	*Ficedula hyperythra*	LC
126	Passeriformes	Muscicapidae	*Sapphire Flycatcher*	*Ficedula sapphire*	LC
127	Passeriformes	Muscicapidae	*Verdier Flycatcher*	*Eumyias thalassina*	LC
128	Passeriformes	Muscicapidae	*Large Niltava*	*Niltava grandis*	LC
129	Passeriformes	Muscicapidae	*Small Niltava*	*Niltava macgrigoriae*	LC
130	Passeriformes	Muscicapidae	*Rufous -bellied Niltava*	*Niltava sundara*	LC
131	Passeriformes	Muscicapidae	*Pale-blue Flycatcher*	*Cyornis unicolor*	LC
132	Passeriformes	Muscicapidae	*Grey-headed Canary Flycatcher*	*Culicicapa ceylonensis*	LC
133	Passeriformes	Muscicapidae	*Siberian Rubythroat*	*Luscinia calliope*	LC
134	Passeriformes	Muscicapidae	*White -tailed Rubythoat*	*Luscinia pectoralis*	LC
135	Passeriformes	Muscicapidae	*Pale-chinned Flycatcher*	*Cyornis poliogenys*	LC
136	Passeriformes	Muscicapidae	*Oriental Magpie Robin*	*Copsychus saularis*	LC
137	Passeriformes	Muscicapidae	*White-rumped shama*	*Copsychus malabaricus*	LC
138	Passeriformes	Muscicapidae	*Hodgon's Redstart*	*Phoenicurus hodgsoni*	LC
139	Passeriformes	Muscicapidae	*Daurian Redstart*	*Phoenicurus auroreus*	LC
140	Passeriformes	Muscicapidae	*Blue front Redstart*	*Phoenicurus frontalis*	LC
141	Passeriformes	Muscicapidae	*Plumbeous Water-redstart*	*Rhyacornis fuliginosa*	LC
142	Passeriformes	Muscicapidae	*White-capped water Redstart*	*Chaimarrornis leucocephalus*	LC
143	Passeriformes	Muscicapidae	*White-tailed Robin*	*Myiomela leucura*	LC
144	Passeriformes	Muscicapidae	*Black-backed fork tail*	*Enicurus immaculatus*	LC
145	Passeriformes	Muscicapidae	*White-throated Bushchat*	*Saxicola insignis*	LC
146	Passeriformes	Muscicapidae	*White-tailed Stonechat*	*Saxicola leucura*	LC
147	Passeriformes	Muscicapidae	*Jordon's bush chat*	*Saxicola jerdoni*	LC
148	Passeriformes	Nectariniidae	*Yellow -vented Flowerpecker*	*Dicaeum chrysorrheum*	LC
149	Passeriformes	Nectariniidae	*Pale-billed Flowerpecker*	*Dicaeum erythrorhynchos*	LC
150	Passeriformes	Nectariniidae	*Fire -breasted Flowerpecker*	*Dicaeum ignipectus*	LC

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151	Passeriformes	Nectariniidae	*Scarlet-baked Flowerpcker*	*Dicaeum cruentatum*	LC
152	Passeriformes	Nectariniidae	*Plain Flowerpecker*	*Dicaeum concolor*	LC
153	Passeriformes	Nectariniidae	*Ruby-cheeked Sunbird*	*Anthreptes singalensis*	LC
154	Passeriformes	Nectariniidae	*Crimson sunbird*	*Aethopyga Siparaja*	LC
155	Passeriformes	Nectariniidae	*Purple sunbird*	*Nectarinia asiatica*	NA
156	Passeriformes	Nectariniidae	*Black-throated Sunbird*	*Aethopyga saturate*	NA
157	Passeriformes	Nectariniidae	*Streak spider hunter*	*Arachnothera magna*	NA
158	Passeriformes	Paridae	*Great Tit*	*parus major*	LC
159	Passeriformes	Paridae	*Sultan Tit*	*Melanochlora sultanea*	LC
160	Passeriformes	Passeridae	*House Sparrow*	*Passer domesticus*	LC
161	Passeriformes	Passeridae	*Eurasian Tree Sparrow*	*Passer montanus*	LC
162	Passeriformes	Passeridae	*Baya weaver*	*Ploceus philippinus*	LC
163	Passeriformes	Passeridae	*Black -headed Munia*	*Lonchura moluca*	LC
164	Passeriformes	Passeridae	*White Wagtail*	*Motacilla alba*	NA
165	Passeriformes	Passeridae	*White-browed Wagtail*	*Motacilla madaraspatensis*	LC
166	Passeriformes	Passeridae	*Blyth's Pipit*	*Anthus godlewskii*	LC
167	Passeriformes	Passeridae	*Tree Pipit*	*Anthus trivialis*	LC
168	Passeriformes	Passeridae	*Black-breasted Weaver*	*Ploceus benghalensis*	LC
169	Passeriformes	Passeridae	*Buff -bellied Pipit*	*Anthus rubescens*	NA
170	Passeriformes	Passeridae	*Streaker Weaver*	*Ploceus manyar*	NA
171	Passeriformes	Passeridae	*Finn's Weaver*	*Ploceus megarhynchus*	NA
172	Passeriformes	Passeridae	*Red Avadavat*	*Amandava amandava*	NA
173	Passeriformes	Passeridae	*Scaly-breasted Munia*	*Lonchura punctulata*	NA
174	Passeriformes	Passeridae	*White-rumped Munia*	*Lonchura striata*	NA
175	Passeriformes	Pittidae	*Hooded Pitta*	*Pitta sordida*	LC
176	Passeriformes	Pycnonotidae	*Black-crested Bulbul*	*Pycnonotus melanicterus*	LC

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177	Passeriformes	Pycnonotidae	*Red-whiskered Bulbul*	*Pycnonotus jocosus*	LC
178	Passeriformes	Pycnonotidae	*Red-vented Bulbul*	*Pycnonotus cafer*	LC
179	Passeriformes	Pycnonotidae	*Ashy Bulbul*	*Hemixos flavala*	LC
180	Passeriformes	Pycnonotidae	*White-throated Bulbul*	*Alophoixus flaveolus*	LC
181	Passeriformes	Pycnonotidae	*Black Bulbul*	*Hypsipetes leucocephalus*	LC
182	Passeriformes	Rhipiduridae	*White -throated Fantail*	*Rhipidura albicollis*	LC
183	Passeriformes	Rhipiduridae	*White-throat Fantail Flycatcher*	*Rhipidura albicollis*	LC
184	Passeriformes	Sittidae	*Chestnut -bellied Nuthatch*	*Sitta castanea*	LC
185	Passeriformes	Sittidae	*Velvet -fronted Nuthatch*	*Sitta frontalis*	LC
186	Passeriformes	Sturnidae	*Sport -wined Starling*	*Saroglossa spiloptera*	LC
187	Passeriformes	Sturnidae	*Chestnut starling*	*Sturnus malabaricus*	LC
188	Passeriformes	Sturnidae	*Brahminy Starling*	*Sturnus pagodarum*	LC
189	Passeriformes	Sturnidae	*Asian Pied Starling*	*Sturnus contra*	LC
190	Passeriformes	Sturnidae	*Common Starling*	*Sturnus vulgaris*	LC
191	Passeriformes	Sturnidae	*Common Myna*	*Acridotheres tristis*	LC
192	Passeriformes	Sturnidae	*Jungle Myna*	*Acridotheres fuscus*	LC
193	Passeriformes	Sturnidae	*White vented Myna*	*Acridotheres cinereus*	LC
194	Passeriformes	Sturnidae	*Common Hill Myna*	*Gracula religiosa*	LC
195	Passeriformes	Sturnidae	*Bank Myna*	*Acridotheres ginginianus*	LC
196	Passeriformes	Sylviidae	*Slaty-bellied Tesia*	*Tesia olivea*	LC
197	Passeriformes	Sylviidae	*Grey- bellied Tesia*	*Tesia cyaniventer*	LC
198	Passeriformes	Sylviidae	*Pale-footed Bush Warbler*	*Cettia pallidipes*	LC
199	Passeriformes	Sylviidae	*Brownish-flanked Bush Warbler*	*Cettia fortipes*	LC
200	Passeriformes	Sylviidae	*Chestnut -crowned Bush Warbler*	*Cettia major*	LC
201	Passeriformes	Sylviidae	*Aberrant Bush Warbler*	*Cettia flavolivacea*	LC
202	Passeriformes	Sylviidae	*Grey-sided Bush Warbler*	*Cettia brunnifrons*	LC

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203	Passeriformes	Sylviidae	*Spotted Bush Warbler*	*Bradypterus thoracicus*	LC
204	Passeriformes	Sylviidae	*Chinese Bush Warbler*	*Bradypterus tacsanowskius*	LC
205	Passeriformes	Sylviidae	*Russet Bush Warbler*	*Bradypterus seebohmi*	LC
206	Passeriformes	Sylviidae	*Paddy field Warbler*	*Acrocephalus agricola*	LC
207	Passeriformes	Sylviidae	Common Tailorbird	*Orthotomus sutorius*	*LC*
208	Passeriformes	Sylviidae	Dusky Warbler	*Phylloscopus fuscatus*	*LC*
209	Passeriformes	Sylviidae	Smoky warbler	*Phylloscopus fuligiventer*	*LC*
210	Passeriformes	Sylviidae	Greenish Warbler	*Phylloscopus trochiloides*	*LC*
211	Passeriformes	Sylviidae	Blunt-winged Warbler	*Acrocephalus*	*LC*
212	Passeriformes	Sylviidae	Bly's Reed Warbler	*Acrocephalus dumetorum*	*LC*
213	Passeriformes	Sylviidae	Clamorous reed Warbler	*Acrocephalus stentoreus*	*LC*
214	Passeriformes	Sylviidae	Thick -billed Warbler	*Acrocephalus aedon*	*LC*
215	Passeriformes	Sylviidae	Oriental Reed Warbler	*Acrocephalus orientalis*	*LC*
216	Passeriformes	Sylviidae	Black-browed Reed Warbler	*Acrocephalus bistrigiceps*	*LC*
217	Passeriformes	Sylviidae	Lesser Whitethroat	*Sylvia curruca*	*LC*
218	Passeriformes	Sylviidae	Mountain Tailorbird	*Orthotomus cuculatus*	*LC*
219	Passeriformes	Sylviidae	Tickell's Leaf WarbleR	*Phylloscopus affinis*	*LC*
220	Passeriformes	Sylviidae	Yellow-eyed Babbler	*Chrysomma sinense*	*LC*
221	Passeriformes	Sylviidae	Striated Babbler	*Turdoides earlei*	*LC*
222	Passeriformes	Sylviidae	Slender-Billed Babbler	*Turdoides longirostris*	*VU*
223	Passeriformes	Sylviidae	Nepal Fulvetta	*Alcippe nipalensis*	*LC*
224	Passeriformes	Sylviidae	Dark-necked tailorbird	*Orthotomus atrogularis*	*LC*
225	Passeriformes	Sylviidae	Large -billed Leaf Warbler	*Phylloscopus magnirostris*	*LC*
226	Passeriformes	Sylviidae	Blyth's Leaf Warbler	*Phylloscopus reguloides*	*LC*
227	Passeriformes	Sylviidae	Yellow -vented Warbler	*Phylloscopus cantator*	*LC*
228	Passeriformes	Sylviidae	Yellow -browed Warbler	*Phylloscopus inornatus*	*LC*

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229	Passeriformes	Sylviidae	Hume's Warbler	*Phylloscopus humei*	*LC*
230	Passeriformes	Sylviidae	Ashy-throated Warbler	*Phylloscopus maculipennis*	*LC*
231	Passeriformes	Sylviidae	Eastern Crowned Warbler	*Phylloscopus coronatus*	*LC*
232	Passeriformes	Sylviidae	Common Chiffchaff	*Phylloscopus collybita*	*LC*
233	Passeriformes	Sylviidae	Golden -Spectacled Warbler	*Seicercus burkii*	*LC*
234	Passeriformes	Sylviidae	Grey -hooded Warbler	*Seicercus xanthoschistos*	*LC*
235	Passeriformes	Sylviidae	White -spectacled Warbler	*Seicercus affinis*	*LC*
236	Passeriformes	Sylviidae	Grey -Cheeked Wabler	*Seicercus poliogenys*	*LC*
237	Passeriformes	Sylviidae	Chestnut -Crowned Warbler	*Seicercus castaniceps*	*LC*
238	Passeriformes	Sylviidae	Rufous -faced Wabler	*Abroscopus albogularis*	*LC*
239	Passeriformes	Sylviidae	Yellow -bellied Warbler	*Abroscopus superciliaris*	*LC*
240	Passeriformes	Sylviidae	Striated Grass bird	*Megalurus palustris*	*LC*
241	Passeriformes	Sylviidae	Bristled Grass bird	*Chaetornis striata*	*LC*
242	Passeriformes	Sylviidae	Rufous-rumped Grass bird	*Graminicola bengalensis*	*LC*
243	Passeriformes	Sylviidae	Lesser Neck laced Laughing thrush	*Garrulax monileger*	*NA*
244	Passeriformes	Sylviidae	Greater Neck laced Laughing thrush	*Garrulax pectoralis*	*NA*
245	Passeriformes	Sylviidae	Rufous -Neck laced Laughing thrush	*Garrulax ruficollis*	*LC*
246	Passeriformes	Sylviidae	Abbott's Babbler	*Malacocincla abbotti*	*NA*
247	Passeriformes	Sylviidae	Buff-breasted Babbler	*Pellorneum tickelli*	*NA*
248	Passeriformes	Sylviidae	Marsh Babbler	*Pellorneum Palustre*	*LC*
249	Passeriformes	Sylviidae	Puff -Throated Babbler	*Pellorneum ruficeps*	*NA*
250	Passeriformes	Sylviidae	Spot- Throated Babbler	*Pellorneum albiventre*	*NA*
251	Passeriformes	Sylviidae	White -browed Scimitar Babbler	*Pomatorhinus schisticeps*	*NA*
252	Passeriformes	Sylviidae	Rufous-fronted Babbler	*Stachyris rufifrons*	*NA*
253	Passeriformes	Sylviidae	White-bellied Yuhina	*Yuhina zantholeuca*	*NA*
254	Passeriformes	Timaliidae	Pygmy Wren-Babbler	*Pnoepyga pusilla*	*LC*

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255	Passeriformes	Timaliidae	Grey-Throated Babbler	*Stachyris nigriceps*	*LC*
256	Passeriformes	Timaliidae	Striped Tit Babbler	*Macronous gularis*	*LC*
257	Passeriformes	Timaliidae	Jordon's Babbler	*Chrysomma altirostre*	*VU*
258	Passeriformes	Timaliidae	Jungle Babbler	*Turdoides striatus*	*LC*
259	Passeriformes	Timaliidae	White -hooded babbler	*Gampsorhynchus rufulus*	*LC*
260	Passeriformes	Timaliidae	Red-tailed Minla	*Minla ignotincta*	*LC*
261	Passeriformes	Turdidae	Dark -throated Thrush	*Turdus ruficollis*	*LC*
262	Passeriformes	Turdidae	Dusky Thrush	*Turdus naumanni*	*LC*
263	Passeriformes	Turdidae	Grey-winged Black Bird	*Turdus boulboul*	*LC*
264	Passeriformes	Zosteropidae	Oriental White-eye	*Zosterops palpebrosus*	*LC*
265	Coraciiformes	Alcedinidae	Common kingfisher	*Alcedo atthis*	*LC*
266	Coraciiformes	Alcedinidae	Blue-eared kingfisher	*Alcedo meninting*	*LC*
267	Coraciiformes	Alcedinidae	Ruddy kingfisher	*Halcyon coromanda*	*LC*
268	Coraciiformes	Alcedinidae	White-throated kingfisher	*Halcyon smyrnensis*	*LC*
269	Coraciiformes	Alcedinidae	Blyth's Kingfisher	*Alcedo hercules*	*NT*
270	Coraciiformes	Cerylidae	Pied Kingfisher	*Ceryle rudis*	*LC*
271	Coraciiformes	Cerylidae	Crested Kingfisher	*Megaceryle lugubris*	*LC*
272	Coraciiformes	Coraciidae	Dollar bird	*Eurystomus orientalis*	*LC*
273	Coraciiformes	Coraciidae	Indian Roller	*Coracias benghalensis*	*LC*
274	Coraciiformes	Halcyonidae	Stork-billed Kingfisher	*Halcyon capensis*	*LC*
275	Coraciiformes	Meropidae	Blue-bearded bee-eater	*Nyctyornis athertoni*	*LC*
276	Coraciiformes	Meropidae	Green Bee-eater	*Merops orientalis*	*LC*
277	Coraciiformes	Meropidae	Blue-tailed bee-eater	*Merops philippinus*	*LC*
278	Coraciiformes	Meropidae	Chestnut-headed Bee-eater	*Merops leschenaulti*	*LC*
279	Bucerotiformes	Upupidae	Common hoopoe	*Upupa epops*	*LC*
280	Anseriformes	Anatidae	Red-breasted Goose	*Branta ruficollis*	*EN*

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281	Anseriformes	Anatidae	Bean Goose	*Anser fabalis*	*LC*
282	Anseriformes	Anatidae	Lesser- whistling -fronted Goose	*Anser erythropus*	*VU*
283	Anseriformes	Anatidae	Graylag Goose	*Anser anser*	*LC*
284	Anseriformes	Anatidae	Bar-headed Goose	*Anser indicus*	*LC*
285	Anseriformes	Anatidae	Ruddy She duck	*Tadorna ferruginea*	*LC*
286	Anseriformes	Anatidae	White-Waged Duck	*Cairina scutulata*	*EN*
287	Anseriformes	Anatidae	Common shield duck	*Tadorna tadorna*	*LC*
288	Anseriformes	Anatidae	Comb Duck	*Sarkidiornis melanotos*	*LC*
289	Anseriformes	Anatidae	Cotton pygmy-goose	*Nettapus coromandelianus*	*LC*
290	Anseriformes	Anatidae	Mandarin duck	*Aix galericulata*	*LC*
291	Anseriformes	Anatidae	Gadwall	*Anas strepera*	*LC*
292	Anseriformes	Anatidae	Falcated Duck	*Anas falcata*	*NT*
293	Anseriformes	Anatidae	Eurasian Wigeon	*Anas penelope*	*LC*
294	Anseriformes	Anatidae	Mallard	*Anas platyrhynchos*	*LC*
295	Anseriformes	Anatidae	Spot-billed Duck	*Anas poecilorhyncha*	*LC*
296	Anseriformes	Anatidae	Northern shoveler	*Anas clypeata*	*LC*
297	Anseriformes	Anatidae	Northen pintail	*Anas acuta*	*LC*
298	Anseriformes	Anatidae	Common Teal	*Anas crecca*	*LC*
299	Anseriformes	Anatidae	Baikal Teal	*Anas formosa*	*LC*
300	Anseriformes	Anatidae	Garganey	*Anas querquedula*	*LC*
301	Anseriformes	Anatidae	long tailed duck	*Clangula hyemalis*	*LC*
302	Anseriformes	Anatidae	common goldeneye	*Bucephala clangula*	*LC*
303	Anseriformes	Anatidae	Smew	*Mergellus albellus*	*LC*
304	Anseriformes	Anatidae	Red-crested Pochard	*Netta rufina*	*LC*
305	Anseriformes	Anatidae	Common Pochard	*Aythya ferina*	*LC*
306	Anseriformes	Anatidae	Ferruginous Pochard	*Aythya nyroca*	*NT*

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307	Anseriformes	Anatidae	Baer's Pochard	*Aythya baeri*	*EN*
308	Anseriformes	Anatidae	Tufted Duck	*Aythya fuligula*	*LC*
309	Anseriformes	Anatidae	Greater Scaup	*Aythya marila*	*LC*
310	Anseriformes	Anatidae	Common Merganser	*Mergus merganser*	*LC*
311	Anseriformes	Dendrocygndiae	Fulvous Whistling duck	*Dendrocygna bicolor*	*LC*
312	Anseriformes	Dendrocygndiae	Lesser- whistling -duck	*Dendrocygna javanica*	*LC*
313	Suliformes	Anhingidae	Darter	*Anhinga melanogaster*	*NT*
314	Suliformes	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	*LC*
315	Suliformes	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	*LC*
316	Suliformes	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	*LC*
317	Caprimulgiformes	Apodidae	Himalayan Swiftlet	*Aerodramus brevirostris*	*LC*
318	Caprimulgiformes	Apodidae	Asian palm Swift	*Cypsiurus balasiensis*	*LC*
319	Caprimulgiformes	Apodidae	Fork-tailed Swift	*Apus pacificus*	*LC*
320	Caprimulgiformes	Apodidae	House Swift	*Apus affinis*	*LC*
321	Caprimulgiformes	Apodidae	Alpine swift	*Tachymarptis melba*	*LC*
322	Caprimulgiformes	Apodidae	White-throated Needle tail	*Hirundapus caudacutus*	*LC*
323	Pelecaniformes	Ardeidae	Little Egret	*Egretta garzetta*	*LC*
324	Pelecaniformes	Ardeidae	Grey Heron	*Ardea cinerea*	*LC*
325	Pelecaniformes	Ardeidae	Purple Heron	*Ardea purpurea*	*LC*
326	Pelecaniformes	Ardeidae	White-bellied Heron	*Ardea insignis*	*CR*
327	Pelecaniformes	Ardeidae	Great Eagret	*Casmerodius albus*	*LC*
328	Pelecaniformes	Ardeidae	Cattle Egret	*Bubulcus ibis*	*LC*
329	Pelecaniformes	Ardeidae	India Pond Heron	*Ardeola grayii*	*LC*
330	Pelecaniformes	Ardeidae	Malayan Night Heron	*Gorsachius melanolophus*	*LC*
331	Pelecaniformes	Ardeidae	Little Bittern	*Ixobrychus minutus*	*LC*
332	Pelecaniformes	Ardeidae	Yellow Bittern	*Ixobrychus sinensis*	*LC*

