Socioeconomic and livelihood assessment in selected rural & urban human settlements in Deepor Beel & its riparian fringe area

Ministry of Environment, Forest and Climate Change

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

Published by
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Protection and Sustainable Management of Aquatic Resources in the Northeastern Himalayan Region of India (NERAQ)
Guwahati Regional Office
Sarbeswar Bhawan,
Byelane No.1, Jayanagar, Six Mile,
Guwahati – 781022, Assam
E: info@giz.de
I: www.giz.de/India

Responsible
Patricia Dorn,
Project Manager, NERAQ

Authors
Study Team: Dr. Partha J Das (Team Lead and Lead Author)
Core survey team and Co-authors: Hemanta Phukon, Kakali Sarma, Pragyan Gautam, Leena Sharma, Nehar Sabnam Sarkar, Shrabyastuti Borgohain, Raktim Ranojoy Neog, Rachel Elizabeth and Arup Das
Supporting team and Core management group: Arup Das (GIS Specialist)**,** Dr. Bidyut Bikash Sarma (Environmental Pollution specialist)**,** Dr. Bibhuti Lahkar (Livelihood specialist), & Pranab Goswami (Environmental awareness and communication specialist)

Design and Layout
Crossed Design

Photo credits
Cover photo: GIZ

GIZ is responsible for the content of this publication.

On behalf of the
German Federal Ministry for the Environment, Nature Conservation,
Nuclear Safety and Consumer Protection (BMUV) under the International Climate Initiative (IKI)
New Delhi, 2024

Socioeconomic and livelihood assessment in selected rural & urban human settlements in Deepor Beel & its riparian fringe area

CONTENTS

List of Tables, Figures, Maps & Photos **5**

TABLE OF CONTENTS

1. Introduction **9**
2. Socio-Demographic Profile of the study area **32**
3. Socio-Economic Profile of the study area **42**
4. Livelihood Scenario in the study area: An Overview **49**
5. Detailed Analysis-Fishing as a livelihood **64**
6. Detailed Analysis-Agriculture as a livelihood **76**
7. Detailed analysis - Livestock Rearing and Animal Husbandry as a livelihood. **83**
8. Detailed analysis-Other Livelihoods Weaving as a livelihood **92**
9. Alternative livelihoods: A need assessment **101**
10. Ecosystem Services from the Deepor Beel **108**
11. Management & Governance issues **116**

Recommendations **134**

Annexures **137**

LIST OF TABLES, FIGURES & IMAGES

LIST OF TABLES

1. Table 1: Number of FGDs, KIIs and informants (both man and woman) who participated in the PRA exercises during the study

2. Table 1: Basic information on the HSUs and survey
Table 2 The demographic features of the selected HSUs
Table 3: Presence of caste, religion, and ethnic/linguistic groups in the HSUs
Table 4: Presence of caste groups in the HSUs
Table 5: Presence of caste groups in the HSUs
Table 6: Presence of ethnic/linguistic groups in the HSUs
Table 7: Educational qualification of the fringe dwellers (Compared to total population)

3. Table 1: Availability of the sources of drinking water for the HSUs of the study area.
Table 2: Summary of drinking water facilities available in the study area
Table 3: Habit of water filtration in households in the study area
Table 4: Range of annual household income
Table 5: Selected indicators of economic condition

4. Table 1-A: Distribution of households and persons pursuing major livelihoods in the HSUs.
Table 1-B: Distribution of households and persons pursuing major livelihoods in the HSUs.
Table 1-C: Distribution of households and persons pursuing major livelihoods in the HSUs.
Table 2: Households associated with major livelihoods: Fishing, weaving, livestock rearing, and own business.
Table 3: Populations associated with major livelihoods: Private job daily wage-earning Government job.
Table 4: Distribution of households pursuing minor livelihoods in the HSUs.
Table 5: Households associated with minor livelihoods: Dairy, Collection of NTFP.
Table 6: Distribution of households with single livelihood sources in the HSUs of the study area.
Table 7: Distribution of the number of persons with single livelihood sources in the HSUs of the study area
Table 8: Number of Households pursuing single livelihoods in agriculture and fishing and Number of Persons having single livelihoods in daily wage earning and service (private /public)
Table 9: Trends in the livelihoods in 2023

5. Table 1: Households having fishing as the main livelihood.
Table 2: Monthly income of fishermen during the fishing season in Deepor Beel

6. Table 1: Major crops cultivated by the agricultural households.

7. Table 1: Number of households engaged with the rearing of various livestock assets(animals)
Table 2 shows the number of HHs that are engaged in livestock rearing for subsistence (to fulfil their own needs) and income generation.