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333	Pelecaniformes	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	*LC*
334	Pelecaniformes	Ardeidae	Black Bittern	*Dupetor flavicollis*	*LC*
335	Pelecaniformes	Ardeidae	Intermediate Egret	*Mesophoyx intermedia*	*LC*
336	Pelecaniformes	Ardeidae	Little Heron	*Butorides striatus*	*LC*
337	Pelecaniformes	Ardeidae	Black -crowned Night Heron	*Nycticorax nycticorax*	*LC*
338	Pelecaniformes	Bucerotidae	Oriental pied hornbill	*Anthracoceros albirostris*	*LC*
339	Pelecaniformes	Bucerotidae	Great hornbill	*Buceros bicornis*	*NT*
340	Pelecaniformes	Pelecanidae	Great White Pelican	*Pelecanus onocrotalus*	*LC*
341	Pelecaniformes	Pelecanidae	Spot-billed Pelican	*Pelecanus philippensis*	*LC*
342	Pelecaniformes	Threskiornithidae	Glossy ibis	*Plegadis falcinellus*	*LC*
343	Pelecaniformes	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	*LC*
344	Caprimulgiformes	Carprimulgidae	large-tailed nightjar	*Caprimulgus macrurus*	*LC*
345	Caprimulgiformes	Carprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	*LC*
346	Caprimulgiformes	Carprimulgidae	Gey Nightjar	*carprimulgus indicus*	*LC*
347	Charadriiformes	Burhinidae	Great Thick-Knee	*Esacus recurvirostris*	*LC*
348	Charadriiformes	Burhinidae	Eurasian Thick-knee	*Burhinus oedicnemus*	*LC*
349	Charadriiformes	Charadriidae	Pacific Golden Plover	*Pluvialis fulva*	*LC*
350	Charadriiformes	Charadriidae	Kentish Plover	*Charadrius alexandrinus*	*LC*
351	Charadriiformes	Charadriidae	Eurasian Golden plover	*Pluvialis apricaria*	*LC*
352	Charadriiformes	Charadriidae	Long-billed Plover	*Charadrius placidus*	*LC*
353	Charadriiformes	Charadriidae	Northen lapwing	*Vanellus vanellus*	*LC*
354	Charadriiformes	Charadriidae	River Lapwing	*Vanellus duvaucelii*	*LC*
355	Charadriiformes	Charadriidae	Grey-headed lapwing	*Vanellus cinereus*	*LC*
356	Charadriiformes	Charadriidae	Little Ringed Plover	*Charadrius dubius*	*LC*
357	Charadriiformes	Charadriidae	Grey-headed Lapwing	*Vanellus cinereus*	*LC*
358	Charadriiformes	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	*LC*

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359	Charadriiformes	Glareolidae	Small Pratincole	*Glareola lactea*	*LC*
360	Charadriiformes	Jacanidae	Pheasant-tailed jacana	*Hydrophasianus chirurgus*	*LC*
361	Charadriiformes	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	*LC*
362	Charadriiformes	Laridae	Pallas's Gull	*Larus ichthyaetus*	*LC*
363	Charadriiformes	Laridae	Brown headed Gull	*Larus brunnicephalus*	*LC*
364	Charadriiformes	Laridae	Black-headed Gull	*Larus ridibundus*	*LC*
365	Charadriiformes	Laridae	River Tern	*Sterna aurantia*	*LC*
366	Charadriiformes	Laridae	Whiskered Tern	*Chlidonias hybridus*	*LC*
367	Charadriiformes	Laridae	Black bellied tern	*Sterna acuticauda*	*LC*
368	Charadriiformes	Recurvirostridae	Pied Avocet	*Recurvirostra avosetta*	*LC*
369	Charadriiformes	Recurvirostridae	Black Winged Stilt	*Himantopus himantopus*	*LC*
370	Charadriiformes	Rostratulidae	Greater Painted-snipe	*Rostratula benghalensis*	*LC*
371	Charadriiformes	Scolopacidae	Pintail Spine	*Gallinago stenura*	*LC*
372	Charadriiformes	Scolopacidae	Common Spine	*Gallinago gallinago*	*LC*
373	Charadriiformes	Scolopacidae	Spotted Redshank	*Tringa erythropus*	*LC*
374	Charadriiformes	Scolopacidae	Common Redshank	*Tringa totanus*	*LC*
375	Charadriiformes	Scolopacidae	Common Greenshank	*Tringa nebularia*	*LC*
376	Charadriiformes	Scolopacidae	Spotted Greenshank	*Tringa guttifer*	*EN*
377	Charadriiformes	Scolopacidae	Green sandpiper	*Tringa ochropus*	*LC*
378	Charadriiformes	Scolopacidae	Wood sandpiper	*Tringa glareola*	*LC*
379	Charadriiformes	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	*LC*
380	Charadriiformes	Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	*LC*
381	Charadriiformes	Scolopacidae	Asian Dowitcher	*Limnodromus semipalmatus*	*NT*
382	Charadriiformes	Scolopacidae	Temminck's Stint	*Calidris temminckii*	*LC*
383	Charadriiformes	Scolopacidae	Long-toed stint	*Calidris subminuta*	*LC*
384	Charadriiformes	Scolopacidae	Little Stint	*Calidris minuta*	*LC*

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
385	Charadriiformes	Scolopacidae	Whimbrel	*Numenius phaeopus*	*LC*
386	Charadriiformes	Scolopacidae	Eurasian curlew	*Numenius arquata*	*NT*
387	Charadriiformes	Scolopacidae	Bar-tailed Godwit	*Limosa lapponica*	*LC*
388	Charadriiformes	Turnicidae	Yellow-legged Buttonquail	*Turnix tanki*	*LC*
389	Charadriiformes	Turnicidae	Barred Buttonquail	*Turnix suscitator*	*LC*
390	Charadriiformes	Turnicidae	Small Buttonquail	*Turnix sylvatica*	*NA*
391	Ciconiiformes	Ciconiidae	Asian Openbill	*Anastomus oscitans*	*LC*
392	Ciconiiformes	Ciconiidae	Black Stork	*Ciconia nigra*	*LC*
393	Ciconiiformes	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus*	*LC*
394	Ciconiiformes	Ciconiidae	Black-necked stork	*Ephippiorhynchus asiaticus*	*NT*
395	Ciconiiformes	Ciconiidae	Paint Stork	*Mycteria leucocephala*	*NT*
396	Ciconiiformes	Ciconiidae	White Stork	*Ciconia ciconia*	*LC*
397	Ciconiiformes	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	*VU*
398	Ciconiiformes	Ciconiidae	Greater Adjutant	*Leptoptilos dubius*	*EN*
399	Columbiformes	Columbidae	Barred Cuckoo Dove	*Macropygia unchall*	*LC*
400	Columbiformes	Columbidae	Rock pigeon	*Columba livia*	*LC*
401	Columbiformes	Columbidae	Pale capped Pigeon	*Columba punicea*	*LC*
402	Columbiformes	Columbidae	Oreintal Turtle Dove	*Streptopelia orientalis*	*LC*
403	Columbiformes	Columbidae	Spotted Dove	*Streptopelia chinensis*	*LC*
404	Columbiformes	Columbidae	Red Collared Dove	*Streptopelia tranquebarica*	*LC*
405	Columbiformes	Columbidae	Eurasian Collared Dove	*Streptopelia decaocto*	*LC*
406	Columbiformes	Columbidae	Pin tailed Green Pigeon	*Treron apicauda*	*LC*
407	Columbiformes	Columbidae	Emerald Dove	*Chalcophaps indica*	*LC*
408	Columbiformes	Columbidae	Pompadour Green Pigeon	*Treron pompadora*	*LC*
409	Columbiformes	Columbidae	Thick -billed Green Pigeon	*Treron curvirostra*	*LC*
410	Columbiformes	Columbidae	Yellow- footed Green Pigeon	*Tredon phoenicoptera*	*LC*

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
411	Columbiformes	Columbidae	Wedge -tailed Green Pigeon	*Treron sphenurus*	*LC*
412	Columbiformes	Columbidae	Green imperial Pigeon	*Ducula aenea*	*LC*
413	Columbiformes	Columbidae	Mountain Imperial Pigeon	*Ducula badia*	*LC*
414	Cuculiformes	Cuculidae	Pied Cuckoo	*Clamator jacobinus*	*LC*
415	Cuculiformes	Cuculidae	Common Hawk cuckoo	*Hierococcyx varius*	*LC*
416	Cuculiformes	Cuculidae	Large Hawk Cuckoo	*Hierococcyx sparverioides*	*LC*
417	Cuculiformes	Cuculidae	Eurasian Cuckoo	*Cuculus canorus*	*LC*
418	Cuculiformes	Cuculidae	India Cuckoo	*Cuculus micropterus*	*LC*
419	Cuculiformes	Cuculidae	Lesser Cuckoo	*Cuculus poliocepharus*	*LC*
420	Cuculiformes	Cuculidae	Asian Koel	*Eudynamys scolopaceus*	*LC*
421	Cuculiformes	Cuculidae	Asian Emerald Cuckoo	*Chrysococcyx maculates*	*LC*
422	Cuculiformes	Cuculidae	Greater Coucal	*Centropus sinensis*	*LC*
423	Cuculiformes	Cuculidae	Lesser Coucal	*Centropus bengalensis*	*LC*
424	Cuculiformes	Cuculidae	Chestnut -Winged Cuckoo	*Clamator coromandus*	*LC*
425	Cuculiformes	Cuculidae	Banded Bay Cuckoo	*Cacomantis sonneratii*	*LC*
426	Cuculiformes	Cuculidae	Plaintive Cuckoo	*Cacomantis merulinus*	*LC*
427	Cuculiformes	Cuculidae	Grey-bellied Cuckoo	*Cacomantis passerines*	*LC*
428	Cuculiformes	Cuculidae	Drongo Cuckoo	*Surniculus lugubris*	*LC*
429	Cuculiformes	Cuculidae	Green-billed Malkoha	*Phaenicophaeus tristis*	*LC*
430	Falconiformes	Falconidae	Pied Falconet	*Microhierax melanoleucos*	*LC*
431	Falconiformes	Falconidae	Lesser Kestrel	*Falco naumanni*	*LC*
432	Falconiformes	Falconidae	Common Kestrel	*Falco tinnunculus*	*LC*
433	Falconiformes	Falconidae	Red -necked Falcon	*Falco chicquera*	*LC*
434	Falconiformes	Falconidae	Amur Falcon	*Falco amurensis*	*LC*
435	Falconiformes	Falconidae	Eurasian Hobby	*Falco subbuteo*	*LC*
436	Falconiformes	Falconidae	Oriental Hobby	*Falco severus*	*LC*

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
437	Falconiformes	Falconidae	Peregrine Flacon	*Falco peregrinus*	*LC*
438	Gruiformes	Gruidae	Sarus Crane	*Grus antigone*	*VU*
439	Gruiformes	Gruidae	Common crane	*Grus grus*	*LC*
440	Gruiformes	Heliornithidae	Masked fin foot	*Heliopais personata*	*CR*
441	Gruiformes	Otididae	Bengal Florican	*Houbaropsis bengalensis*	*CR*
442	Gruiformes	Rallidae	Slaty legged crake	*Rallina eurizonoides*	*LC*
443	Gruiformes	Rallidae	Slaty breasted rail	*Gallirallus striatus*	*LC*
444	Gruiformes	Rallidae	Water Rail	*Rallus aquaticus*	*LC*
445	Gruiformes	Rallidae	White Breasted water hen	*Amaurornis phoenicurus*	*LC*
446	Gruiformes	Rallidae	Black tailed Crake	*Porzana bicolor*	*LC*
447	Gruiformes	Rallidae	Ruby breasted Crake	*Porzana fusca*	*LC*
448	Gruiformes	Rallidae	Brown Crake	*Amaurornis akool*	*LC*
449	Gruiformes	Rallidae	Common Coot	*Fulica atra*	*LC*
450	Gruiformes	Rallidae	Watercock	*Gallicrex cinerea*	*LC*
451	Gruiformes	Rallidae	Purple Swamp Hen	*Porphyrio porphyrio*	*LC*
452	Gruiformes	Rallidae	Common Moorhen	*Gallinula chloropus*	*LC*
453	Gruiformes	Rallidae	Common Coot	*Fulica atra*	*LC*
454	Galliformes	Phasianidae	Black Francolin	*Francolinus francolinus*	*LC*
455	Galliformes	Phasianidae	Swamp Francolin	*Francolinus gularis*	*VU*
456	Galliformes	Phasianidae	Common quail	*Coturnix coturnix*	*LC*
457	Galliformes	Phasianidae	Rain Quail	*Coturnix coromandelica*	*LC*
458	Galliformes	Phasianidae	Blue-breasted Quail	*Coturnix chinensis*	*LC*
459	Galliformes	Phasianidae	Red jungle fowl	*Gallus gallus*	*LC*
460	Galliformes	Phasianidae	Kalij Pheasant	*Lophura leucomelanos*	*LC*
461	Piciformes	Picidae	Eurasian Wryneck	*Jynx torquilla*	*LC*
462	Piciformes	Picidae	Specked Piculet	*Picumnus innominatus*	*LC*

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
463	Piciformes	Picidae	White-browed Piculet	*Sasia ochracea*	*LC*
464	Piciformes	Picidae	Bay woodpecker	*Blythipicus pyrrhotis*	*LC*
465	Piciformes	Picidae	Grey-capped pygmyWood pecker	*Dendrocopos canicapillus*	*LC*
466	Piciformes	Picidae	Rufous Woodpecker	*Celeus brachyurus*	*LC*
467	Piciformes	Picidae	Lesser Yellow Nape	*Picus chlorolophus*	*LC*
468	Piciformes	Picidae	Great Yellow Nape	*Picus flavinucha*	*LC*
469	Piciformes	Picidae	Streak -throated Woodpecker	*Picus xanthopygaeus*	*LC*
470	Piciformes	Picidae	Grey-headed Woodpecker	*Picus canus*	*LC*
471	Piciformes	Picidae	Great Flame Back	*Chrysocolaptes*	*LC*
472	Piciformes	Picidae	Himalayan Flame black	*Dinopium shorii*	*LC*
473	Piciformes	Picidae	Pale -Headed woodpecker	*Gecinulus grantia*	*LC*
474	Piciformes	Picidae	Fulvous-breasted Woodpecker	*Dendrocopas macei*	*LC*
475	Piciformes	Ramphastidae	Great barbet	*Megalaima virens*	*LC*
476	Piciformes	Ramphastidae	Lineated Barbet	*Megalaima lineata*	*LC*
477	Piciformes	Ramphastidae	Blue-throated Barbet	*Megalaima asiatica*	*LC*
478	Piciformes	Ramphastidae	Coppersmith Barbet	*Megalaima haemacephala*	*LC*
479	Piciformes	Ramphastidae	Blue-eared Barbet	*Psilopogon cyanotis*	*LC*
480	Psittaciformes	Psittacidae	Alexandrine parakeet	*Psittacula eupatria*	*LC*
481	Psittaciformes	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	*LC*
482	Psittaciformes	Psittacidae	Blossom-headed Parakeet	*Psittacula roseata*	*LC*
483	Psittaciformes	Psittacidae	Red-breasted Parakeet	*Psittacula alexandrin*	*LC*
484	Strigiformes	Strigidae	Oriental bay Owl	*Phodilus badius*	*LC*
485	Strigiformes	Strigidae	Oriental Scops Owl	*Otus sunia*	*LC*
486	Strigiformes	Strigidae	Collared Scops Owl	*Otus bakkamoena*	*LC*
487	Strigiformes	Strigidae	Eurasian Eagle Owl	*Bubo bubo*	*LC*
488	Strigiformes	Strigidae	Brown fish Owl	*Ketupa zeylonensis*	*LC*

Sr. No.	Order	Family	Common Name	Scientific Name	IUCN Status
489	Strigiformes	Strigidae	Tawny fish Owl	*Ketupa flavipes*	*LC*
490	Strigiformes	Strigidae	Asian Barred Owlet	*Glaucidium cuculoides*	*LC*
491	Strigiformes	Strigidae	Jungle Owlet	*Glaucidium radiatum*	*LC*
492	Strigiformes	Strigidae	Collared Owlet	*Glaucidium brodiei*	*LC*
493	Strigiformes	Strigidae	Spotted Owlet	*Athene brama*	*LC*
494	Strigiformes	Strigidae	Brown hawk Owl	*Ninox scutulata*	LC
495	Strigiformes	Strigidae	Short -eared Owl	*Asio flammeus*	LC
496	Strigiformes	Tytonidae	Grass Owl	*Tyto capensis*	LC
497	Strigiformes	Tytonidae	Barn Owl	*Tyto alba*	LC
498	Trogoniformes	Trogonidea	Red -headed Trogon	*Harpactes erythrocephalus*	LC
499	Podicipediformes	Podicibedidae	Little Grebe	*Tachybaptus ruficollis*	LC
500	Podicipediformes	Podicibedidae	Great Crested Grebe	*Podiceps cristatus*	LC
501	Podicipediformes	Podicibedidae	Black-necked Grebe	*Podiceps nigricollis*	LC

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ASSAM STATE BIO-DIVERSITY BOARD

ECOSYSTEM SERVICE REVIEW REPORT AND BIODIVERSITY MANAGEMENT PLAN

ECOSYSTEM SERVICE REVIEW REPORT AND BIODIVERSITY MANAGEMENT PLAN

Ecosystem Services Review

Ecosystems provide businesses — as well as people and communities—with a wide range of goods and services. For example, woodlands supply timber and wood fibre, regulate climate by absorbing carbon dioxide, and yield genetic resources for medicines. Coral reefs attract tourists, serve as nurseries for commercial fish species, and protect properties along coastlines from storm surges. Wetlands absorb waste, help reduce floods and purify water. These and other benefits from nature are known as “ecosystem services”.

Categories of Ecosystem Services

The Millennium Ecosystem Assessment shed light on the importance of ecosystem services for human well-being and business development. Its findings provide the first state-of-the-art scientific evaluation of the condition and trends in the world’s ecosystems and the services they provide, as well as the scientific basis for action to conserve and use them sustainably. The Assessment defined four categories of services:

- **Provisioning services:** The goods or products obtained from ecosystems such as food, fresh water, timber, and fibre.
- **Regulating services:** The benefits obtained from an ecosystem’s control of natural processes such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards. “Regulating” in this context is a natural phenomenon and is not to be confused with government policies or regulations.
- **Cultural services:** The nonmaterial benefits obtained from ecosystems such as recreation, spiritual values, and aesthetic enjoyment.
- **Supporting services:** The natural processes such as nutrient cycling and primary production that maintain the other services

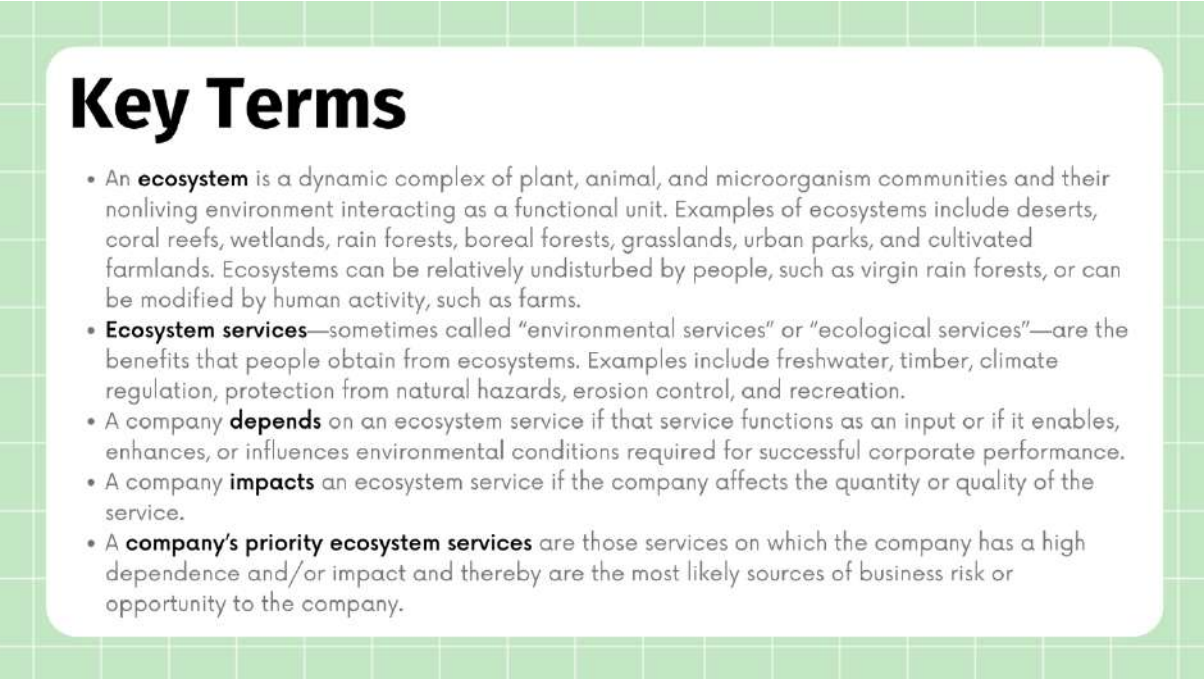


Figure 62 : Summary on Ecosystem and Ecosystem services

Ecosystems provide businesses with numerous benefits or "ecosystem services." Forests supply timber and wood fibre, purify water, regulate climate, and yield genetic resources. River systems provide fresh water, power, and recreation. Coastal wetlands filter waste, mitigate floods and serve as nurseries for commercial fisheries. However, human activities are rapidly degrading these and other ecosystems. The Millennium Ecosystem Assessment— the first global audit of the world's forests, wetlands, and other ecosystems—found that ecosystems have declined more rapidly and extensively over the past 50 years than at any other comparable time in human history. Global climate change and the demands of a growing population are likely to further degrade ecosystems in coming years, increasingly challenging business assumptions and practices.

Tea Estates for the majority of the Habitat in the study area

Ecosystem degradation is highly relevant to business because companies not only impact ecosystems and the services they provide but also depend on them. Ecosystem degradation, therefore, can pose a number of risks to corporate performance as well as create new business opportunities. The opportunities and risks related to the business includes:

- **Operational**: It relates to the day-to-day activities, expenditures, and processes of the company.
- **Regulatory and Legal**: It relates to the laws, government policies, and court actions that can affect corporate performance.
- **Reputational**: It relates to the company's brand, image, or relationship with customers, public, and other stakeholders.
- **Market and Product**: It relates to product and service offerings, customer preferences, and other market factors that can affect corporate performance.
- **Financing**: It relates to the cost and availability of capital from investors.

Many companies are not fully aware of the extent of their dependence and impact on ecosystems and the possible ramifications. This chapter details the list of priority ecosystem services for Oil India Limited and enlists dependencies and impacts of the operations on the same. A Corporate Ecosystem Services Review is used as a tool to accomplish the said objective. The corporate ecosystem services review (ESR) consists of a structured methodology that helps managers proactively develop strategies to manage business risks and opportunities arising from their company's dependence and impact on ecosystems. The Ecosystem Services Review can provide value to businesses in industries that directly interact with ecosystems such as agriculture, beverages, water services, forestry, electricity, oil, gas, mining, and tourism.

Figure 63 : Developers of Corporate Ecosystem Service Review

Figure 64 : Local communities use floral diversity for livestock

Methodology

Figure 65 : Methodology of Ecosystem Service Review

Results

Oil and gas provisioning service dependencies include the use of water, aggregates and timber for consumption by staff, and for the construction and operation of facilities. Oil and gas regulating service dependencies are typically more indirect and include a range of physical functions provided by vegetation and habitats such as erosion control, water filtration and flood control. Although not exactly an operational dependency, cultural services can be important for remotely operating workforces that can benefit in terms of enjoyment, health and motivation, from activities such as ecotourism and bird watching, and simply from appreciating the surrounding undisturbed landscapes.

Step 1: Select the Scope

The first step is to select the "scope" of the ESR. The purpose of this step is to define clear boundaries within which to conduct analysis. This helps to keep the process manageable and yield results that are more actionable.

An ESR for Oil India Limited will be focused on the company's operations in the project area and the dependencies of the locals on the ecosystem services used by both. Both planned and unplanned operations of Baghjan PML - ERD Surface Locations were screened and analysed for all possible dependencies and impacts. The aspects of company operations taken into consideration for defining the scope includes:

1. ERD surface locations – PAD1, PAD2, PAD3
2. ERD subsurface locations – Well locations A, B, C, D, E, F
3. 10 km project buffer area - A combination of an area within a 10 km radius from the boundaries of PAD 1, PAD 2 and PAD 3

Step 2: Identification of Priority Ecosystem Services

Listing of Ecosystem Services

Following are the ecosystem services that are relished by Baghjan Petroleum Mining Lease (PML), Oil India Limited & the local community in the area:

Table 39 : Identification of Priority Ecosystem Services; Relevance to OIL India Limited and Local Community

Service	Description	Relevance to Oil India Limited	Relevance to local community
A. Provisional Services: The goods/products obtained from ecosystems			
1. Crop	Cultivated plants and agricultural produce harvested for human consumption as food	Use of food from local areas for employees	Use of cultivated & agricultural produce for the local community
			Use of Tea harvest for small and large businesses and household purposes

Service	Description	Relevance to Oil India Limited	Relevance to local community
2. Capture fisheries	Wild fish captured through boats and other non-farming methods	Use of fish from local areas for employees	Fish populations serve as a regulator of food webs and can influence the community structure of other species and regulate pests and diseases. Use of fish for small and large fisheries businesses by local fishermen
3. Wild foods	Edible plant and animal species gathered or captured in the wild.		Use of edible plants and fruits for the local community
4. Timber and other wood fibre	Products made from trees, harvested from forest ecosystems, plantations or non-forested lands	The wood used for furniture and other accessories	Use of Bamboo, cane[40] and Areca Nut Leaf [41] in crafts making such as Household furniture & tools (Baskets, mats, fans, *Jappi* - hats, umbrellas etc.) Fishing Tools (*Polo, Jakai, Khalai, Dori, Chepa, Paran, Jhuti, Hogra*), Musical Instruments (Cymbals) and folk medicine etc.
5. Fibres and resins	Non-wood and nonfuel fibres and resins extracted from the natural environment.		Use of silk in making traditional handloom silk products
			Use of water hyacinth in craft making as a cost-effective

[40] https://ignca.gov.in/divisionss/janapada-sampada/northeastern-regional-centre/bamboo-and-cane-culture-of-assam/

[41] https://industriescom.assam.gov.in/portlet-innerpage/present-handicrafts-industries-in-assam#main6

Service	Description	Relevance to Oil India Limited	Relevance to local community
			alternative to cane
6. Ornamental resources	Ecosystem-derived products that serve aesthetic purposes.		Use of wild orchids & other such species in the religious festivities
7. Freshwater	Inland bodies of water, groundwater, rainwater and surface water for household and industrial uses	The water requirement would be 5m^3 per day of water for construction and 3m^3 per day for workers during the construction phase will be derived from groundwater.	Use of Dibru River freshwater for drinking, cleaning, cooling etc.
		10m^3 per day will be used for domestic purposes including drinking; washings and domestic use will be met through packaged drinking water	Use of Maguri & Dibru river streams as a mode of transportation
		Surface water runoff from dredged materials to land/stream	Assimilation service of rivers, soils, etc. disposing of liquid and solid wastes.
		Treated wastewater will be discharged into the surface waterbody	
		Use of water to control fires in case of accidental	
		Use of water for cooling and controlling the dust emissions on roads	
B. Regulatory Services: The benefits from an ecosystem's control of the natural			

Service	Description	Relevance to Oil India Limited	Relevance to local community
process			
8. Maintenance of Air Quality	Influence the ecosystem has on air quality by acting as a source or sinks for the chemicals/pollutants	Green areas will filter and trap emitted air pollutants from DG sets & flaring will include CO2, carbon particles (soot), unburnt hydrocarbons, CO and other partially burned or altered hydrocarbons, NOx.	Existing homestead tree cultivations and forested areas will filter and trap emitted air pollutants & dust from vehicular movement
		Surface waterbody to act as a sink for emitted Sulphur compounds in case of probable accidental leakage of gas/ liquid hydro-carbons due to failure of safety devices	
		Compensatory plantation for clearing of vegetation for oil well and oil pad	
9. Regional/local climate regulation	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Forests such as DSNP & BBPWLS can capture carbon dioxide produced in the process, increased cooling through evapotranspiration	Forests such as DSNP & BBPWLS play an important role in regulating air quality by removing pollutants from the atmosphere.
		Ambient noise and air quality will be affected only for a short period.	Fisheries and aquaculture are directly impacted by water and air temperature
		Possible impacts on biodiversity of DSNP, BBPWLS & Maguri	

Service	Description	Relevance to Oil India Limited	Relevance to local community
		Beel in case of extreme events	
10. Erosion Control	Role Ecosystem play in retaining and replenishing soil		Cultivated vegetation cover prevents soil erosion and ensures soil fertility through natural biological processes such as nitrogen fixation
			Animal excreta can be an important source of nutrients and maintain soil fertility in grazed grasslands and croplands
11. Water Purification and waste treatment	Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes.	The presence of the Maguri Beel wetland will help absorb & remove harmful pollutants from water by trapping metals & organic materials	Trees contribute heavily to wastewater treatment through their root system and their role in nutrient cycling.
		Run-off and treated wastewater discharge from the ERD surface locations may reach Dibru River through several small channels of the wetland and may affect the aquatic ecology.	Fishes, molluscs, and other aquatic animals as well as fish habitats are key to functional wetlands which are the main natural waste-water treatment mechanism
		Assimilation services (e.g. dilution and microbial action) to help break down and disperse oil and chemicals in case of accidental events	Water filtration service to provide clean water

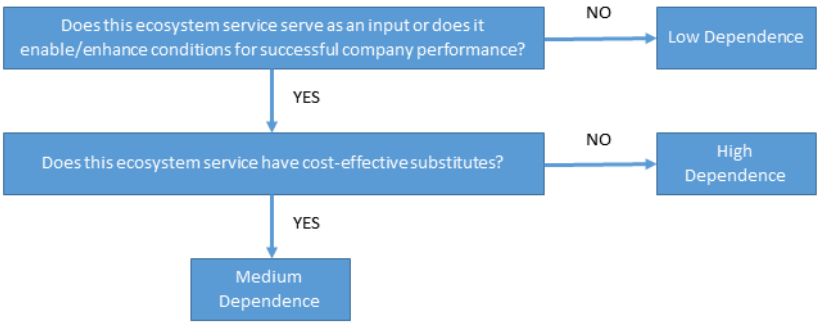
Service	Description	Relevance to Oil India Limited	Relevance to local community
12. Maintenance of soil quality	Role ecosystems play in sustaining soil's biological activity, diversity and productivity; in regulating and partitioning water and solute flow; and, in storing and recycling nutrients and gases.		Animal excreta can be an important source of nutrients and maintain soil fertility in grazed grasslands and croplands
13. Pollination	Role ecosystems play in transferring pollen from male to female flower parts.		The presence of pollinator species such as birds, butterflies & bats aids in pollination in the cultivated lands (homestead and tea plantation) providing food security
C. Cultural Services: The non-material benefits from the ecosystems			
14. Recreational and Ecotourism	Recreational pleasures people obtain from natural or cultivated ecosystems	Presence of lawns and gardens for the staff	Ecotourism through hiking, camping, and birdwatching in the DSNP, and BBPWLS areas.
			Using Dibru river streams for recreational purposes –houseboats, water sports, and boat rides etc.
			Boat safaris in Maguri Beel and Dibru Saikhowa National Park

Service	Description	Relevance to Oil India Limited	Relevance to local community
15. Ethical and spiritual values	Spiritual, religious, aesthetic, intrinsic, existence or other values people attach to ecosystems, landscapes, or species.		Community-driven actions and Homestead plantations to protect endangered species and rare habitats of the area such as Barekuri Villages for Hoolock Gibbon
D. Supporting Services: The natural process that maintains the ecosystem services			
16. Habitat	Natural or Semi Natural spaces that maintain species population and protect the capacity of ecological communities to recover the disturbance	The presence of Forests and Riverine Habitats around Baghjan PML provides good habitat for native species of the area. In addition, Tea estates also act as a great wildlife corridor.	The presence of Forests and Riverine Habitats in and around the study area provides good habitat for native species of the area. In addition, Tea estates also act as a great wildlife corridor.

Prioritization of identified ecosystem services

The second step is to evaluate in a structured yet rapid manner the company's and the local community's dependence and impact on ecosystem services. This evaluation will help identify which of these are "priority" services—the ones most likely to be a source of risk or opportunity for the company. These priority ecosystem services are the focus of analysis in subsequent steps; the other services are screened out. To identify its priority services, a company needs to understand its level of dependence and impact on each ecosystem service along with the dependence of the local community on that ecosystem. This is because the ecosystem services that are sources of business risk or opportunity typically are those that the company highly depends upon and/or highly impacts.
There are two steps in this process:

a. Evaluating dependence: The following process is used to identify the dependence of the business operations on ecosystem services



b. Evaluating impact: Following the flow chart below, the impacts on the ecosystem services can be evaluated.

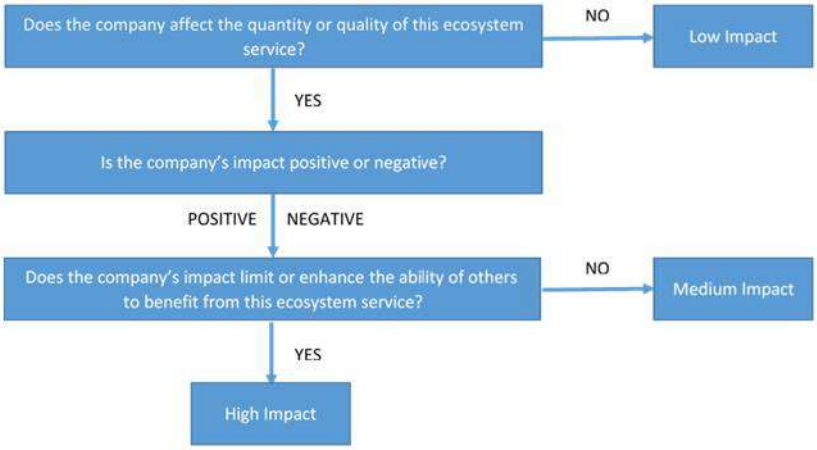


Figure 66 : Ecosystem Dependence and Impact Evaluation Flow Chart

Taking in account the dependence of both company and community and followed by the impact of company on the ecosystem services, the priority ecosystems are determined.

Prioritization in Oil India Limited:

Table 40 : Company Dependence and Impact on the Ecosystem Services

Company	Oil India Limited, Tinsukia, Assam	Company DEPENDENCE on ecosystem services				Company IMPACT on ecosystem services			
Assessment Scope	Company Operations	1	2			3	4	5	
Product/unit/ market:	Oil and gas exploration, development and production	Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful company performance? If "no" skip to question 3	Does this ecosystem service have cost-effective substitutes?	Comments or supporting information		Does the company affect the quantity or quality of this ecosystem service? If "no" skip to the next service	Is the company's impact positive or negative? -Positive: The company increases the quantity or quality of this ecosystem -Negative: The company decreases the quantity or quality of this ecosystem	Does the company's impact limit or enhance the ability of others to benefit from this ecosystem service?	Comments or supporting information
Ecosystem Services	Definitions								
Provisional Services									

1. Crop	Cultivated plants and agricultural produce harvested for human consumption as food	No	NA	Although food from local areas is provided to employees, it does not enhance the performance of the company.		Yes	Negative	Yes	Land under tea cultivation and vegetation is used for creating PADs - ERD Surface locations, it is a direct impact on this ecosystem.
2. Capture fisheries	Wild fish captured through boats and other non-farming methods	No	NA	Although food from local areas is provided to employees, it does not enhance the performance of the company.		Yes	Negative	Yes	As per the discussions with locals, there is a possibility of low fish catch during the project period.
3. Wild foods	Edible plant and animal species gathered or captured in the wild.	No	NA	No direct dependencies		No	NA	NA	No impact due to company operations
4. Timber and other wood fibre	Products made from trees, harvested from forest ecosystems, plantations or	No	NA	Wooden products used for furniture and other accessories		No	NA	NA	No impact due to company operations

	non-forested lands								
5. Fibres and resins	Non-wood and nonfuel fibres and resins extracted from the natural environment.	No	NA	No direct dependencies		No	NA	NA	No impact due to company operations
6. Ornamental resources	Ecosystem-derived products that serve aesthetic purposes.	No	NA	No direct dependencies		No	NA	NA	No impact due to company operations
7. Freshwater	Inland bodies of water, groundwater, rainwater and surface water for household and industrial uses	Yes	No	Groundwater is used for industrial and domestic purposes as well as for controlling accidental fires.		Yes	Negative	Yes	Freshwater is the most important ecosystem service for the company as the operations of OIL are dependent on freshwater. Operations and Decommissioning activities will have negative impact on Maguri Motapung Beel and Dibru-

								Saikhowa National Parks
Regulatory Services								
8. Maintenance of Air Quality	Influence the ecosystem has on air quality by acting as a source or sinks for the chemicals/pollutants	Yes	No	Green & blue spaces are required for pollution absorption through company operations, this will be a direct impact		Yes	Negative	Yes	Green & blue areas will act as a filter to absorb the pollutants resealed during company operations. Air pollutants may affect wildlife and possible mortality.
9. Regional/local climate regulation	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Yes	No	Forests such as DSNP and BBPWLS can capture CO_2 and increase cooling through evapotranspiration.		Yes	Negative	Yes	Possible impacts on biodiversity of DSNP, BBPWLS & Maguri Beel in case of extreme events Air pollutants have an effect on agricultural/cultivated crops
10. Erosion Control	Role Ecosystem play in retaining and replenishing soil	No	NA	No direct dependencies		Yes	Negative	Yes	Site clearance and stripping of topsoil during site construction may result in an increase in soil erosion and loss of

								fertile soil
11. Water Purification and waste treatment	Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes.	Yes	No	The presence of the Maguri Beel wetland will help absorb & remove harmful pollutants from water by trapping metals & organic materials. Run-off and treated wastewater discharge from the ERD surface locations may reach Dibru River through several small channels of the wetland and may affect the aquatic		Yes	Negative	Yes	Wastewater and formation water will be generated during drilling activity and the domestic wastewater from the labour camps may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality.

				ecology.				
12. Maintenance of soil quality	Role ecosystems play in sustaining soil's biological activity, diversity and productivity; in regulating and partitioning water and solute flow; and, in storing and recycling nutrients and gases.	No	NA	No direct dependencies		Yes	Negative	Yes	Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, e-waste and municipal waste affects the soil microbes and bacterial growth and can affect the soil quality
13. Pollination	Role ecosystems play in transferring pollen from male to female flower	No	NA	No direct dependencies		No	NA	NA	No impact due to company operations

	parts.								
Cultural Services									
14. Recreational and Ecotourism	Recreational pleasures people obtain from natural or cultivated ecosystems	No	NA	No direct dependencies		Yes	Negative	Yes	In case of extreme events, ecotourism in these regions will come to a stop, until the ecosystem recovers.
15. Ethical and spiritual values	Spiritual, religious, aesthetic, intrinsic, existence or other values people attach to ecosystems, landscapes, or species.	No	NA	No direct dependencies		No	NA	NA	No impact due to company operations
Supporting Services									

16. Habitat	Natural or Semi Natural spaces that maintain species population and protect the capacity of ecological communities to recover the disturbance	Yes	No	Baghjan PLM is majorly surrounded by forests and riverine habitats supporting native and migratory species of the region. The company is dependent on this land for hydrocarbon exploration.		Yes	Negative	Yes	Since the habitat is or will be used for exploration activity, change in land use will result in a change in species composition along with loss of native vegetation.

Prioritization for local communities in the project area as per interactions with locals

Table 41 : Local community's Dependence and Impact on Ecosystem Services

Company	**Oil India Limited, Tinsukia, Assam**	**Local community's DEPENDENCE on ecosystem services**				**Local community's IMPACT on ecosystem services**			
Assessment Scope	**Local Community's tasks**	**1**	**2**			**3**	**4**	**5**	

Product/unit/market:	Oil and gas exploration, development and production	Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful community performance? If "no" skip to question 3	Does this ecosystem service have cost-effective substitutes?	Comments or supporting information		Does the community affect the quantity or quality of this ecosystem service? If "no" skip to the next service	Is the community's impact positive or negative? -Positive: The community increases the quantity or quality of this ecosystem -Negative: The community decreases the quantity or quality of this ecosyste m	Does the community 's impact limit or enhance the ability of others to benefit from this ecosystem service?	Comments or supporting information
Ecosystem Services	Definitions								
Provisional Services									

1. Crop	Cultivated plants and agricultural produce harvested for human consumption as food	Yes	No	The local community is dependent on agricultural and cultivation produce. The land to be cleared for one of the PADs – ERD surface locations has ongoing Tea Cultivation.		Yes	Negative	Yes	Excessive use of pesticides and mono cultivation, and the inclusion of invasive species in cultivation can affect the cropland/soil quality of Tea Estates and can have negative effects on the ecosystem. Landscape homogenisation can decrease natural pollination
2. Capture fisheries	Wild fish captured through boats and other non-farming methods	Yes	No	The fishermen's community is dependent on various species of fish in this region.		Yes	Negative	Yes	Overfishing may have a devastating impact on aquatic communities as it destabilizes the food chain and destroys the natural habitats of many aquatic species. Inefficient engines can discharge unburned fuel or oil directly into the water harming underwater creatures, fish embryos as well as avifauna.

3. Wild foods	Edible plant and animal species gathered or captured in the wild.	Yes	No	The local community is dependent on edible plants and fruits from this ecosystem.		No	NA	NA	No direct impacts on the ecosystem.
4. Timber and other wood fibre	Products made from trees, harvested from forest ecosystems, plantations or non-forested lands	Yes	Yes	The local community's small bamboo and cane crafts businesses are dependent on this ecosystem.		Yes	Negative	Yes	Overuse of Bamboo, Areca Nut Leaf and Cane can have an adverse impact on forests. Depletion of Cane in the forest areas has hampered the traditional cane & bamboo sector of the North Eastern Region. Hence the introduction of processed raw material from water hyacinth has thus facilitated an alternative and viable option as suggested by NEDFi[42] Bamboo forests form a major connectivity to reach the homestead/protected habitats for Hoolock Gibbon, cutting these

[42] https://industriescom.assam.gov.in/portlet-innerpage/present-handicrafts-industries-in-assam

									bamboos and habitat trees for wood isolates these species
5. Fibres and resins	Non-wood and nonfuel fibres and resins extracted from the natural environment.	Yes	No	The local community uses silk to produce handloom silk products. Hence, there is a direct dependency on this ecosystem as it generates livelihood opportunities.		No	NA	NA	There is no direct impact.
6. Ornamental resources	Ecosystem-derived products that serve aesthetic purposes.	Yes	No	Use of wild orchids & other such species in the religious festivities		No	NA	NA	There is no direct impact.
7. Freshwater	Inland bodies of water, groundwater, rainwater and surface water for household and industrial uses	Yes	No	Dibru river and Maguri streams are used for household work and transportation. Groundwater is also used for household work. Crops and		Yes	Negative	No	Freshwater is the most important ecosystem service for the community as they are dependent on freshwater, cascading low impact on the ecosystem. The study area does not fall in a water-scarce region.[43]

[43] https://indiawris.gov.in/wris/#/groundWater

				Livestock are heavily dependent on freshwater.					
Regulatory Services									
8. Maintenance of Air Quality	Influence the ecosystem has on air quality by acting as a source or sinks for the chemicals/pollutants	Yes	No	Existing homestead tree cultivations and forested areas will filter and trap emitted air pollutants & dust from vehicular movement		Yes	Positive and Negative	Yes	Natural Green areas and community-driven and individual homestead plantations bring a positive impact in reducing air pollutant exposure and act as a barrier from dust from vehicular movement. Indoor air pollution caused by burning traditional fuels such as dung, wood and crop residues may affect the ecosystem
9. Regional/local climate regulation	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Yes	No	Forests such as DSNP & BBPWLS play an important role in regulating air quality by removing pollutants from the atmosphere.		Yes	Positive	Yes	Community-driven and individual homestead plantations bring a positive impact in regulating local climates

10. Erosion Control	Role Ecosystem play in retaining and replenishing soil	Yes	No	Cultivated vegetation cover prevents soil erosion and ensures soil fertility through natural biological processes such as nitrogen fixation Animal excreta can be an important source of nutrients and maintain soil		No	NA	NA	No direct impacts on this ecosystem
11. Water Purification and waste treatment	Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes.	No	NA	NA		Yes	Negative	Yes	Wastewater generated during domestic activity from the settlements may contain chemical and biological contaminants. If discharged untreated/unfiltered may adversely affect the surface water quality and can spread disease. Surface runoff from tea estates based at Dibru riverbed contains fertilizers and pesticides

12. Maintenance of soil quality	Role ecosystems play in sustaining soil's biological activity, diversity and productivity; in regulating and partitioning water and solute flow; and, in storing and recycling nutrients and gases.	Yes	No	Mulch from unused tea leaves and excreta from livestock provide a good source of soil nutrients		Yes	Positive and negative	No	Soil quality is restored when the agricultural lands are kept for grazing alternatively with paddy Excessive use of fertilizers and pesticides on tea estates impacts this ecosystem
13. Pollination	Role ecosystems play in transferring pollen from male to female flower parts.	No	NA	No direct dependency		Yes	Negative	Yes	Although pollinators are essential for orchard, horticultural and forage production, excessive landscape homogenisation can decrease natural pollination
Cultural Services									
14. Recreational and Ecotourism	Recreational pleasures people obtain from natural or cultivated ecosystems	Yes	No	Ecotourism through hiking, camping, and birdwatching in the DSNP, and BBPWLS areas. Using Dibru river		Yes	Positive	Yes	Enjoyment of nature attracts many travellers across country. This cultural ecosystem service offers both benefits to visitors and livelihood opportunities for

				streams for recreational purposes – houseboats, water sports, boat rides etc. Boat safaris in Maguri Beel and Dibru Saikhowa NP					ecotourism service providers.
15. Ethical and spiritual values	Spiritual, religious, aesthetic, intrinsic, existence or other values people attach to ecosystems, landscapes, or species.	Yes	No	Community efforts add to the conservation of native rare biodiversity Agriculturally related diets and harvest festivals such as Magh Bihu are central to religious communities of the area. During Kati Bihu, lamps are placed high on bamboo poles to attract insects or pests in the fields and to keep the crops		Yes	Positive	Yes	Community-driven actions and Homestead plantations to protect endangered species and rare habitats of the area such as Barekuri Villages for Hoolock Gibbon enhance biodiversity. Traditional Knowledge used in agricultural practices, help to maintain ecosystem balance.

				healthy.[44]					
Supporting Services									
16. Habitat	Natural or Semi Natural spaces that maintain species population and protect the capacity of ecological communities to recover the disturbance	Yes	No	The project area is majorly surrounded by forests and riverine habitats supporting native and migratory species of the region. The local community is dependent on the forests and surface/groundwater resources heavily for living and cattle grazing		Yes	Negative	Yes	There is a possibility of depletion in biological diversity due to agricultural and tea estate expansion, leading to changes in land use patterns. Low diversity in the homestead gardens than in the natural habitats.