8. Table 1: nature of private and government jobs/employment and own business done by the people in the study area.

9. Table: 1: Choice of alternative livelihoods of the community

10. Table 1. Provisioning Services
Table 2. Regulating Services
Table 3. Cultural Services
Table 4. Supporting Services

11. Table 1: The statistics of Landuse-landcover change of the elephant corridor area on the south bank of the Deepor Beel during 2001-2015

LIST OF FIGURES

1. Figure 1: Deepor Beel: Location, catchment, and hydrological connectivity

2. Figure 1: Male-female population ratio in the study area
Figure 2: Presence of caste groups in the HSUs
Figure 3: Presence of caste groups in the HSUs
Figure 4: Presence of ethnic/linguistic groups in the HSUs
Figure 5: Literacy situation in the study area
Figure 6: Educational qualifications of the people in the study area

3. Figure 1: Household-level practices of treating drinking water.
Figure 2: Range of annual household income.
Figure 3: Status of poverty in the study area in terms of the number of households in the BPL and APL categories.
Figure 4: housing types in the study area.

4. Figure 1: The Sustainable Livelihood Framework concept (as presented in DIFID, 1999).
Figure 2: Reformulated framework of SLF, source: Natarajan et al., 2022
Figure 3: Households associated with some major livelihoods.
Figure 4: Population associated with some major livelihoods.
Figure 5: Households involved with minor livelihoods.
Figure 6: Number of Persons having single livelihood sources: Daily Wage Earning and Service (Private & Public) and Number of Households having single sources of livelihoods: Agriculture and Fishing

5. Figure 1: Distribution of the families of fisherfolks in the HSUs in the study area
Figure 2: A leaflet on information about the fishing ban/lean period as per Government rules published by Aaranyak under the NERAQ Project for the awareness of the people living around the Doloni Beel, Bongaigaon District.

6. Figure 1: Number of households with agriculture as a livelihood in the HSUs
Figure 2: Number of households having the livelihood of agriculture as a percentage of the total number of households in the study area.
Figure 3: Number of households belonging to the two categories of land ownership.
Figure 4: Number of HH producing major crops both as absolute numbers and % of agricultural HH
Figure 5: A flow diagram informing about the problems and constraints affecting their pursuit of agriculture as a livelihood.

7. Figure 1: Distribution of households having LiRAH as a livelihood in the HSUs compared to the total number of HHs of the HSUs in the study area.
Figure 2: Households with LiRAH as % of the total number of HH in HSUs
Figure 3: Number of households having Livestock Rearing and Animal Husbandry as a source of livelihood

Figure 4: Households having various livestock types as % of total HH with LiRAH

8. Figure 1: Number of households with weaving as a major livelihood compared to the total number of HHs in the HSUs.
Figure 2: Number of persons earning from private jobs compared to the populations in the HSUs.
Figure 3: Number of persons having government jobs in the HSUs compared to the % of the population in the HSUs.
Figure 4: Number of persons earning from daily work as % of the population of the HSUs
Figure 5: Households having own business as a livelihood and as % of total HSU population.

10. Figure 1: Categories of ecosystem services as defined by the MEA, 2005

11. Figure 1: The map of the Eco-sensitive Zone of the Deepor Beel as defined by the draft ESZ notification, GoI.
Figure 2: The Map of ESZ overlaid on the map of the study area.
Figure 3: Landscape analysis on the southern plain strip of the Deepor beel containing the elephant corridors for the years 2001 and 2005.
Figure 4: Landscape analysis on the southern plain strip of the Deepor beel containing the elephant corridors for the years 2010 and 2015.
Figure 5: Map of the Deepor Beel as of November 22, 2022, showing the extent of the wetland and its land use in the post-monsoon season of 2022.