[44] https://assam.gov.in/about-us/399

Summary of Ecosystem Services Dependence and Impact Matrix

Above two tables, illustrate the dependencies and impacts of both the OIL and the community have on the ecosystems.

Table 42 : Ecosystem Services Dependence and Impact Matrix

Ecosystem Services	Oil India Limited's Operations		Local Community's tasks	
	Dependence	Impact	Dependence	Impact
Provisioning				
Crop		● -	●	● -
Capture Fisheries		● -	●	● -
Wild food			●	
Timber and Other Wood Products			○	● -
Fibres and resins			●	
Ornamental Resources			●	
Freshwater	●	● -	●	○ -
Regulating				
Maintenance of Air Quality	●	● -	●	● +/-
Regional/local climate regulation	●	● -	●	● +
Erosion Control		● -	●	
Water Purification and waste treatment	●	● -		● -
Maintenance of soil quality		● -	●	○ +/-
Pollination				● -
Cultural and Aesthetic				
Recreational and Ecotourism		● -	●	● +
Ethical and spiritual values			●	● +
Supporting				
Habitat	●	● -	●	● -
Key: ● High	**+ Positive impact**			
○ Medium	**- Negative impact**			
Low	**? Don't know**			

Step 3: Analyse Trends in Priority Ecosystem Services

In order to shortlist the priority ecosystem services for Oil India Limited, the dependencies of both Oil India Limited & local community and impacts of Oil India Limited's operations has been considered. The shortlisted priority ecosystem services are as follows:

- Freshwater
- Maintenance of Air Quality
- Regional/local climate regulation
- Habitat

Freshwater

Oil is dependent on the ground water for its operations. The water requirement would be 5m^3 per day of water for construction and 3m^3 per day for workers during the construction phase will be derived from groundwater. 10m^3 per day will be used for domestic purposes including drinking; washings and domestic use will be met through packaged drinking water. Surface water runoff as well as Treated wastewater will be reaching surface waterbody and may impact on aquatic ecology. OIL is also dependant on water to control fires in case of accidental. Water will also be used for cooling and controlling the dust emissions on roads.

Communities use freshwater for drinking, and other household purposes as well as for mode of transportation. Maguri beels is surrounded by Tea estates on one side and banks of Dibru River are dominated by them. Tea gardens are known to use extensive pesticides and other chemicals, which ultimately drains into the waterbodies. These types of chemicals drained into the waterbody doesn't only prove harmful to aquatic life but also possess a danger of entering into food chain and causing long term damage.

Dibru River and Maguri Motapung Beel are recognized for its populations of endemic and migratory birds and protected species. Even though the study area does not fall in the water scarce region overuse of these resources may add pressure on this ecosystem. It is recommended to conserve these areas in order to protect its diversity.

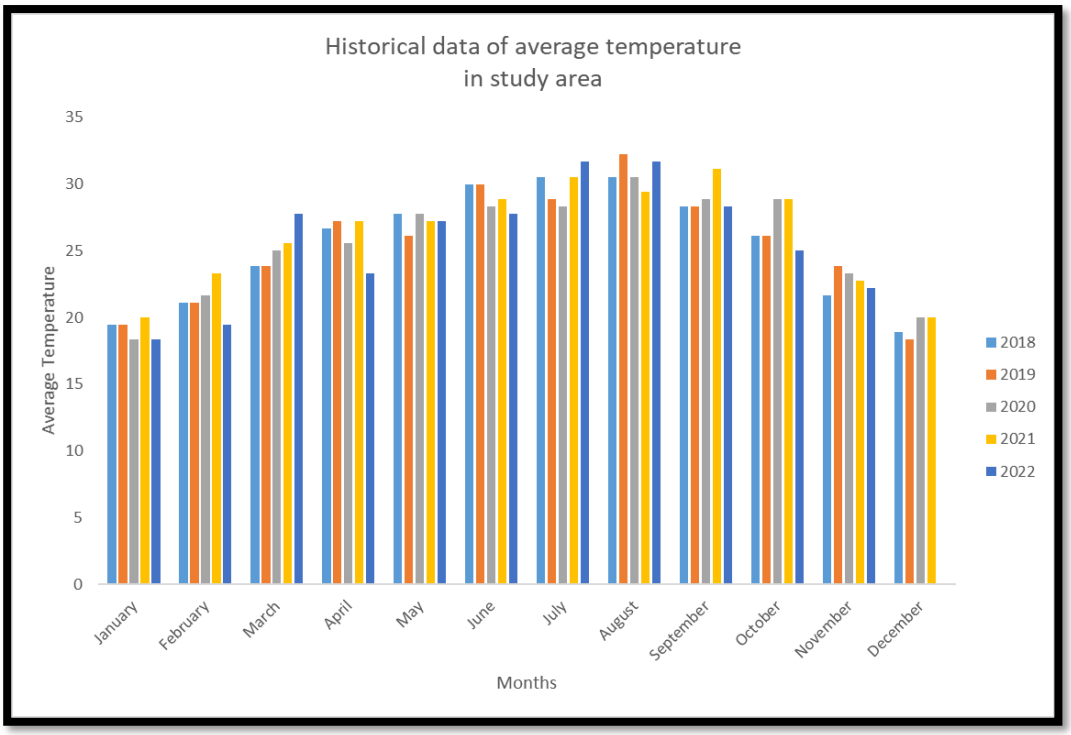
Regional/local climate regulation

The study area is surrounded by DSNP, BBPWLS & Maguri Beel primarily in the rural environmental setting. These areas nestle variety of trees and wetland ecosystems that aid in climate regulation. They can impact regional rainfall levels. Forests such as DSNP can help in absorbing CO_2, carbon particles (soot), unburnt hydrocarbons, CO and other partially burned or altered hydrocarbons, NOx, they play an important role in regulating air quality by removing pollutants from the atmosphere. In case of extreme events, there is a possibility of impacts on biodiversity of DSNP, BBPWLS & Maguri Beel holds and may have long-term implications. The air pollutants may have effects on agricultural/cultivated crops.

Community-driven and individual homestead plantations bring a positive impact in regulating local climates. Forests such as DSNP and BBPWLS can capture CO_2 and increase cooling through evapotranspiration.

Following graph shows historical data of average temperatures in the study area from 2018 to 2022[45], sourced from World Weather. Monthly variations and yearly variations are shown in the graph:

[45] *https://world-weather.info/forecast/india/duliajan_oil_town/*



Source: World Weather

Figure 67 : Historical data of average temperature in study area

Maintenance of Air Quality

The study area is primarily in the rural environmental setting. The potential sources of emission to air include emission from dust and fugitive emissions, operation of DG sets and Flaring and plying of vehicles at the dilapidated roads within the study area. There is absence of other major industries in the study area.

The operation of DG sets, movement of vehicles and machineries during construction and drilling at drill sites will result in the generation of air pollutants viz. PM, NOx and SOx, which may affect the ambient air quality temporarily. Air pollutants like soot and NOx will also be generated as a result of flaring of natural gas, if gas reserves are encountered during drilling operations. These air pollutants can affect the biodiversity of surrounding areas.

Surrounding green & blue areas such as Dibru - Saikhowa Complex and Bherjan-Borajan-Podumoni Wildlife Sanctuary and Maguri Motapung Beel connecting to Dibru River will act as a filter to absorb the pollutants resealed during company operations. Air pollutants may affect wildlife and possible mortality. These spaces are essential for pollution absorption through company operations. As they support a large variety of biodiversity.

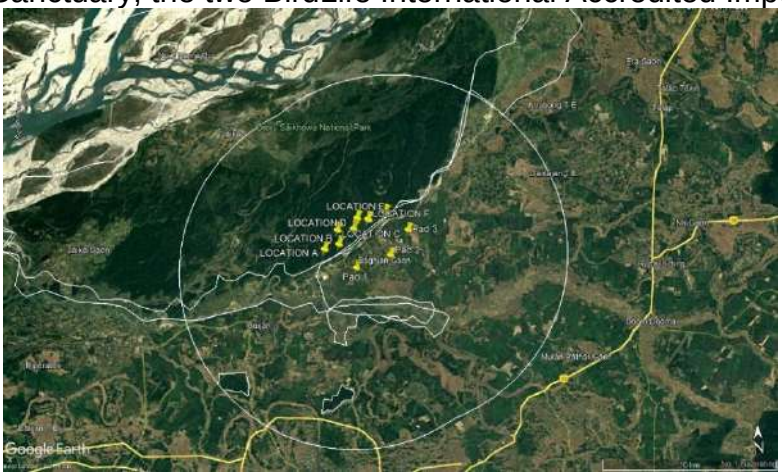
The local community driven and individual homestead plantations and natural green areas bring a positive impact in reducing air pollutant exposure and act as a barrier from dust from vehicular movement. Indoor air pollution caused by burning traditional fuels such as dung, wood and crop residues may affect the ecosystem. Existing homestead tree cultivations and forested areas will filter and trap emitted air pollutants & dust from vehicular movement.

Around 75 sq.km. The Petroleum Exploration License (PEL) area has been converted into Baghjan Mining Lease (ML) and OIL has so far drilled 19 wells. In the recent EIA conducted by ERM, ambient air quality was monitored in Baghjan, Kesharuguri,

Daimuli, Bagaltoli, Guijan, Jkaishuk villages. The baseline values of the parameters monitored have complied to National Ambient Air Quality Standards (NAAQS)[46] of residential, commercial and industrial areas across all locations. Presence of surrounding green areas help in maintaining the air quality.

Habitat

The study area falls in North East Region biogeographic zone[47], which is characterized by Tropical Evergreen Forest, Tropical Semi Evergreen Forest and Seasonal swamp forests. The ERD surface and subsurface locations fall within the depositional plains of the River Brahmaputra and its tributaries. The study area comprises different types of habitats such as Forest, Tea Plantation, Waterbody, Cropland, Homestead Plantation, Built up and Open land. This area supports rare and valuable fauna and flora from Dibru - Saikhowa Complex and Bherjan-Borajan-Podumoni Wildlife Sanctuary, the two BirdLife International Accredited Important Birding Sites (IBA).



November 1986

July 1995

☜ *On the left hand side, a series of Google Earth Imageries are provided along with month/year and the study area boundaries.*

The Dibru Saikhowa Complex was once a large tract of tropical rain forest but during the earthquakes of 1950, a large part of the sanctuary sank by a few metres, resulting in regular flooding. The natural vegetation gradually changed and now the woodland is a tropical

[46] *http://www.moef.nic.in/sites/default/files/notification/Recved%20national.pdf*

[47] *Rodgers, W.A. and Panwar, S.H. (1988) Biogeographical classification of India. New Forest, Dehra Dun, India.*

January 2003

June 2015

April 2022

deciduous type[48]. Through Google Earth Imagery, changes in the floodplains of Brahmaputra and Dibru River are clearly visible. There have been seasonal changes in the Beel expanse.

From 1991 to 2022, the land use has seen an increase in the agricultural lands as well as dense forest areas. [49]

Habitats of Bherjan Bhorjan Podumoni Wildlife sanctuary, Maguri Motapung Beel, Dibru-Saikhowa Complex along with many homestead plantations such as Barekuri Villages support a good amount of diversity and they need to be conserved. Efforts should be taken to prioritise preservation of these habitats and reduction of human induced disturbance to these sites.

Figure 68 : Google Earth images of Dibru Saikhowa Complex

[48] *Choudhury, A.U. 1994b. A Report on Bird Survey in Dibru-Saikhowa Wildlife Sanctuary, Assam, India. Report to the Oriental Bird Club, UK.*

[49] *https://www.ijitee.org/wp-content/uploads/papers/v9i6/F3814049620.pdf*

Step 4: Identify business risks and opportunities

Table 43 : Potential Risks and Opportunities of the Priority Ecosystem Service

Priority Ecosystem Services	Potential Risks	Potential Opportunities	Types of Risk/Opportunity
Freshwater	Loss of aquatic life due to water contamination can have regulatory, reputational and market risks in case of extreme events.	Opportunity to improve efficiency through optimizing source selection, minimizing resource use and maximizing recycle and reuse. This could reduce costs, reduce waste outputs and reduce the likelihood of conflicts.	Operational Regulatory Reputational Market Risk
Maintenance of Air Quality	Air pollutants may affect wildlife through the disruption of endocrine function, organ injury, increased vulnerability to stresses and diseases; lower reproductive success	Opportunity to maintain and enhance air quality through offset plantation in degraded forest or any other areas.	Regulatory Reputational
Regional/local climate regulation	Loss of endemic biodiversity and habitat due to oil spills and accidental fires. Risk of social unrest and confrontation, from local communities and stakeholders, and claims for compensation in case of extreme events	Opportunity to support management of protected areas. There may be scope to provide support (e.g. technical, management, equipment or financial) to help manage important conservation areas. This could generate important reputational benefits for the company and economic benefits for the community	Operational Reputational Market Risk
Habitat	Loss of species can have regulatory and reputational risks	Efforts taken for conservation of biodiversity the area caters, will aid in increase the reputation	Regulatory Reputational

Biodiversity Management Plan

Biodiversity in an area is most affected by and best conserved by the communities in that area. A community that utilizes the ecosystem and biodiversity services must understand and strive to conserve these components, for sustainable living.
Since the inception of 'National Biodiversity Targets, 2012', Biodiversity is considered an integral part of a measure of national development. Thus, Biodiversity conservation is no longer a secondary responsibility, but an indicator of the growth and development of an organization. To witness the great progress and sustainability of a firm, it is essential to develop and conserve the local biodiversity and involve all the stakeholders in this plan.
The responsibility of dissemination of knowledge and facts regarding biodiversity and the environment in an area naturally falls upon the organizations and individuals who monitor and are aware of these factors. These faculties must engage the resident population periodically, to discuss, enhance and conserve the local biodiversity.
The following Biodiversity Management Plan is a set of site-specific actions for implementation of the oil and gas exploration activity in an ecologically conscious manner for understanding the potential ecological perils arising out of the proposed project and taking appropriate actions to manage them.
Below table illustrates the mitigation hierarchy wise actions to be taken for mitigating the imapcts of the project operations:

Table 44 : Management Plan according to the Mitigation Hierarchy

Mitigation Hierarchy	Management Plan	Impacts mitigated
Avoidance	**Action 1**: **Construction of a green wall along the boundary of the ERD surface locations**	**Impact 1**: There will be an increase in the ambient noise levels in and around the drill sites due to the project activities, which will lead to changes in species abundance, and disruption of species communication, breeding, nesting and roosting patterns.
	Action 2A) Identification and Monitoring of Fish breeding and pools site **Action 2B) Identification and Monitoring of river turtle species** **Action 2C) Third-Party Monitoring of Ganges River Dolphin using Passive acoustic monitoring (PAM)**	**Impact 2**: Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.

Mitigation Hierarchy	Management Plan	Impacts mitigated
	Action 3a) Use of retrofitted emission control equipment for DG sets with duel fuel technology **Action 3b) Water sprinkling for the vehicular dust and fugitive emissions during operations** **Action 3c) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary** **Action 3d) Regular care and maintenance for vehicles and drilling equipment**	**Impact 3:** Air pollutants can affect wildlife through the disruption of endocrine functions, organ injury, increased vulnerability to stresses and diseases; lower reproductive success, and possible mortality.
	Action 7: Increasing the High-Density Polyethylene (HDPE) lined pit wall's height	**Impact 8:** Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.
	Action 9: Construction of floating treatment wetlands and reusing the top soil	**Impact 12:** Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil. **Impact 13:** Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings, which may affect local floral and faunal species and ecosystems.
	Action 11: Prevention of animal - human conflict **Action 11a) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary** **Action 11b) Studying animal mortality due to collision with vehicles**	**Impact 15:** Decreased habitat use and increase in the roadkill of native fauna/ livestock. **Impact 16:** Damage to existing nearby flora

Mitigation Hierarchy	Management Plan	Impacts mitigated
	Action 11c) Installation of reflective signboards **Action 11d) Installation of reflective speed breakers and adding speed limit regulations** **Action 11e) Preventive measures to minimize Human-Animal conflict on encountering wild animals**	
	Action 12: Safe practices using groundwater resources	**Impact 17:** Over use of ground water may lower the ground water table **Impact 18:** During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.
Avoidance and Minimization	**Action 10: Use of dark sky friendly lighting practices**	**Impact 14:** Illumination with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like 1) they might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals
Minimization	**Action 4: Construction of floating treatment wetlands**	**Impact 4:** Wastewater and formation water will be generated during drilling activity and the domestic wastewater from the labour camps, which may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality. **Impact 5:** Surface runoff from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is likely to be contaminated and have the potential to impact the water quality of the receiving waterbody. This will affect the ecologically sensitive areas of

Mitigation Hierarchy	Management Plan	Impacts mitigated
		the waterbody like migratory and resident bird habitats, fish habitats, breeding and nursing ground for fishes, and the habitat of the Gangetic Dolphin. Degradation of water quality will affect the primary productivity of the river.
	Action 5: Solid waste management plan for the ERD locations	**Impact 6:** Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, and e-waste and municipal waste affects the soil microbes and bacterial growth and can affect the soil quality **Impact 9:** Kitchen Waste from Labour camps if not disposed properly can attract rodents, snakes, monkeys etc. that may lead to human wildlife conflict on the site.
	Action 6: Preventive measures for contamination due to accidental spillage	**Impact 7:** Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.
	Action 13: Construction underpass for water below the approach road	**Impact 19:** Alteration of onsite micro drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas, which may affect habitats of reptiles, and mortality of floral species.
Restoration	**Action 14: Restorative Practices after decommissioning**	**Impact 10:** Change in Landuse and species composition along with loss of native vegetation.
Offset	**Action 8: Offset plantations with Native species and offset monitoring.**	**Impact 10:** Change in Landuse and species composition along with loss of native vegetation. **Impact 11:** Faunal dispersal and loss of feeding ground.
In case of extreme events		

Mitigation Hierarchy	Management Plan	Impacts mitigated
Action 15: Formation of wildlife rescue teams and creating a network of veterinary hospitals and refuge sites **Action 16: Clean-up of Oil spill on surface water**		
Additional Conservations Efforts		
Action 17: Connecting fragmented forests and homestead plantations for Hoolock Gibbon populations		

Impact 1: There will be an increase in the ambient noise levels in and around the drill sites due to the project activities, which will lead to changes in species abundance, and disruption of species communication, breeding, nesting and roosting patterns.

Action 1: Construction of a green wall along the boundary of the ERD surface locations

Concept and Approach: The ERD surface locations are located in rural settings of villages namely Baghjan and Dighaltarang. The construction activities such as the transportation of raw materials for civil works, the operation of heavy equipment and construction machinery are likely to cause an increase in the ambient noise levels in and around the drill sites. In the operational phase, noise emissions are expected from operation of drilling rig and ancillary equipment viz. shale shakers, mud pumps and diesel generators. As per the discussion with existing PAD team, the noise will be generated from various operational activities at the ERD surface locations, during the drilling phase, for a period of four months.

During this operations phase, there is a high possibility for a temporary increase in the ambient noise levels in and around the drill sites; affecting biodiversity in the region. It is recommended to construct a tall green wall with the help of climbers and mesh wire on the compound wall of the building as sound can be reflected, absorbed and diffracted (scattered) by plant elements.[50] Green walls are vertical structures that have different types of plants or other greenery attached to them. Construction of a green wall can have ecological and social benefits and it is a sustainable solution for improving the environmental balance while limiting the major negative effects of noise produced.

During the visit to the existing PAD area, various birds, and butterflies were observed crossing through, flying above and within PAD areas while the drilling operations were ongoing. It is strongly recommended that perching sites to be created for faunal species by plantation of native climbers' species along the boundary of the PAD area.

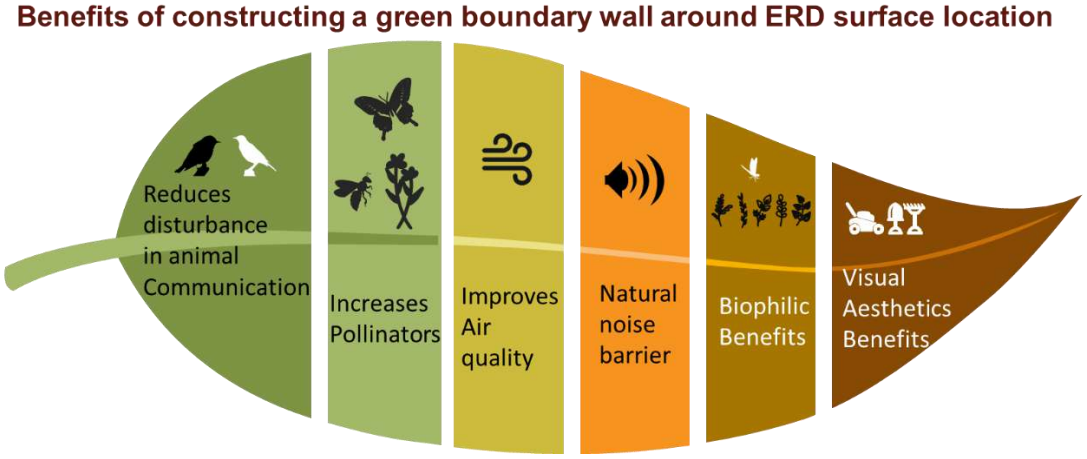


Figure 69 : Benefits of constructing a green boundary wall around ERD surface location

The green wall construction of the periphery of ERD surface locations can provide visual aesthetics as well as biophilic benefits. Green walls can act as a natural noise

[50] *http://innova-eng.eu/proceedings/2017/30.noise%20pollution%20reduction%20and%20control%20provided%20by%20green%20living%20systems%20in%20urban%20areas.pdf*

barrier and can improve the air quality in the area; reduce the disturbance in animal communication. Bringing in natural elements to places where they cannot generally be seen, will have a positive impact on human health.
The plantation of native flowering climbers will lead to increases in the population of pollinators, which can also support agricultural productivity in the surrounding region.

A list of native species suggested for plantation is given below:

Table 45 : List of native species suggested for plantation

Sr. No.	Common Name	Scientific Name	Family
1	Rosary Pea	*Abrus precatorius*	Papilionaceae
3	Indian birthwort	*Aristolochia tagala*	Aristolochiaceae
4	Easter Lily Vine	*Beaumontia grandifloral*	Apocynaceae
5	Harjora	*Byttneria pilosa*	Malvaceae
6	Velvetleaf	*Cissampelos pareira*	Menispermaceae
7	Winged treebine	*Cissus quadrangularis*	Vitaceae
8	Ivy Gourd	*Coccinia grandis*	Cucurbitaceae
9	Giant dodder	*Cuscuta reflexa*	Cuscutaceae
10	Water yam	*Dioscorea alata*	Dioscoreaceae
11	Climbing Lily	*Gloriosa superb*	Liliaceae
12	Common Chinese Mistltoe	*Gymnopetalum cochinchinense*	Cucurbitaceae

Figure 70 : Representative image for construction of a green wall at the periphery of the ERD surface area

Implementation location: Edge or boundary wall of all three ERD Surface locations
Stage of Mitigation Hierarchy: Avoidance
Implementation agency: Oil India Limited's gardening and landscape department, local nursery.
Broad Costing: Rs. 2000 to 3000 per sq. ft.
Benefited Species: Birds, pollinators, climbers (Including species protected under schedules of WPA).

Impact 2: Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.

Action 2: Identification and Monitoring Plan for Fishes, Turtles and Ganges River Dolphin

The exploitation of hydrocarbons requires the construction of a conduit between the surface and the reservoir. This is achieved by the ERD drilling process. The well will be starting from ERD surface locations to crossing the Dibru River and towards the hydrocarbon reserves beneath the DSNP. Noise and vibration will be generated due to the operation of the drilling rig, leading to an increase in the underwater noise and vibration levels in the Dibru River. This may hamper the aquatic biodiversity and in turn, the efficient ecosystem functioning.
Dibru River and DSNP areas are rich in bird life and nestle a variety of biodiversity inclusive of rare, endangered fauna and flora. The river is home to significant aquatic fauna such as the Gangetic River Dolphin (*Plantanista gangetica*), Assam roofed turtle *(Kachuga sylhetensis)* along with various fish species. Hence, it is strongly recommended drilling operations should not be conducted with low water levels as these species might find it difficult to cross the river belts during the high noise and vibration emissions. In case they face find it challenging to cross the river belts, there is a possibility that they may get confined in shallow water pools and will find it arduous to meet their biological necessities.

The following three sub-actions are suggested in order to avoid and mitigate the possible impact of increased underwater noise & vibrations:

Action 2A) Identification and Monitoring of Fish breeding and pools site
Concept and approach: Habitat is the foundation for healthy and productive fisheries. When critical habitats for fish are lost, degraded or altered, their ability to support the life processes of fish may be compromised. For fish that require substrate for spawning, lack of appropriate spawning substrate is inherently limiting and a lack of access to suitable spawning habitat can lead to population collapse.

- There is an increased need to consider the effectiveness of techniques to enhance or create habitats for breeding fish.
- At various marine locations, hauls of maximum catch and their corresponding geographical locations can be recorded using GPS to identify areas of aggregations of brood fishes.
- These GPS points can be pooled and plotted on a map using GIS techniques.
- It is advised that these locations should be monitored for any variations in the number of fishes, during the drilling operations.
- In case any decrease is observed in these numbers, it is suggested to create artificial spawning grounds.

To effectively replicate, create or enhance spawning habitat, it is important to identify habitat and environmental characteristics that influence productivity for specific

species. The spawning habitats used by fishes are quite varied and factors such as temperature, depth, wave exposure, water quality, water velocity, vegetation composition, and adjacency to nursery habitat, must all be considered when attempting to design a successful habitat restoration.

Figure 71 : Location for fish monitoring near Maguri Motapung Beel opening into Dibru River and Location for fish monitoring at the Dibru River in DSNP

During the survey, two spots for fish breeding pool sites were identified. One of them is near the opening of Maguri Motapung Beel into the Dibru River (27.582173°, 95.337188°) and another at the Dibru River in DSNP (27.587458°, 95.359519°). It is encouraged to find more of such spots with the communication between fishermen and local boat safari services.

Artificial Spawning Grounds: Creating artificial spawning nests is a unique and inexpensive way to improve the environmental conditions of the Dibru River for fish spawning. These are manmade pools for artificial breeding, hatching, and rearing through the early life stages of fishes. Sites can be selected depending on easy access for breeders, accessibility of inputs such as feed, seed, fertilizer, and construction material and ecological factors such as fertile soil, water quality, topography and climate. An intelligent design and layout are essential for efficient spawning ground construction. The implementation agency should select an appropriate type of artificial Spawning Ground depending on the fish species and site requirements. Construction of these nests protects fish eggs from destruction; they are advanced for specific species of fish and can be characterized by high efficiency of substrate development and the increased output of viable young fish.

Implementation Location: 10 km radius of the proposed ERD well locations
***Stage of Mitigation Hierarchy*:** Offset
Implementation Agency: State fishery Dept., Assam University (Guwahati), Central Inland Fisheries Research Institute (ICAR)
***Broad estimate*:** Rs. 20,00,000 Lump sum
Benefited Species: Fish and other aquatic biodiversity (Including species protected under schedules of WPA).

Action 2B) Identification and Monitoring of river turtle species

Source: RAWW

***Concept and approach*:** Indian Roofed Turtles were observed basking on banks, logs or aquatic vegetation during the boat survey in DSNP through channels of the Dibru River. They usually avoid areas disturbed by humans. The species feeds on aquatic plants. It is recommended to conduct regular boat surveys and record geographical locations using GPS to identify areas that are maximally used by the species. Surveyors can paddle along the Dibru River counting basking turtles during and after the drilling operations.

Figure 72 : Representative image for Turtle Monitoring

Conversations with local people from the nearby coastal villages can also help in identifying the spots used by Turtles. Marking and following Turtle nesting sites can be an indirect method to assess the turtle populations. These GPS points can be pooled and plotted on a map using GIS techniques. These locations should be surveyed and monitored during and after the drilling activity to check for any variations in the turtle populations.

***Implementation location*:** 10 km radius of the proposed ERD well locations – on the banks of Dibru River and in DSNP river channels

***Stage of Mitigation Hierarchy*:** Avoidance

***Implementation agency*:** WWF India, Locals community, Assam University

***Broad Costing*:** Rs. 5,00,000 Lump sum

***Benefited Species*:** Turtles and other aquatic biodiversity (Including species protected under schedules of WPA)

Action 2C) Third-Party Monitoring of Ganges River Dolphin using Passive acoustic monitoring (PAM)

Concept and approach: Monitoring will help us in the evaluation of the impact of the progress of operations activities. This will allow conservation experts to evaluate the effectiveness of efforts and precautions undertaken so that necessary adjustments or improvements can be made based on previous failures and new information from scientific investigations.
The Ganges river dolphin uses bio-sonar clicks and the returning echoes to understand its surrounding environment and capture prey. To develop a viable strategy for their conservation, an understanding of their ecology - especially of their acoustic characteristics and underwater behaviour in the wild environment, is essential. However, they inhabit mostly turbid water and stay underwater except for respiration, which makes visual observations difficult.

Figure 73 : Live sonar LiveScope System Transom or Trolling Motor Mount

Passive acoustic monitoring (PAM) - PAM using an array of hydrophones that can record the high-frequency echolocation clicks of the dolphins has been used as one of the major observation systems for field studies in the wild environment [51,52]. PAM has high effectiveness for monitoring aquatic fauna, ecological studies, measurement of anthropogenic noise, studying noise impact and mitigation monitoring, presence, and abundance monitoring.

Implementation location: 10 km radius of the proposed ERD well locations
Duration and Data: During both pre-drilling and operational phases, monitoring is to be carried out in a 10 km radius of the project activities. Data to be collected for phases is mentioned below:

- Effectiveness of the mitigation measures
- Habitat and population monitoring
- Identification of new Impacts (other than pre-identified)
- Creation and monitoring of an exclusion zone
- Stranding locations
- Quality of habitat

[51] *W.L.Au, "The Sonar of Dolphins", New York: Springer, 1993. (Book)*
[52] *W.M.X. Zimmer,"Passive Acoustic Monitoring of Cetaceans," Cambridge Univesity Press, Cambridge, 2011. (book)*

- Hindrance in a migration pattern
- Fatality or injury cases
- Threats responsible for dolphin death

Stage of Mitigation Hierarchy: Avoidance
Implementation agency: Assam University, Wildlife Institute of India, WWF – India
Board Costing: Rs. 20, 00,000 Lump sum
Expected output from action 2:

- Real-time improvement of existing mitigation plans or designing of new mitigation plans.
- Implementation of improved or new mitigation plans.
- Develop and implement sustainable recovery plans if required.

Benefited Species: Ganges River Dolphin, fishes and other aquatic biodiversity (Including species protected under schedules of WPA).

Impact 3: Air pollutants can affect wildlife through the disruption of endocrine functions, organ injury, increased vulnerability to stresses and diseases; lower reproductive success, and possible mortality.

Action 3: Practices for reducing air pollutants

The operation of DG sets, movement of vehicles and machineries during construction and drilling at drill sites will result in the generation of air pollutants viz. PM, NOx and SOx, which may affect the ambient air quality temporarily. Air pollutants like soot and NOx will also be generated as a result of flaring of natural gas, if gas reserves are encountered during drilling operations. These air pollutants can affect the biodiversity of surrounding areas. The following three sub-actions are suggested in order to avoid and mitigate the possible impact of air pollutants:

Action 3a) Use of retrofitted emission control equipment for DG sets with duel fuel technology

Concept and approach: The proposed hydrocarbon exploration will involve the operation of two diesel driven 1000 KW generators for drilling of each exploratory well; additionally, one 200 KW generator will be required to meet power demand of the residential camp and other emergency requirements.

Combustion of fuel in a DG sets typically happens at high temperatures resulting in generation of considerable amounts of NOx. The SO_2 concentration in emissions is dependent on the Sulphur content in fuel burnt and particulate matter consisting of unburnt Carbon particles. The emissions from the DG set will be discharged into the atmosphere through a stack of height about 7 m from ground level and will be dispersed into the surrounding atmosphere.

Flaring of gases primarily during the drilling testing phase will contribute to additional air pollution. Flaring will involve high temperature oxidation process to burn combustible gases that may be generated from the proposed well sites. Emissions from flaring will include CO_2, carbon particles (soot), unburnt hydrocarbons, CO and other partially burned or altered hydrocarbons, NOx. The flaring will only be intermittent and will not last for more than a few days.

Air pollutants can have a negative effect on both flora & fauna, often causing marked decreases in local animal populations. The major effects of industrial air pollution on wildlife include direct mortality, debilitating industrial-related injury and disease, physiological stress, anaemia, and bioaccumulation.[53]

[53] *https://www.sciencedirect.com/science/article/abs/pii/0006320779900399*

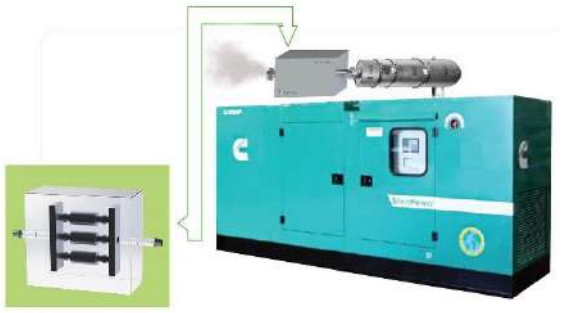


Figure 74 : Retrofitted emission control equipment

Emission control devices are installed to meet the exhaust standards of the Clean Air Act for carbon monoxide and hydrocarbons. Use of retrofitted emission control equipment for DG sets with duel fuel technology should be used for controlling the emissions. Retrofit is a device or equipment that can be fitted in the silencer to reduce the exhaust emissions and particulate matter or by converting the entire diesel engine into a gas engine by making necessary conversion kits in compliance with CPCB norms.

Location of flare stacks to be chosen considering the sensitive receptors adjoining the site. These stacks should neither be in close connectivity of any ecological sensitive areas nor household areas. It is encouraged that proper engineering controls to be taken to ensure complete combustion of gas. No cold venting should be resorted instead flaring will be done with combustion efficient elevated flare tip.

Implementation Location: all ERD surface locations
Stage of Mitigation Hierarchy: Avoidance
Implementation Agency: EOEnergy (Faridabad), Vasthi Instruments (Andhra Pradesh).
Broad estimate: Rs. 5, 00,000 to 7, 00,000 per unit
Benefited Species: Butterfly, Mammal and Bird species (Including species protected under schedules of WPA).

<u>Action 3b) Water sprinkling for the vehicular dust and fugitive emissions during operations</u>

Figure 75 : Representative Image for water spinkling for the dust emission

Concept and approach: Fugitive dust emission will occur during well site preparation, drilling and decommissioning phases of the proposed project. Approximately, 100 trucks/trailers load materials will be transported to drill site during predrilling phase. During drilling activity 5-7 trucks / trailers, load materials will be transported to drill site; additionally, 10 to 15 vehicles will be required for transport of site workers.

Fugitive emission during construction of waste pits, filling of site and handling of construction material, during drilling operations (loading, unloading, handling of drilling mud, chemical additives, cement and cement additives), from storages of volatile

chemicals and fuels at site, adds to the negative impacts on biodiversity.
Hence, water sprinkling in the internal unpaved roads is recommended for dust suppression. Sprinkling of water on earthworks, material haulage and transportation routes on a regular basis during pre-drilling, drilling and decommissioning phase of the wells is also advised. Periodic ambient air quality monitoring can be conducted.

Figure 76 : Representative Image for covering the materials in transportation to avoid dust emission

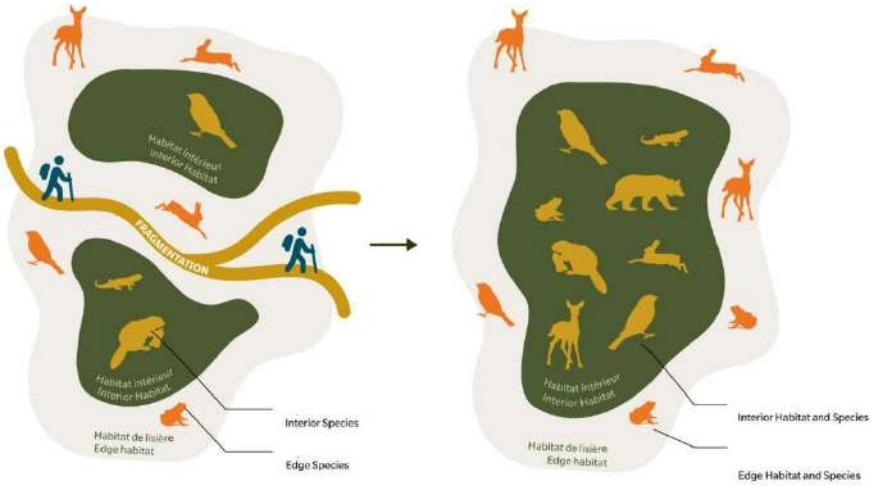
It is suggested to carry out regular water sprinkling at the site during dry season especially during the construction and decommissioning activities. All the efforts to be made to cover the stockpiles or storage materials with sheets to avoid fugitive emission by strong winds. The trucks used for transport of fill material (especially fine aggregates) during the site preparation and debris transport during the decommissioning shall be provided with resistant sheeting.

It is suggested that during construction, the approach road will be kept clean, free from mud and slurry to prevent any entrainment of dust. Proper handling of materials is highly recommended to ensure minimal emission of dust.

Implementation Location: Approach roads and ERD surface locations
Stage of Mitigation Hierarchy: Avoidance
Implementation Agency: Oil India Limited, Local water tanker services
Broad estimate: Rs. 20,000 per month for 6 months
Benefited Species: Mammal, Butterfly and Bird species (Including species protected under schedules of WPA).

Action 3c) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary

Concept and approach: During the survey, it was observed that the Delakhat road passing through Bherjan Borajan Podumoni Wildlife Sanctuary (BBPWLS) was used intensively for traversing Oil India Limited's heavy trucks equipped with drilling machinery and other materials throughout the day. Locals and visitors in the area use the road for travelling (bikes, cars, trucks, bicycles) without lowering the speed, stridently honking and using flashlights. Further end of the Delakhat road meets Makum Bypass road.



Source: Natural Capital Commission

Figure 77 : Representative illustration showing impact of fragmentation of habitat

Although this road is an easiest way to reach Baghjan PML and its surrounding drilling site locations, trucks passing through an ecologically sensitive area with heavy equipment not only disturbs the faunal species but also leads to destruction of valuable flora in the sanctuary. It is highly recommended to make all the efforts to avoid Delakhat road passing through BBPWLS, even if it requires taking a longer route/bypass.

Wild animals are vulnerable to vehicular traffic passing through forests, especially at night when, blinded by bright headlights. Most of the mammal movement occurs from dusk until dawn. Hence, complete restriction on the movement of heavy vehicles at night, from 4pm to 6 am, is recommended. This is to be followed for all the vehicles passing through or nearby ecologically sensitive areas.

Stage of Mitigation Hierarchy: Avoidance
Benefited Species: Mammal, Butterfly, Reptiles and Bird species (Including species protected under schedules of WPA).

Action 3d) Regular care and maintenance for vehicles and drilling equipment

Concept and approach: It is advised for preventive maintenance of DG sets to be undertaken as per manufacturers schedule to ensure compliance with CPCB specified generator exhaust. Flaring should be undertaken in accordance with the CPCB Guidelines for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry. Periodic monitoring of DG set stack emission will be carried out to assess compliance with CPCB DG set exhaust standards. Maintenance of diesel engines - used as prime movers for mainline & fire water pumps, instrument air compressors and emergency generators should be carried out in accordance with OISD Standard "OISD STD-121-Inspection of Turbines & Diesel Engines".
Vehicle movement to be minimised for construction and decommissioning phase; a speed of 20 km/hr should be enforced along the access and approach roads during entire project activity period. All diesel-powered equipment should be regularly maintained and idling time reduced to minimise emissions. Vehicle / equipment should be turned off when not in use to control the emissions. Vehicle / equipment exhausts observed emitting significant black smoke in their exhausts would be serviced/replaced as it can be dangerous to the faunal species in the area.

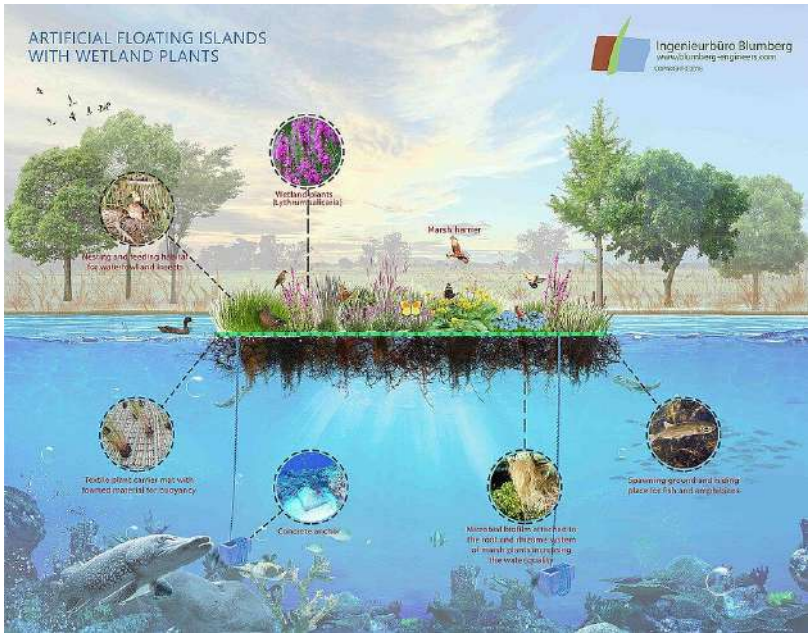
Implementation Location: All the vehicles owned by Baghjan PLM
Stage of Mitigation Hierarchy: Avoidance
Implementation Agency: Oil India Limited, servicing centres/ companies for particular unit
Benefited Species: Mammal, Butterfly, Reptiles and Bird species (Including species protected under schedules of WPA).

Impact 4: Wastewater and formation water will be generated during drilling activity and the domestic wastewater from the labour camps, which may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality.

Impact 5: Surface runoff from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is likely to be contaminated and have the potential to impact the water quality of the receiving waterbody. This will affect the ecologically sensitive areas of the waterbody like migratory and resident bird habitats, fish habitats, breeding and nursing ground for fishes, and the habitat of the Gangetic Dolphin. Degradation of water quality will affect the primary productivity of the river.

Action 4: Construction of floating treatment wetlands

Concept and approach: The process wastewater and formation water will be generated during drilling activity. The process wastewater treated through ETP would meet the CPCB discharge standards before it is discharged into the local stream of the Dibru River. Contaminated surface runoff from drilling waste will also influence the water quality of the receiving waterbody. It is advised to create Floating treatment wetlands (FTWs) at the mouth of the discharge point of the canal or stream where the treated water will be released. Discharge of surface run-off, treated wastewater can cause reversible damage to water quality but is likely to easily revert to an earlier stage with mitigation.



Source: Ingenieurburo Blumgerg

Figure 78 Representative illustration for Floating treatment wetlands

Floating treatment wetlands (FTWs) or islands are small artificial platforms that allow these aquatic emergent plants to grow in water that is typically too deep for them. Their roots spread through the floating islands and down into the water creating dense columns of roots with lots of surface area. The floating island creates a natural

sanctuary for spawning with underwater protection. Floating reed bed islands have proven efficacy in treating wastewater from effluent discharge. They work by allowing bacteria, fungi and microorganisms to break down, digest and clean the wastewater to the point where it can be safely discharged.

These wetlands can have riparian edges for easy access for young birds, turtle, and frogs, thereby creating a safe and comfortable habitat for nesting away from shoreline predators. Floating islands can create valuable rest stops for migrating songbirds. The islands can be planted with a variety of native plants that will attract pollinators. Insects such as honeybees, wasps, dragonflies or other small insects can act as pollinators. Native plants attract native insects, which are the food source for a majority of songbirds.

Species native to the study area are mentioned in below table for construction of floating treatment wetland:

Table 46 : List of Native Flora for Floating Treatment Wetland

List of Native Flora for Floating Treatment Wetland					
Sr. no.	**Scientifc Name**	**Common Name**	**Family**	**Habit**	**IUCN**
1	*Caltha palustris*	Marsh Marigold	Ranunculaceae	Herb	LC
2	*Oenanthe javanica*	Water Dropwort	Apiaceae	Herb	LC
3	*Acorus calamus*	Sweet Flag	Acoraceae	Herb	LC
4	*Schumannianthus benthamianus*	NA	Marantaceae	Herb	-
5	*Pleurolobus gangeticus*	Sal Leaved Desmodium	Fabaceae	Herb	-
6	*Persicaria microcephala*	Knotweed	Polygonaceae	Herb	-
7	*Phlogacanthus thyrsiformis*	NA	Acanthaceae	Shrub	-
8	*Plumbago zeylanica*	Ceylon Leadwort	Plumbaginaceae	Shrub	-
9	*Typha domingensis*	Southern Cat-tail	Typhaceae	Herb	LC
10	*Saccharum spontaneum*	Canne Dauvage	Poaceae	Grass	LC
11	*Tripidium ravennae*	Ravenna Grass	Poaceae	Grass	-

Implementation locations: Locations for treated water discharge into the stream/river channels
Stage of Mitigation Hierarchy: Minimization
Implementation agencies: Oil India Limited, local nurseries
Broad Costing: Rs. 30,000 per 1 x 1 Unit
Species benefitted: Butterfly, Mammal and Bird species (Including species protected

under schedules of WPA).

Impact 6: Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, and e-waste and municipal waste affects the soil microbes and bacterial growth and can affect the soil quality
Impact 9: Kitchen Waste from Labour camps if not disposed properly can attract rodents, snakes, monkeys etc. that may lead to human wildlife conflict on the site.

Action 5: Solid waste management plan for the ERD locations

Drill cuttings, waste drilling mud, wash water, kitchen waste and sewage, waste oil and lead acid batteries from the proposed project operations will generate waste at the ERD locations. The following mitigations measures are to be followed for controlling the solid waste generated in the drilling operations.

a) Drilling Waste (cuttings, spent mud and wash water): It is advised that the use of water-based mud or eco-friendly polymer-based mud primarily for drilling of well. Low toxicity chemicals are recommended for the preparation of drilling fluid. Protection of the surrounding environment of a drilling waste (cutting & spent mud) storage and disposal site can be effectively achieved by using an impermeable liner on the base and sides to prevent contamination soil and groundwater.

There is no common TSDF in Assam for disposal of hazardous drill cuttings and other wastes. The liner system for the proposed waste pit has to be designed based on recommendation of the Ministry of Environment and Forests for construction of a non-permeable lining system at the base and wall of waste disposal site. The liner will have, at a minimum, a composite barrier having HDPE geo-membrane. Design aspects of the impervious waste disposal pit will be communicated/ shared by OIL with Assam State Pollution Control Board (ASPCB).

It is strongly recommended that the drilling cuttings pit will be bunded and kept covered using tarpaulin sheets during monsoon to prevent the spillage in the runoff water.

b) Storage and Disposal of Used oil & Spent Oil: The hazardous waste (waste and used oil) should be managed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The hazardous waste should be stored in properly labelled and covered bins located in paved and bunded area. Necessary spill prevention measures viz. spill kit should be made available at the hazardous material storage area. Storage details of onsite hazardous waste generated should be maintained and periodically updated. Adequate care should be taken during storage and handling of such waste.
The hazardous waste generated and stored should be periodically transported to ASPCB registered used and/or waste oil recyclers/facilities. Utmost care should be taken while transportation and disposal of these materials.

c) Storage and Disposal of Lead Acid Batteries: 2 – 3 Lead acid batteries will be used per drilling of well in the operation. Lead acid batteries should be recycled through the vendors supplying them. A proper record for the same is necessary as per the management plan.

d) Domestic Waste (Kitchen Waste, Sewage) Storage & Disposal of Kitchen Waste: All the waste bins at the ERD site should be properly labelled and covered with lids at all the times. The waste generated should be segregated and stored in designated waste bins.

There should be adequate care taken to minimize the contact of monkeys, crows, dogs near the kitchen waste bins. Proper care should be taken to seal the lids or tie the lids to the bins to prevent the animals from overturning the bins or spreading the waste on the ground. There is a possibility of plastics and micro-plastic from the waste ending up in the soil or in the digestive system of wild animals.
The kitchen waste should be disposed in nearest dumping station available on a daily basis. Discussion with the local panchayat/municipality authorities in this aspect should be conducted.

e) Treatment & Discharge of Domestic Waste Water: The sewage generated should be treated in a combination of septic tank and soak pits. Regular supervision should be undertaken for the domestic waste treatment system to report any overflows, leakage, foul odour etc. In addition to the management measures specified for the major waste stream, OIL should prepare and update periodically a waste management inventory of all waste streams identified for the proposed project. Necessary measure should also be taken by OIL to incorporate appropriate waste management and handling procedures in the contractor work document and conduct periodic training of personnel involved in waste handling onsite to ensure proper implementation of the WMP. In this regard, necessary inspection, record keeping, training program and monitoring procedures should be established by OIL and made operational to achieve proper management of all wastes generated on site.

Implementation locations: All the ERD surface locations
Stage of Mitigation Hierarchy: Minimization
Implementation agencies: Oil India Limited, local waste service centres and ASPCB registered recyclers
Species benefitted: Mammal, Butterfly, Reptiles and Bird species (Including species protected under schedules of WPA).

Impact 7: Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.

Action 6: Preventive measures for contamination due to accidental spillage

Concept and approach: It is advised that the drill cuttings separated from drilling fluid should be adequately washed and temporarily stored and disposed in an impervious pit lined by HDPE. Drilling wastewater should be stored in HDPE lined pit and should be treated prior disposal.
All the efforts should be made to recycle the drilling mud to maximum extent possible. Temporary storage of drilling fluid and wash wastewater should be done in an impervious pit lined with HDPE. Disposal of drilling wash water can be achieved through necessary treatment through onsite ETP to comply with the CPCB onshore effluent discharge standard for oil and gas industry. The waste pit after it is filled up should be covered with impervious liner over which a thick layer of native top soil with proper top slope should be provided.

Implementation locations: All the ERD surface locations
Stage of Mitigation Hierarchy: Minimization
***Implementation agencies*:** Oil India Limited, local waste service centres
***Species benefitted*:** Subterranean and Aquatic species (Including species protected under schedules of WPA).

Impact 8: Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.

Action 7: Increasing the High-Density Polyethylene (HDPE) lined pit wall's height

Concept and approach: Mud used during the operation will flush out formation cuttings from the well hole. These cuttings will be separated from the drilling mud using a solids control and waste management package. Cuttings will then be stored in the HDPE lined pits (of approximately 800m^3 capacity). The flocs from separating the cuttings and drilling liquid will be store in the HDPE lined pits as well. It is advised that drilling wastewater should be stored in HDPE lined pit and should be treated prior disposal.
If these pits are not covered appropriately in monsoon, there is a high possibility of these pits overflowing and the liquid materials will be drifted away along with it. Hence it is advised that the pit wall size should be increased and these pits to be covered, to not mix with the surface water.

Implementation locations: All the ERD surface locations
Stage of Mitigation Hierarchy: Avoidance
Implementation agencies: Oil India Limited
Broad Costing: Rs. 700 to 800 per sq. m.
Species benefitted: Aquatic species (Including species protected under schedules of WPA).

Impact 10: Change in Landuse and species composition along with loss of native vegetation.

Impact 11: Faunal dispersal and loss of feeding ground.

Action 8: Offset plantations with Native species and offset monitoring.

Source: The Threatened Species Recovery Hub

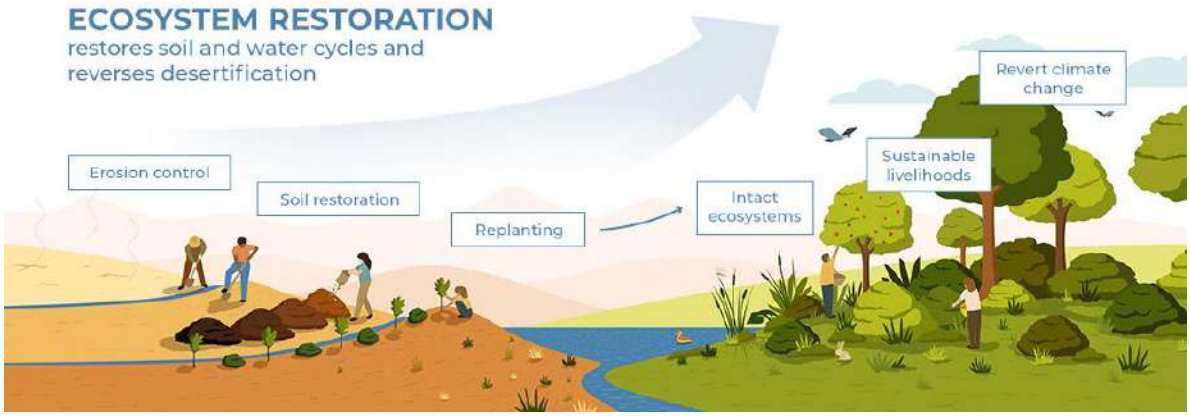
Concept and approach: The average area required for three ERD surface locations are about 3.2 ha. Site development required for the drill pads would require removal of vegetation. The clearance of vegetation is likely to cause change in the landuse and species composition in the area. The native vegetation growing in these areas will be lost in creating/widening approach road, constructing PAD areas and new infrastructure for drilling activities.

Figure 79 : Impact Assessment infographic

Faunal species depending on these areas will lose their regular feeding ground and will disperse to different areas in search of food. Stripping of vegetation will also have visual and aesthetic impacts at surrounding localities.

Plantation Matters: Vegetation is the basis of an ecosystem and conservation of all other species starts with the conservation of habitat and its floral species. For conservation, accurate, real-time and detailed information about the species of the vegetation is essential. It is strongly recommended that an offset site with native plantation should be created for biodiversity benefits.

Restoring native plant habitat is vital to preserving biodiversity. By creating a native plantation area, each patch of habitat becomes part of a collective effort to nurture and sustain the living landscape for birds and other animals. Without native vegetation and the insects that co-evolved with them, local birds cannot survive.



Source: Ecosystem Restoration Camps

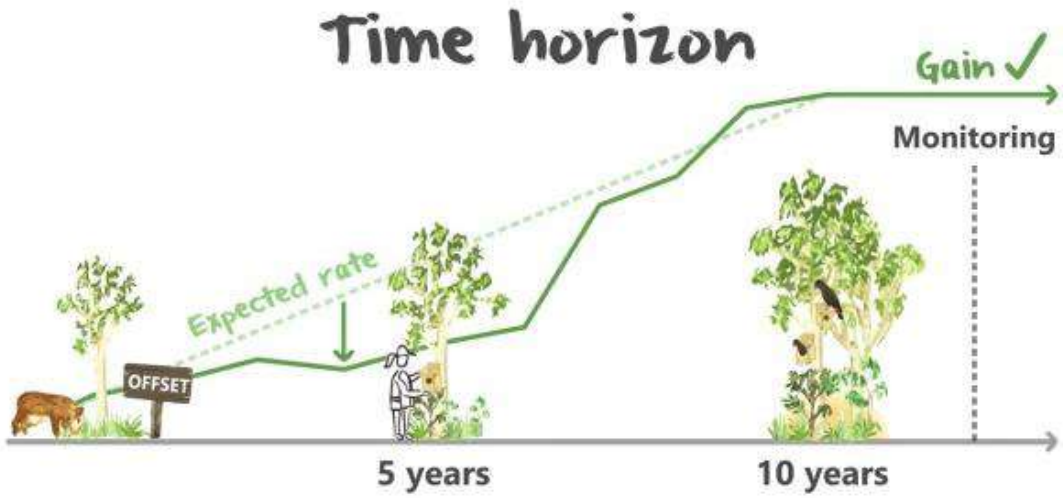
Figure 80 : Ecosystem Restoration infographic

Importance planting native species: Most of the landscaping plants available in local nurseries are alien species from other countries. These exotic plants not only sever the food web, but many have become invasive pests, outcompeting native species and degrading habitat in remaining natural areas. Plantation choices have meaningful effects on the populations of birds and the insects they need to survive. Hence, OIL can benefit birds and other wildlife by simply selecting native plants when making landscaping decisions for offset plantation. Suggestions for such native plant species are given in

Action 17: Connecting fragmented forests and homestead plantations for Hoolock Gibbon populations

- This plantation activity can create a microhabitat for faunal species leading to increase in diversity.
- Plantation of flowering trees/ shrubs will lead to increases in the population of pollinators, which can also support agricultural productivity in the surrounding region.
- Fruit bearing native tree species will attract birds and act as nesting & perching sites for them.
- The colourful array of butterflies and moths are dependent on very specific native plant species.
- Native plants provide nectar for pollinators including native bees, butterflies, moths, and bats. They provide protective shelter for many mammals.

Gaining Offsets through plantation: Regular monitoring of these faunal species in the plantation area can act as measure to compare the increase in the diversity due to offset plantation. The difference the offset plantation made compared to what would have happened without the offset monitoring includes on-ground measurements that can be used to verify these estimates of future gains.



Source: The Threatened Species Recovery Hub

Figure 81 : Representative illustration for functioning of biodiversity offsets

During monitoring, it is essential to track what actually occurs once an offset is implemented. This requires field visits to the offset site and measuring how the biodiversity features that are the focus of the offset are responding. For example, here the aim of offset is increasing the population size of native biodiversity. Hence, the monitoring should consist of counting the number of faunal & floral individual species at the site, after the offset actions have commenced, depending on the size of the offset site and the distribution of the species at the site. The monitoring can be done by locating sampling quadrats randomly and counting the number of individuals in the quadrats and then using these results to estimate the total number of individuals at the offset site. On a yearly basis, these numbers can be compared to the existing species lists for PAD areas to be stripped of vegetation in order to find out whether the gains are being occurred at the expected rates or they are falling short, which means it is required to take additional offset actions for conservation.

Implementation locations: Land properties owned by Villagers or OIL for restoring or plantation, degraded forest lands.
Stage of Mitigation Hierarchy: Offset
Implementation agencies: Oil India Limited, Local nurseries, Villagers, Forest Dept.
Broad Costing: Rs. 1200 to 1500 per sampling
Species benefitted: Trees, herbs, shrubs, climbers, butterflies, mammals and birds species (Including species protected under schedules of WPA).

Impact 12: Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil.

Impact 13: Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings, which may affect local floral and faunal species and ecosystems.

Action 9: Construction of floating treatment wetlands and reusing the top soil

Concept and approach: Site development required for the drill pads would require removal of vegetation. Top soil from the sites will be stripped and stored for future use. Surface runoff during monsoon season from disturbed construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste. This will also increase the silt load in the surface run-off. This situation is likely to be more pronounced considering high rainfall received in these areas. The surface run offs may contain high sediment load, oil residues, organic wastes, etc. The higher value of suspended solid and organic rich sediment load may affect the lowering of DO levels and affect the aquatic ecology.

It is strongly encouraged that earth works and other construction activities during heavy rains to be avoided at all costs. As mentioned in the **Action 4 (Page 259)** construction of floating treatment wetlands at the discharge points to be created to reduce the silt flow in the surface runoff. It is also recommended to increase the vegetation near the storm water drainage, in order to reduce the silt entry in it.

The stripped topsoil can be saved and stored to use either in the offset plantation locations as mentioned in the **Action 8 (Page 265)** or it can be used to restore the ERD surface after decommissioning the drilling well.

All efforts should be taken to avoid any accidental discharges before they reach any surface waterbody through sedimentation tank and oil-water separator. Proper monitoring of indicator species should be carried out and compared to baseline conditions to understand any negative impacts.

Implementation locations: Land properties owned by Villagers or OIL for restoring or plantation or ERD surface locations.
Stage of Mitigation Hierarchy: Avoidance
Implementation agencies: Oil India Limited
Broad Costing: Rs. 30,000 per 1 x 1 Unit
Species benefitted: Trees, herbs, shrubs, climbers, butterflies, mammals, fishes and birds species (Including species protected under schedules of WPA).

Impact 14: Illumination with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like 1) they might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals

Action 10: Use of dark sky friendly lighting practices

***Concept and approach*:** The drill site would be illuminated with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant alternation of existing illumination levels in the area and may disturb the local fauna as well as the fauna (particularly birds and mammals) in DSNP and Maguri Motapung Wetland.

Set of case studies for impact of artificial lights on biodiversity

The scale and scope of disruption to wildlife has surprised ecologists. Here are a few selected findings that illustrate the enormous variety of impacts.

Communication error
The male eastern firefly (*Photinus pyralis*) flashes its tail-lights to attract a mate, but under artificial light females don't flash back as often as they do in the dark, so males can't find them.

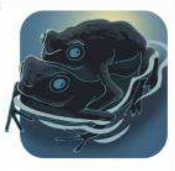
Losing sleep
Great tits (*Parus major*) fall asleep later, wake earlier and sleep less under artificial light.

Missing microbes
Light causes a loss of diversity in microbial communities in freshwater sediments. Photosynthesizers — diatoms and cyanobacteria — proliferate at the expense of other organisms.

Going hungry
Florida's Santa Rosa beach mouse (*Peromyscus polionotus leucocephalus*) forages under the cover of dark. A bright moon — or artificial light — prevents it.

Compass jammed
Nocturnal dung beetles (*Scarabaeus satyrus*) navigate by the Milky Way and polarized light from the Moon. Too much light sends them round in circles.

Delayed departure
Light from buildings and bridges along the Cedar River in Renton, Wash., delays the migration of sockeye salmon fry (*Oncorhynchus nerka*) heading for the Pacific.



Speed dating
Increased light makes female Tungara frogs (*Engystomops pustulosus*) less selective in their choice of mate — the risk of predation is lower if they rush to reproduce.

Wrong scent
Light causes female cabbage moths (*Mamestra brassicae*) to give off faulty sex pheromones, producing less and using the wrong recipe.

Crop failure
Bright floodlights from an Ohio prison prevent normal development of soybeans (*Glycine max*) in a nearby field.

Fatal attraction
A recent estimate puts the number of birds killed at lit communications towers in the United States and Canada at 6.8 million each year.

SOURCE: REPORTING BY S. PAIN

CREDIT: M. SCHUMACHER

Figure 82 : Set of case studies for impact of artificial lights on biodiversity

Illumination with artificial lights disturbs biodiversity: Plants and animals depend on Earth's daily cycle of light and dark rhythm to govern life-sustaining behaviours such as reproduction, nourishment, sleep and protection from predators. Artificial light at night has negative and deadly effects on many creatures including amphibians, birds, mammals, insects and plants.

- Nocturnal animals sleep during the day and are active at night. Light pollution radically alters their night-time environment by turning night into day.
- Predators use light to hunt, and prey species use darkness as cover.
- Glare from artificial lights can also impact wetland habitats of Maguri Motapung Beel and DSNP that are home to amphibians such as frogs and toads, whose night-time croaking is part of the breeding ritual. Artificial lights disrupt this nocturnal activity, interfering with reproduction and reducing populations.
- Birds that migrate or hunt at night navigate by moonlight and starlight.
- Birds can die colliding with needlessly illuminated infrastructure.
- Migratory birds of Maguri and DSNP depend on cues from properly timed seasonal schedules. Artificial lights can cause them to migrate too early or too late and miss ideal climate conditions for nesting, foraging and other behaviours.

Hence, it is **ideal to use dark sky friendly lights during drilling operations** in night - time.

- ✓ All lights should have a clear purpose.
- ✓ Before installing or replacing a light, determining if light is needed is essential.
- ✓ Consideration for using reflective paints or self-luminous markers for signs, curbs, and steps to reduce the need for permanently installed lighting is advised.
- ✓ It is strongly recommended to use warm colour lights where possible and limiting the amount of shorter wavelength (blue-violet) light to the least amount needed.
- ✓ Light should be directed only to where needed, to avoid scattering.
- ✓ Use of shielding and careful aiming to target the direction of the light beam is advised, so that it points downward and does not spill beyond where it is needed.

Being mindful of the surface conditions use of the lowest light levels is required. There is a possibility that some surfaces may reflect more light into the sky than intended. Hence, light should be no brighter than necessary and should be used only when it is useful. Use of controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed is advised.

Implementation locations: All ERD surface locations
Stage of Mitigation Hierarchy: Avoidance and Minimization
Implementation agencies: Oil India Limited
Species benefitted: Herpetofauna, mammals, fishes and birds species (Including species protected under schedules of WPA).

Impact 15: Decreased habitat use and increase in the roadkill of native fauna/ livestock.

Impact 16: Damage to existing nearby flora

Action 11: Prevention of animal - human conflict

It is noted that Doom Dooma-Baghjan road will be the main road for transportation of construction material and drilling rig and machineries**Error! Bookmark not defined.**. Approximately, 100 trucks/trailers load materials will be transported to drill site during predrilling phase. During drilling activity 5-7 trucks / trailers, load materials will be transported to drill site; additionally, 10 to 15 vehicles will be required for transport of site workers. The increase of traffic during construction phase will cause perceptible changes in the existing road traffic. This may cause damage of existing nearby flora and increase in the roadkill of native fauna / livestock. The following four sub-actions are suggested in order to avoid and mitigate the possible impact on biodiversity:

Action 11a) Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary

Refer to the concept given in **Action 3c (Page 257)** for this.
***Stage of Mitigation Hierarchy*:** Avoidance
***Benefited Species*:** Mammals, butterflies, Herpetofauna and bird species (Including species protected under schedules of WPA).

Figure 83 : Faunal species found dead on the road passing through Bherjan Bhorajan Podumoni WLS

Action 11b) Monitoring animal mortality due to collision with vehicles

Concept and approach: Animals are known to be active in the twilight and early in the morning during dawn. Majority of animals are known to take strolls for various reasons viz. quenching thirst, hunting, inspecting and marking territory etc. Human infrastructure often collides with the territory of many animals, which animals do not recognize speeding vehicles during these active hours that often leads to the vehicles running over the animals crossing the roads passing through their habitat.
It is crucial to identify locations frequently used by the majority of animals near the roads, for successful implementation of the action strategy.

- Monitoring along the highways and all approach roads for the sighting of faunal elements. Including informal conversations with locals for the presence of wild animals.

- Camera traps along the monitoring points identified through direct sightings and or socio ecological interviews

Figure 84 Reference image of Camera trap used for wildlife monitoring

For patches/locations where passes are not possible it is needed to understand and to find the root cause of animals preferring the identified patch for its daily route. An alternative route if can be created in a case where the corridor/animal over/underpass construction is not feasible.

Stage of Mitigation Hierarchy: Avoidance
Estimated costing: Rs. 5,00,000 Lumpsum
Benefited Species: Mammals, butterflies, Herpetofauna and bird species (Including species protected under schedules of WPA).

<u>Action 11c) Installation of reflective signboards</u>

Concept and approach: The reflective signboard will inform the citizens passing by about the presence of wild animals crossing the roads. Design should be in a way that the animal symbol or graphic should be large enough for drivers to see it from distance. Proximate areas with a high rate of animal movement, there should be installations of reflective signboards, indicating the presence of important wild animal and it is an area of animal crossing. Such signboards should also mention a penalty of over-speeding and penalty for wildlife schedules. For example, at the entrances and exits of BBPWLS.

Figure 80 : Example of awareness reflective signage indicating presence of animal

During the survey, a few points were noted for installation of Reflective signboards, Rumble strips and Camera Traps at Bherjan Borajan Podumoni Wildlife Sanctuary.
As it was also observed that homestead plantations and tea-estates also supported a good amount of biodiversity. During the informal discussions with locals, tea estate workers and forest officials also confirmed the presence of animals in these habitats. Hence, it is advised to monitor these locations and install the Reflective signboards, Rumble strips and Camera Traps at the necessary locations.

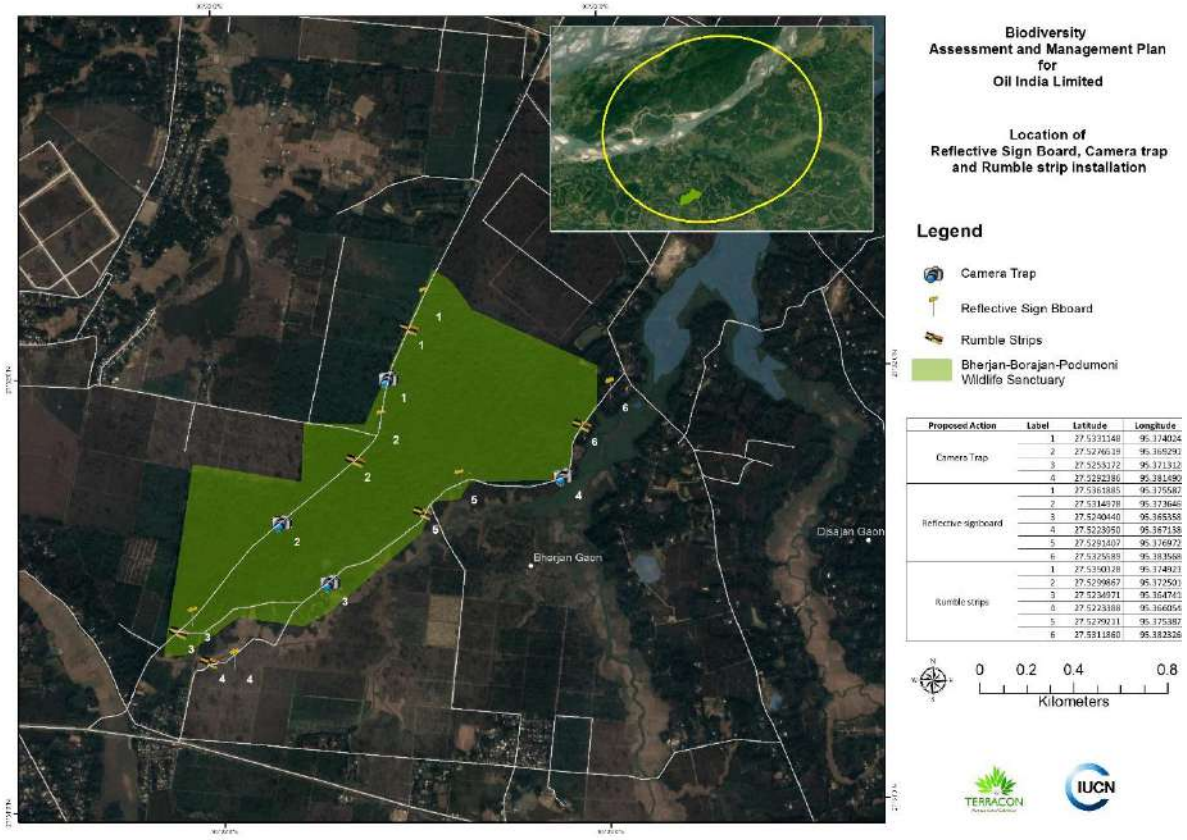


Figure 85 : Locations for installation of Reflective signboards, Rumble strips and Camera Traps

Stage of Mitigation Hierarchy: Avoidance
Estimated costing: Rs. 30,000 per signage
Benefited Species: Mammals, Herpetofauna and birds species (Including species protected under schedules of WPA).

Action 11d) Installation of reflective speed breakers and adding speed limit regulations

Concept and Approach: In order to reduce/mitigate instances of animal road kills and to ensure safety of both vehicle users and wildlife, it is important to lay speed breakers at identified animal crossing zones. Putting up speed breakers on the roads that pass through human settlements and ecologically sensitive areas such as BBPWLS to protect animals/livestock can bring down the number of road kills.

Figure 86 : Representative image for Rumble strips on roads

Road humps such as Rumble strips are necessary in these dense forest areas teeming with wildlife to curtail the speed. Movement of vehicles during night time should be restricted. Speed limits should be maintained by vehicles involved in transportation of raw material and drilling rig. Awareness programmes for drivers who frequent these roads are urgently needed. These awareness sessions are recommended be included in the induction/ training programs of all the drivers. Emphasizing safety aspects among drivers, particularly with regard to safe driving speeds is necessary.

Deploying traffic supervisors at important road junctions and near sensitive receptors (e.g. forests, schools) for maintenance of project traffic is recommended.
Collaboration with local communities and responsible authorities to improve signage, visibility and awareness of traffic and pedestrian safety is essential.

***Stage of Mitigation Hierarchy*:** Avoidance
Estimated Costing: Rs. 2,500 to 3,000 / Running Meter
Benefited Species: Mammals, butterflies, Herpetofauna and birds species (Including species protected under schedules of WPA).

Action 11e) Preventive measures to minimize Human-Animal conflict on encountering wild animals

Source: Living in Singapore

- In case of presence of Wild animal (carnivorous), inform residents around about the same and conduct awareness programs on ‘Dos and Don’ts’.
- Strict practice of not feeding any wild animal should be followed to reduce and minimize the conflict with wild animals.
- Monkeys should not be fed with anything as these can get used to humans, leading to conflict situations.

Figure 87 : Dos and Don'ts to minimize Human-Wildlife conflicts

- On encountering snake, security team should be informed immediately. Movement of the snake should be checked until the rescue team arrives. No should rush towards the snake to take photograph, especially during the rescue, as this may result in putting life of snake and / or rescuer in danger.

Impact 17: Over use of ground water may lower the ground water table

Impact 18: During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.

Action 12: Safe practices for using groundwater resources

Concept and Approach: During the drilling operations, water requirement at a drill site is expected to be 50m^3 per day. The water requirement at the drilling sites during construction and drilling phase will be met groundwater after obtaining necessary permission. Approximately, 5m^3 per day water will be required for construction and 3m^3 per day for workers during construction phase.

The required water for drilling activities will be sourced from ground water. It is recommended to take utmost care while drawing water from the groundwater resources.

The estimated depth of the drilling is 3950 m. During drilling activity, different aquifer will be intersected. The intersected ground water (formation water) will come out to surface with drill cuttings and mud. However, the well should be immediately protected by providing casing and cementing. This will prevent the ground water from being discharged from the aquifer or its contaminations.

Stage of Mitigation Hierarchy: Avoidance
Benefited Species: Subterranean fauna, mammals, reptiles and flora

Impact 19: Alteration of onsite micro drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas, which may affect habitats of reptiles, and mortality of floral species.

Action 13: Construction underpass for water below the approach road

Concept and Approach: Potential impact on drainage and topography viz. alteration of drainage pattern and water logging are anticipated during well site preparation and raising of the well site and access roads. The sites will be raised to a height of one and half a meter more than the high flood level of past ten-twenty years. This may lead to alteration of onsite micro-drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas abutting the drill sites. This problem is likely to be further aggravated due to heavy rainfall experienced by the area throughout the year. The length of the site approach road will vary between 100 to 200m only. Approach road may interfere with the drainage of surface run-off during rainfall.

Losing access to large areas of their living space makes it challenging for wetland animals to forage for food, find mates and carry on their genetic legacies. It is recommended to create an underpass below the approach road to the ERD sites to allow the Herpetofauna and reptile species to pass across to the other side. Connecting this underpass to storm water drains in the area can help in releasing any water logged inside.

The underpass floor must be naturalized so that small vegetation can grow and give the underneath area a natural passage looks. The underpass floor can be planted with native plant and grass species. The underpass height should be able accommodate animals like Hyena, Jackal, Wild boar etc. Special care should be taken to ensure that the animal movement is not restricted due to the construction work.

All the efforts should be taken in maintaining the general slope of site during levelling and grading operations with minimal disturbance to the existing contour.

Stage of Mitigation Hierarchy: Minimization

Benefited Species: Aquatic vegetation, Mammals, Herpetofauna and birds species (Including species protected under schedules of WPA).

Impact 10: Change in Landuse and species composition along with loss of native vegetation

Action 14: Restorative Practices after decommissioning

Concept and approach: On completion of activities, the exploratory wells will be either plugged and connected with flow lines or suspended. In the event of a decision to suspend the well, it will be filled with a brine solution containing very small quantities of inhibitors to protect the well. The well will be sealed with cement plugs and few wellhead equipment (Blind Flange) left on the surface (Cellar). After the development activities, the well will be sealed with a series of cement plugs, all the wellhead equipment will be removed leaving the surface clear of any debris and site will be restored.

The complete demobilisation of the facilities at site will happen after well testing has been completed. This will involve the dismantling of the rig, all associated equipment and the residential camp, and transporting it out of the project area in the span of 15 to 20 days. It is estimated that about 60 truckloads will be transported out of site during this period.

The wellhead and all casing string will be cut off to a minimum depth of 3 m (10 ft.) below ground level. All fencing and access gates will be removed. Removal of all stock piling is necessary. Restoration of ERD surface area along with the widened approach road is recommended. Topsoil can be replaced and native species plantation can be carried out in these areas. These areas can be seeded with local, native wildflower and wild grasses to create a refuge for wildlife, which develops naturally over time. The land can be managed as a wildflower meadow or orchards for small shrubs and fruit bearing trees. This will also help improvise the soil quality. These plants can be refuge to various native birds for foraging, roosting and nesting. Presence of flowers can increase the pollinator species that these birds depend on. These fruiting trees can slowly sustain troops of macaques, sprightly squirrels and a numerous insect. There is a possibility that these plantations may need extra care to become established over several years – and restore the site's natural drainage patterns.

Following photographs shows the before and after examples of restored oil pads from Oklahoma Oil & Natural Gas, United States.

[54]

Figure 88 : Before and after restoration photograph from Oklahoma Oil & Natural Gas, United States

Implementation locations: All ERD surface locations
Stage of Mitigation Hierarchy: Restoration
Implementation agencies: Oil India Limited, local nurseries
Broad Costing: Rs. 1200 to 1500 per sapling
Species benefitted: Trees, herbs, shrubs, insects, herpetofauna, mammals, fishes and bird species (Including species protected under schedules of WPA).

[54] *https://oerb.com/well-cleanup/*

In case of extreme events:

Action 15: Formation of wildlife rescue teams and creating a network of veterinary hospitals and refuge sites

In case of extreme events such as blowouts and oils spills, it can have a negative impact on local wildlife and livestock through direct contact, inhalation and ingestion of toxic chemicals. Oil-drenched feathers and fur can adversely affect animal's ability to regulate their body temperatures. Surface-dwelling animals and birds can die by poisoning or suffocation. Birds that are smothered in oil will also lose their natural buoyancy feathers provide, render immobile and can sink and drown in polluted water. While preening, to remove the oil they will be ingesting toxic chemicals, which will cause internal organ damage and eventually death. Fumes from more volatile petroleum products will cause burns, eye irritation and neurological issues.

Oil layer on vegetation can lead to malnutrition/poisoning of dependant fauna. These suspended materials (oils) stay on the riverbed, poisoning the sediment. Eventually they will damage the dependant fauna overtime.

Source: RAWW

Figure 89 : Representative Photos for Wildlife Rescue Team

The aquatic fauna that is trapped in oil spill might be seriously injured or face starvation. Hence, there is a need for a dedicated team comprising of conservation biologists, veterinarians, forest personal, fishermen, and locals for rescuing these animals. This team will also keep a check on illegal poaching that may arise due to unnoticed stranding.

It is important to have a network of pre-identified wildlife as well as domesticated refuge areas in order to save and treat these animals. It is recommended to have a network of biologists, veterinarians, forest personal and fishermen in order to quickly respond in such emergencies. There is intense need for awareness programmes in these networks regarding wildlife rescue or responses in case of extreme events.

For a successful rescue operation, it is imperative to prepare a list of equipment and conduct regular maintenance so that they are all clean and functional in the event of a rescue call. Most equipment used during rescues can be easily procured from the local market, but a few items might require specific design and modification. It is also

advisable to keep two sets of minor but necessary equipment, in case of damage or loss. This also comes in handy in the event of multiple animal rescues.

Implementation locations: All ERD surface locations
Stage of Mitigation Hierarchy: Minimization
Implementation agencies: Oil India Limited, conservation biologists, veterinarians
Broad Costing: Rs. 10, 00,000 to 20, 00,000 lakhs
Species benefitted: Herpetofauna, mammals and bird species (Including species protected under schedules of WPA).

Action 16: Clean-up of Oil spill on surface water

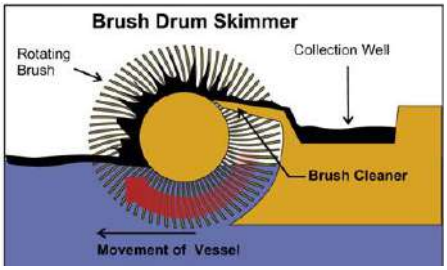
Concept and Approach: In case of extreme events like blow out of wells may result in oil spillage not only on the land but also into the surrounding rivers and wetlands.

Mechanical containment and recovery is the most common response measure to mitigate adverse environmental impacts from oil spills in bodies of water. This technique consists of physical barriers (booms) to contain and concentrate floating oil, mechanical devices (skimmers) to remove oil from the water's surface, and temporary storage devices to store the recovered oil and water until it can be properly disposed of.

Containment booms: A boom is a floating mechanical barrier designed to stop or divert the movement of oil on water. Booms resemble a vertical curtain with portions extending above and below the water line. Most commercial booms consist of four basic components: a means of flotation, a freeboard member (or section) to prevent oil from flowing over the top of the boom, a skirt to prevent oil from being swept underneath the boom, and one or more tension members to support the entire boom. Booms are constructed in sections, usually 15 or 30m long, with connectors installed on each end so that sections of the boom can be attached to each other, towed, or anchored.

Figure 90 : Representative images for physical spill counter measures

Skimmers: Skimmers are mechanical devices designed to remove oil from the water's surface.



Representative images for Skimmer

Skimmers are mechanical devices designed to remove oil from the water's surface. They vary greatly in size, application, and capacity, as well as in recovery efficiency. Skimmers are available in a variety of forms, including independent units built into a vessel or containment device and units that operate in either a stationary or mobile (advancing) mode. Some skimmers have storage space for the recovered oil, and some of these have other equipment such as separators to treat the recovered oil.

The effectiveness of a skimmer is rated according to the amount of oil that it recovers, as well as the amount of water picked up with the oil. The skimmer is placed in front of the boom or wherever the oil is most concentrated in order to recover as much oil as possible. Skimmers are often placed downwind from the boom, so that the wind will push the oil toward them.

Temporary Storage: When oil is recovered, sufficient storage-space must be available for the recovered product. The recovered oil often contains large amounts of water and debris that increase the amount of storage space required. A massive collection of drums that are used as temporary storage after a successful clean up.

Sorbents: Sorbents are materials that recover oil through either absorption or adsorption. They play an important role in oil spill clean-up and are used in the following ways: to clean up the final traces of oil spills on water or land; as a backup to other containment means, such as sorbent booms; as a primary recovery means for very small spills; and as a passive means of clean up. An example of such passive clean-up is when sorbent booms are anchored off lightly oiled shorelines to absorb any remaining oil released from the shore and prevent further re-oiling of the shoreline. Sorbents can be natural or synthetic materials. Natural sorbents are divided into organic materials, such as peat moss or wood products, and inorganic materials, such as vermiculite or clay.

Implementation locations: All ERD surface locations
Stage of Mitigation Hierarchy: Minimization
Implementation agencies: Oil India Limited, conservation biologists, veterinarians
Broad Costing: Boom: Rs. 60,000 to Rs. 80,000 for 15 meter and Skimmer: Rs. 1, 00,000 to Rs. 1, 50,000
Species benefitted: Herpetofauna, mammals and bird species (Including species protected under schedules of WPA).

Additional conservation efforts

Action 17: Connecting fragmented forests and homestead plantations for Hoolock Gibbon populations

Concept and Approach: Habitat fragmentation resulting from linear infrastructures such as pipelines, roads or railways has emerged as one of the severest threats for wildlife globally. Among the many primate species affected by fragmented habitats, the loss of canopy connectivity in a fragmented landscape is especially detrimental to strictly arboreal, canopy-dwelling species, such as Hoolock gibbons.

The western Hoolock gibbon is listed as Endangered on the IUCN Red List of Threatened Species[55] and the Indian Wildlife (Protection) Act of 1972 has it classified as a schedule-I species. Several studies carried out in India have identified habitat loss, habitat fragmentation, and hunting as the greatest threats for this species throughout their entire distribution in India[56].

Ecological studies on Hoolock Gibbon indicate that they are monogamous, frugivorous, territorial and brachiator in nature. The movement of the gibbons is strictly dependent upon the canopy continuity of the forest due to their strict arboreal and brachiating habits. The canopy used by them depends upon the profile of the forest, the nature of plant species, production and distribution of food at different levels and site.

During the field study, the presence of the Hoolock gibbon was ascertained by direct sighting, its distinctive call and in some areas by informal discussions local forest staff and local villagers. In Tinsukia district, the Hoolock gibbon occurs in all regions excluding the wide riverbeds of the Brahmaputra and Dibru. Tea gardens, roads, railway and large human settlements have resulted in fragmentation of the habitats for them.

[55] *Brockelman, W., S. Molur and T. Geissmann. 2019. Hoolock hoolock. The IUCN Red List of Threatened Species 2019: e. T39876A17968083*

[56] *Chetry, D., R. Chetry and P. C. Bhattacharjee. 2007. Hoolock: The Ape of India. Gibbon Conservation Centre, Assam, India.*

Informal discussions with the locals revealed that Dighal Haku Gaon is famously known as Barekuri Hoolock Gibbon Park, it has 22 families of Gibbons in privately owned homestead plantation/woodland of the village, as per the last counting done the villagers. They were sighted swinging along high canopies of Barekuri Village, Na-Matapung Gaon, Borgaon, Denka Gaon, Dighal Sako Gaon, Baghjan Gaon, and Dhelakhat Gaon Villages Assam. Secondary data suggests presence of Western Hoolock Gibbons (Hoolock hoolock) in the DSNP regions; however, no sightings were occurred in the study period. Forest guards and officials also confirmed that Western Hoolock Gibbons are no longer sighted in Podumoni and Bherjan regions of Bherjan-Borajan-Podumoni Wildlife Sanctuary but can be sighted in Dibru Saikhowa National Park.

Bherjan-Borajan-Podumoni Wildlife Sanctuary comprises of Bherjan, Borajan and Podumoni as separate three pockets of lowland tropical forest regions disjunct and separated by tea gardens and human habitations. Bherjan and Podumoni regions fall in the present study area. It is a perfect habitat for primates and it nestles many rare birds. Bherjan is almost entirely covered with trees with closed canopy. Delakhat road passes through forest area. The Podumoni region is observed to have a broken canopy and it is surrounded by tea estates, village settlements and croplands.

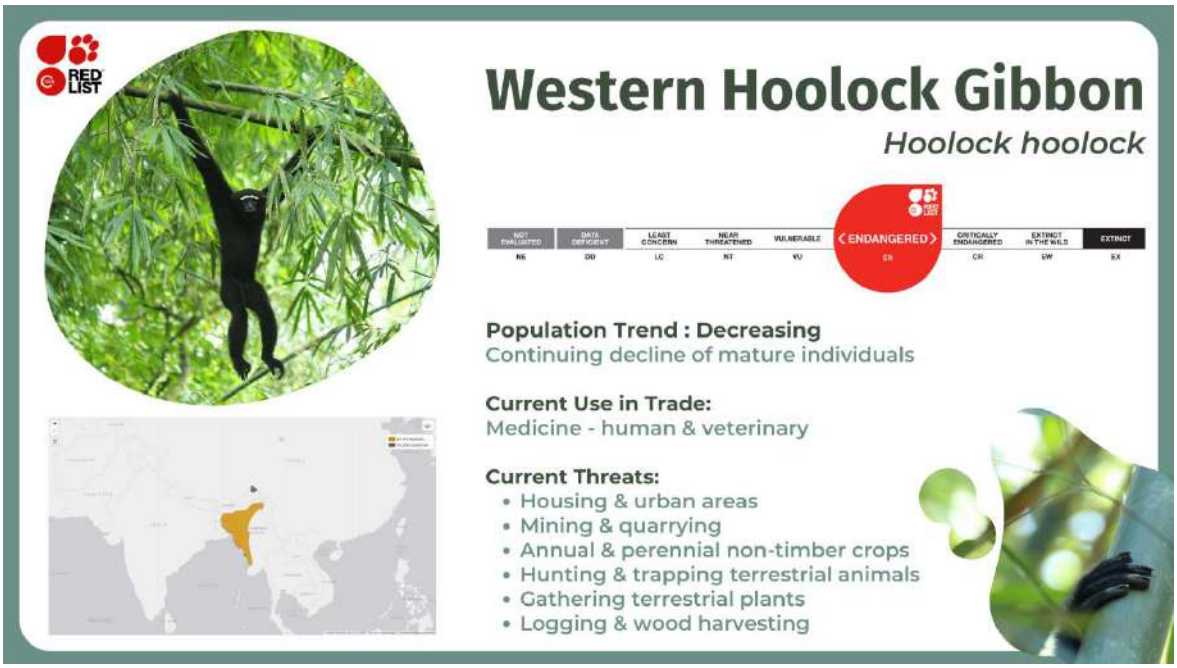


Figure 91 : Western Hoolock Gibbon IUCN Redlist

We strongly encourage the construction of natural canopy bridges and plantations of native species-specific trees forming a linear connectivity network. These bridges can be made from bamboos and ropes and tied up in the canopy as shown in the illustration below. These bridges and plantations can be cost effective and extremely valuable in increasing forest connectivity towards the Podumoni and Bherjan regions of Bherjan-Borajan-Podumoni Wildlife Sanctuary and the homestead plantations of 12 Barekuri villages for increasing the habitat range of Hoolock Gibbons.

Hoolock gibbons rarely move between forest fragments; they may refuse to cross-

gaps even as small as 200 meters. On top of that, they are extremely precise about their food choices, and a restricted home range in Barekuri means limited food options. If a single connecting tree is felled, an entire portion of their home range becomes inaccessible via the canopy. This will in turn affect the diet and nutritive content of the species. There is a possibility that juvenile gibbons would be severely emaciated - a phenomenon that occurs when they had to feed on leaves for prolonged periods in the absence of fruits.

Figure 92 : Representative illustration for canopy bridges

In Tinsukia a contiguous habitat of forest patches was reduced into scattered smaller fragments, they have now become into small ‘habitat islands’ in an inhospitable sea of degraded habitat. Measures such as creating corridors between these fragmented habitats by planting trees and establishing canopy bridges would help in connecting these habitats and increasing the home range of these rare species.

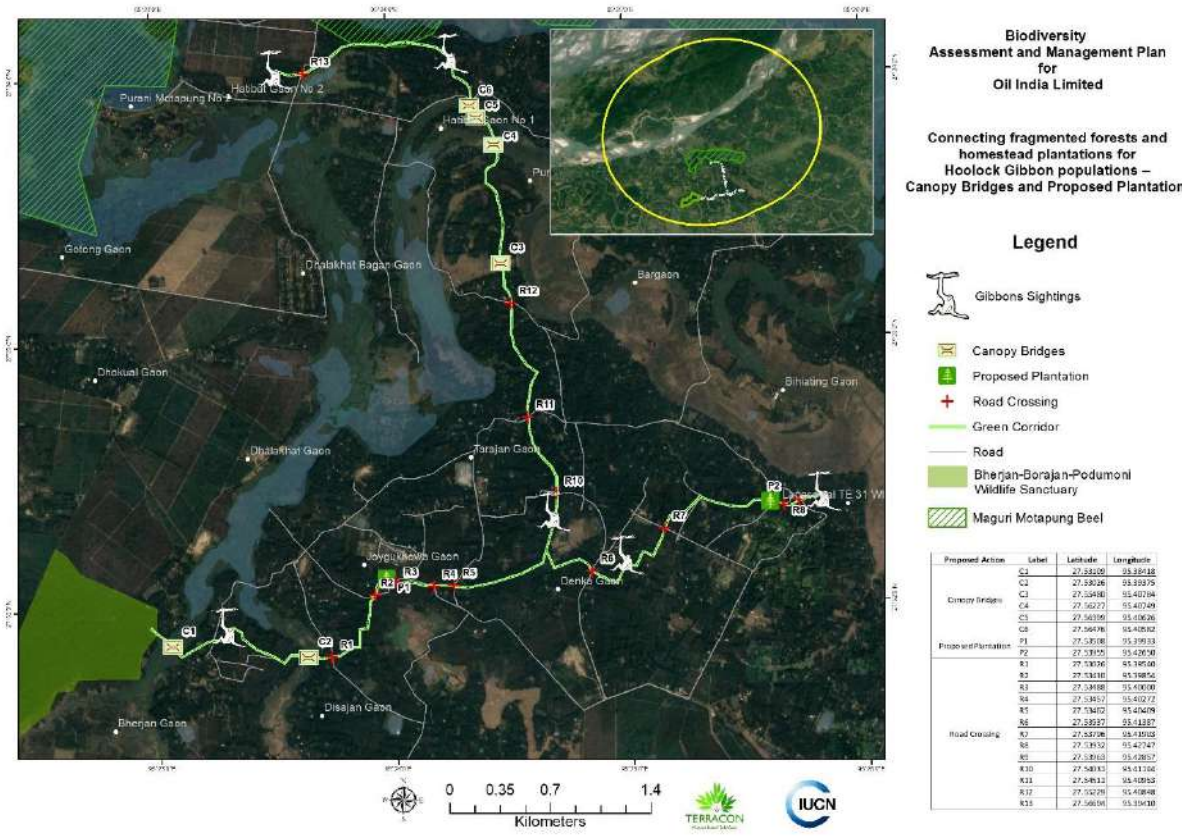


Figure 93 : Locations for construction of canopy bridges and plantation network in the study area

Hoolock Gibbons feed on young leaves, mature leaves, flowers, fruits, petioles, buds and on animal matter such as insects such as Leaf insect, Weaver's red ant, Black ant, Drury's Jewel, Muga silk worm, Tasar silk worm, Winged white termite[57], caterpillars, and bird eggs of Black Drongo, Ashy drongo, Lesser racket-tailed drongo[58]. In different plant species, various food parts are consumed by Gibbons. A list of native species used by Gibbons suggested for plantation is given below:

Table 47 : list of native species used by Gibbons suggested for plantation and parts of the plant consumed

Sr. No.	Scientific Name of species consumed	Family	Parts of plant Consumed					
			Young Leaves	Mature Leaves	Flowers	Fruits	Petioles	Buds
1	*Ichnocarpus frutescens*	Apocynaceae	YL	ML	FL			
2	*Ficus lepidosa*	Moraceae				FR	P	

[57] *https://www.researchgate.net/publication/319632801*

[58] *https://www.currentscience.ac.in/Volumes/107/10/1657.pdf*

3	*Artocarpus chaplasha*	Moraceae			FL	FR	P	B
4	*Ficus ramentacea*	Moraceae	YL	ML		FR		B
5	*Anthocephalus chinensis*	Rubiaceae				FR		
6	*Balakata baccata*	Euphorbiaceae				FR	P	
7	*Elaeocarpus ganitrus*	Euphorbiaceae				FR		
8	*Ficus gibbosa Blume*	Moraceae				FR		
9	*Ficus laevis*	Moraceae	YL	ML		FR	P	
10	*Dysoxylum gobara*	Meliaceae	YL	ML				
11	*Eurya acuminata*	Pentaphylacaceae				FR		
12	*Horsfieldia amygdalina*	Myristicaceae				FR		
13	*Trichosanthes truncata*	Cucurbitaceae	YL	ML		FR		
14	*Pothos hookerii Schott*	Araceae	YL				P	B
15	*Hoya parasitica Wallich*	Azelepidaceae	YL	ML	FL			
16	*Ailanthus grandis*	Simaroubaceae	YL	ML				
17	*Gynocordia odorata*	Achariaceae				FR		
18	*Alseodaphne petiolaris*	Lauraceae		ML				
19	*Agapetes kanjilalii*	Ericaceae	YL	ML		FR		
20	*Ficus rhododendrifolia*	Moraceae	YL	ML		FR		
21	*Barringtonia acutangula*	Lecythidaceae	YL	ML				
22	*Abrus pulchellus*	Papilionaceae	YL	ML		FR		
23	*Olea dioica*	Oleaceae				FR		
24	*Tetrastigma thomsonianum*	Vitaceae	YL	ML				
25	*Ficus hispida*	Moraceae				FR		
26	*Ficus benjamina*	Moraceae				FR		
27	*Tricalysia singularis*	Rubiaceae				FR		
28	*Passiflora edulis*	Passifloraceae	YL			FR	P	
29	*Ficus bengalensis*	Moraceae	YL				P	B
30	*Carallia brachiata*	Rhizophoraceae	YL			FR		
31	*Aspidocarya uvifera*	Menispermaceae	YL		FL			
32	*Butea parviflora*	Papilionaceae	YL	ML				
33	*Talauma hodgsoni*	Magnoliaceae	YL		FL			B
34	*Spondias mombin*	Anacardiaceae				FR		

35	*Spondias pinnata*	Anacardiaceae	YL					
36	*Spondias pinnata*	Menispermaceae	YL	ML				
37	*Mangifera sylvatica*	Anacardiaceae				FR		
38	*Millettia pachycarpa*	Papilionaceae	YL			FR		
39	*Macrosolen cochinchinensis*	Loranthaceae			FL			
40	*Syzygium jambos*	Myrtaceae	YL		FL			
41	*Dalbergia pinnata*	Papilionaceae	YL			FR		
42	*Piper longum*	Piperaceae	YL	ML		FR		B
43	*Bombax ceiba*	Bombacaceae			FL			
44	*4 Syzygium fruticosum*	Myrtaceae	YL					
45	*Cayratia trifolia*	Vitaceae	YL	ML		FR		B
46	*Stenochlaena palustris*	Blechnaceae	YL					
47	*Ficus fistulosa*	Moraceae				FR		
48	*Trewia nudiflora*	Euphorbiaceae	YL	ML				
49	*Piper nigrum*	Piperaceae	YL					
50	*Smilax perfoliata*	Smilacaceae	YL	ML				
51	*Papilionanthe teres*	Orchidaceae	YL		FL			
52	*Talauma phellocarpa*	Magnoliaceae				FR		
53	*Paederia foetida*	Rubiaceae		ML				

***Implementation locations*:** As illustrated in the location map above.
***Stage of Mitigation Hierarchy*:** Additional Conservation Efforts
***Implementation agencies*:** Oil India Limited, conservation biologists, local infrastructure services
Broad Costing: Depending on the feasibility
***Species benefitted*:** Tree Dwelling mammals, birds, butterflies and herpetofauna (Including species protected under schedules of WPA).

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CONCLUSION

Conclusions

For Biodiversity Assessment for OIL India Limited, Baghjan, baseline data was collected during the monsoon and winter season. Tea Plantation is the dominant habitat of the study area followed by Forest, Waterbody, Built-up and Open land, Cropland, and Homestead Plantation.

In monsoon season, 40 species of trees, 33 shrubs, 62 herbs and 13 Pteridophytes were recorded under flora; whereas 65 species of Birds, 70 species of Butterflies, 4 species of Mammals, 4 species of Herpetofauna and 17 species of Fishes were recorded under fauna.

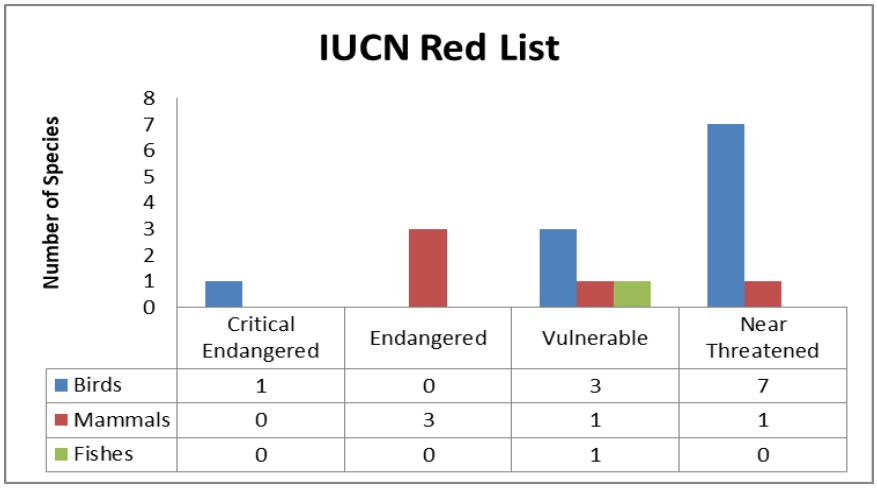
In winter season, 45 species of trees, 33 shrubs, 86 herbs and 20 Pteridophytes were recorded under flora; whereas 133 species of Birds, 80 species of Butterflies, 10 species of Mammals, 2 species of Herpetofauna and 19 species of Fishes were recorded under fauna.

Table 48 : : Conclusive Baseline Data

Taxa	Season 1	Season 2	COMBINED
Birds	65	133	147
Butterflies	70	80	112
Mammals	4	10	10
Herpetofauna	4	2	6
Fishes	17	19	19
Trees	40	45	86
Shrubs	33	33	57
Herbs	62	86	152
Pteridophytes	13	20	47

In the two seasons a total of 86 species of trees, 57 shrubs, 152 herbs and 47 Pteridophytes were recorded under flora; whereas 147 species of Birds, 112 species of Butterflies, 10 species of Mammals, 6 species of Herpetofauna and 19 species of Fishes were recorded under fauna.

Various species falling under IUCN Red List and WPA Schedules were observed during the primary data collection. Number of species falling under IUCN Red List across the taxa are as follows:



Number of species falling under WPA Schedules across the taxa are as follows:

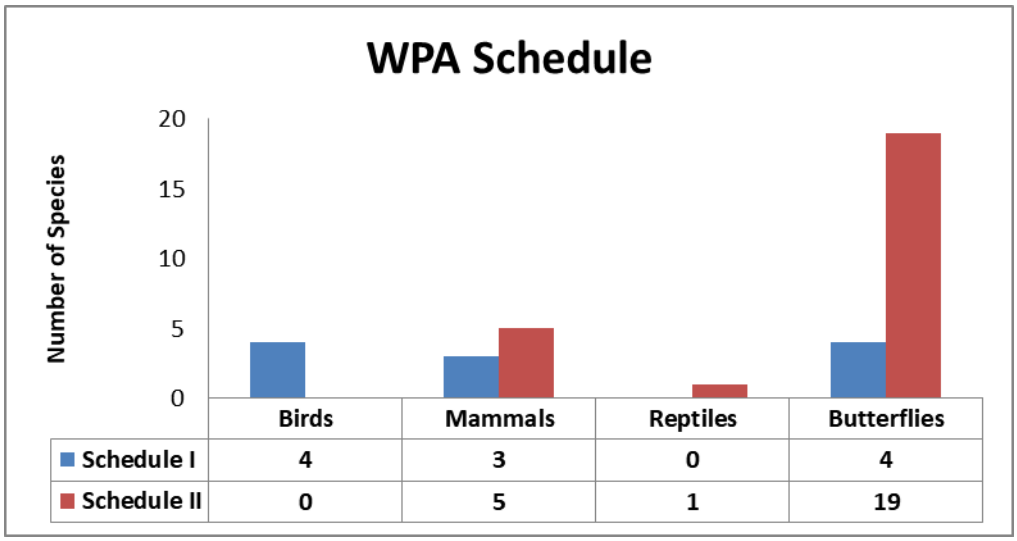


Figure 94 : Observed species falling under IUCN Red List and WPA Schedules

In terms of species documented during survey, 4 species of birds, 3 species of mammals, 4 species of butterflies were found to be protected under schedule I of the WPA and 5 species of mammals, 19 species of butterflies and 1 species of reptiles were found to be protected under schedule II of the WPA.

Table 49 : WPA Schedule Fauna group

Group	WPA schedule	
	WPA schedule I	WPA schedule II
Birds	**4**	**-**
Mammals	**3**	**5**
Butterflies	**4**	**19**
Reptiles	**-**	**1**

The study area was screened for all the possible impacts due to exploration and the relevance of each impact was noted. These identified impacts were screened through a biodiversity impact matrix where the likelihood of impacts and the magnitude of impact was taken in consideration to identify the level of significance.

In addition to the impacts, a risk assessment to identify the potential risk from the exploration study was conducted through a matrix of Biodiversity Importance Category (sensitivity of species, habitat, or sustaining ecosystem) and the biodiversity impact (likelihood and magnitude of the Impact).

The **Biodiversity Importance Category** for the given study can be considered as **Category B** due to presence of forest and aquatic habitats supporting rich biodiversity.

As three of the identified risks, i.e. Impact 10, Impact 15, and Impact 16 fall in the 'Severe category' in the biodiversity risk matrix. *In case of extreme events such as blowouts, as four of the identified risks, i.e. Impact 23, Impact 24, Impact 26, and Impact 29 fall in the Severe category in the biodiversity risk matrix, along with above mentioned three impacts,* ***it can be concluded that the overall risk for the given study on Biodiversity is 'HIGH'.***

The impact assessment study presents a valuable list of species that can serve as a reference for conservation considerations throughout the project. The study's findings indicate a high level of biodiversity risk, as revealed by the conducted biodiversity study. In light of this, it is strongly advised by the International Union for Conservation of Nature (IUCN) that OIL India Limited actively implements the suggested measures outlined in the Biodiversity Management Plan as a conscious biodiversity conservation effort.

Impact	**Recommended Action**
Impact 1: There will be an increase in the ambient noise levels in and around the drill sites due to the project activities, which will lead to changes in species abundance, and disruption of species communication, breeding, nesting and roosting patterns.	**Action 1:** Construction of a green wall along the boundary of the ERD surface locations
Impact 2: Increase in underwater noise and vibration in the river water by the equipment and machinery used during the drilling would be most noticeable in the immediate surrounding area and would hamper the natural movement of dolphins, fishes, and turtles, which would prevent them from meeting their biological requirements. It may also affect the echolocation properties of dolphins.	**Action 2:** Identification and Monitoring Plan for Fishes, Turtles and Ganges River Dolphin Action 2A) Identification and Monitoring of Fish breeding and pools site Action 2C) Third-Party Monitoring of Ganges River Dolphin using Passive acoustic monitoring (PAM)
Impact 3: Air pollutants can affect wildlife through the disruption of endocrine functions, organ injury, increased vulnerability to stresses and diseases; lower reproductive success, and possible mortality.	**Action 3:** Practices for reducing air pollutants **Action 3a)** Use of retrofitted emission control equipment for DG sets with duel fuel technology **Action 3b)** Water sprinkling for the vehicular dust and fugitive emissions during operations **Action 3c)** Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary **Action 3d)** Regular care and maintenance for vehicles and drilling equipment
Impact 4: Wastewater and formation water will be generated during drilling activity and the domestic wastewater from the labour camps, which may contain chemical and biological contaminants. If discharged untreated may adversely affect the surface water quality. **Impact 5:** Surface runoff from drilling waste (cuttings and drilling mud) storage areas, hazardous waste (waste oil, used oil, etc.) storage areas and chemical storage areas is	**Action 4:** Construction of floating treatment wetlands

likely to be contaminated and have the potential to impact the water quality of the receiving waterbody. This will affect the ecologically sensitive areas of the waterbody like migratory and resident bird habitats, fish habitats, breeding and nursing ground for fishes, and the habitat of the Gangetic Dolphin. Degradation of water quality will affect the primary productivity of the river.	
Impact 6: Contamination of soil due to spillage of hazardous waste, chemicals, cement, fuel, lubricants, (spent oil & used oil), batteries, and e-waste and municipal waste affects the soil microbes and bacterial growth and can affect the soil quality **Impact 9:** Kitchen Waste from Labour camps if not disposed properly can attract rodents, snakes, monkeys etc. that may lead to human wildlife conflict on the site.	**Action 5:** Solid waste management plan for the ERD locations
Impact 7: Spillage of drill cuttings, drilling mud and drilling fluid during storage on the nearby open soil may lead to change of soil characteristics due to chemical contamination.	**Action 6:** Preventive measures for contamination due to accidental spillage
Impact 8: Surface runoff during monsoon season from the construction site, construction material & waste storage area and spillage area have the potential to degrade soil quality due to deposition of foreign materials, hydrocarbon and other hazardous waste.	**Action 7:** Increasing the High-Density Polyethylene (HDPE) lined pit wall's height
Impact 10: Change in Landuse and species composition along with loss of native vegetation. **Impact 11:** Faunal dispersal and loss of feeding ground.	**Action 8:** Offset plantations with Native species and offset monitoring.
Impact 12: Site clearance and stripping of top soil during site construction may result in increase in soil erosion and loss of fertile soil. **Impact 13:** Increase in silt load in the surface run-off will in turn increase the suspended solids load on immediate surroundings, which may affect local floral and faunal species and ecosystems.	**Action 9:** Construction of floating treatment wetlands and reusing the top soil
Impact 14: Illumination with artificial lighting as drilling is conducted continuously for 24 hours and thus may cause significant effects on local faunal species like 1) they might abandon breeding or roosting. 2) Change in migratory patterns 3) Biological stress on animals	**Action 10:** Use of dark sky friendly lighting practices

Impact 15: Decreased habitat use and increase in the roadkill of native fauna/ livestock. **Impact 16:** Damage to existing nearby flora	**Action 11:** Prevention of animal - human conflict **Action 11a)** Minimal use of routes passing through Bherjan Borajan Podumoni Wildlife Sanctuary **Action 11b)** Monitoring animal mortality due to collision with vehicles **Action 11c)** Installation of reflective signboards **Action 11d)** Installation of reflective speed breakers and adding speed limit regulations **Action 11e)** Preventive measures to minimize Human-Animal conflict on encountering wild animals
Impact 17: Over use of ground water may lower the ground water table **Impact 18:** During drilling activity, different aquifer will be intersected which may get contaminated by chemicals, lubricants, oil etc.	**Action 12:** Safe practices for using groundwater resources
Impact 19: Alteration of onsite micro drainage pattern leading to potential problems of water logging in the agricultural land and low-lying areas, which may affect habitats of reptiles, and mortality of floral species.	**Action 13:** Construction underpass for water below the approach road
Impact 10: Change in Landuse and species composition along with loss of native vegetation	**Action 14:** Restorative Practices after decommissioning
In case of extreme events	**Action 15:** Formation of wildlife rescue teams and creating a network of veterinary hospitals and refuge sites **Action 16:** Clean-up of Oil spill on surface water
Additional conservation efforts	**Action 17:** Connecting fragmented forests and homestead plantations for Hoolock Gibbon populations

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- Official website of the Assam State Biodiversity Board: http://www.asbb.gov.in/

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