LIST OF MAPS

2. Map 1: Location of various HSUs in the fringe area of the Deepor Beel within 1 km and 2 km buffer zones
Map 2: Distribution of the selected 19 HSUs surveyed around the Deepor Beel

LIST OF PHOTOS

1. Photo 1: A moment during the Orientation Session where the survey team was trained on the PRA methodology by the resource persons of Aaranyak.
Photo 2: Dr. Sudip Kanta Basistha speaking in the consultation on 12th April 2023 in Pachim Guwahati College
Photo 3: Resource persons who spoke about various issues on Deepor Beel in the consultation in Pachim Guwahati College on April 12
Photo 4: Local community leader Umed Ali interacting with the resource persons in the meeting.
Photo 5: A glimpse from the consultation at Matia village on May 17, 2023
Photo 6: A view of the rural woman participating in the Matia meeting on May 17, 2023
Photo 7: Women strongly raising their voices during the Matia meeting.
Photo 8-16: The project team is seen conducting various PRA exercises with the communities of the study area.

5. Photo 1: Jal (net)
Photo 2: Goroi Langi Jal
Photo 3: Dheki Jal
Photo 4: Poloh
Photo 5: Aska
Photo 6: Fish being sold in containers called Aska which is the popular unit of volume of fish in the market.
Photo 7: Some households are doing integrated fish and duck farming in household ponds.

6. Photo 1: Although agriculture is fast losing its importance as a major income source, some households are still farming various paddy types for their own consumption as well as for business.
Photo 2: Sight of a common homestead garden of an indigenous family in the study area

7. Photo 1: A typical cattle shed in a household.
Photo 2: Lack of grazing land is a major constraint for the people who are rearing livestock for a livelihood.

8. Photo 1: A traditional waving loom locally called 'Tant Shal' is a common feature in every indigenous Assamese household.
Photo 2: The lady weavers at work in Natun Basti (also known as Natun Gaon) using the yarn derived from water hyacinth (Archive photo of Aaranyak, June 2021)
Photo 3: Yoga mats known as Moorhen Yoga Mat are produced from water hyacinth under the NECTAR -SIMAN Project in Natun Basti, Deepor Beel (Archive photo of Aaranyak, June 2021).

9. Photo 1: The wetland provides grasses and other plants and fodder for the livestock of the local people.
Photo 2: Euryale ferox or Foxnut plant grows in plenty in the Deepor Beel, the fruit of this plant yields the makhana or nikori
Photo 3: Makhana or Nikori (Foxnut) fruit is an important aquatic edible fruit that is used in local recipes and has high value for producing nutritious food products.

11. Photo 1: Beltol (Matia) Elephant Corridor
Photo 2: Sabhaghar Elephant Corridor
Photo 3: Mikirpara Elephant Corridor
Photo 4: Segunbari Elephant Corridor
Photo 5: Tower Camp Elephant Corridor
Photo 6: Bhangrasthan Elephant Corridor
Photo 7: The sluice gate on the Khanajan rivulet which was constructed to reduce flooding in the area has become an impediment to the fish passage and movement between the Deepor Beel and the Brahmaputra River. (Photo in 2021)
Photo 8: The Khanajan sluice gate in 2023. The gate of the sluice system remains closed during the rainy season which is also the breeding season of fish this blocks the movement of the fish from the Brahmaputra to the wetland (2023).
Photo 9. Dumping of MSW near Boragaon since 2006 (situation in 2021). The dump site directly polluted water in Deepor Beel.
Photo 10: The MSW dump on the bank of the Deepor Beel near Boragaon (condition 2023).
Photo 11: MSW deposits on the new site on the Belor Ali in Pub Boragaon that started in August 2021
Photo 12: The Railway track passing through the southern part of the Deepor Beel
Photo 13: About 15 elephants died during 2004-2019 due to collision with trains while crossing the railway track near the Deepor Beel (From the archive of Aaranyak).

Introduction & the Background of the Study

Introduction & the background of the study

The Deepor Beel: The Baseline Information

Located in the southwestern fringe of Guwahati city (Figure 1), the Deepor Beel is one of the most important riverine wetlands of Assam. The beel is situated in the Kamrup. Metropolitan District, at a distance about 22 km from Dispur, the state capital by road. Although officially, the wetland is said to have an area of 4000 Ha (approximately 40 km2), (for example, in the Ramsar site portal) in reality, the effective average area is now only about 9 km2 (900 ha) on an average in the lean season.

It is a permanent freshwater swampy lake formed at an altitude of about 53 meters from the mean sea level. Geomorphologically, its origin and development are intimately linked with the geologic and tectonic history of the region, hydrology and channel dynamics of rivers, and pattern and intensity of land use in the area. Experts believe that the Beel, together with those adjoining swamps are the remnants of an abandoned channel of the Brahmaputra River (Sharma et al., 2008)[2].

The southern margin of the wetland is flanked by the Rani-Garbhanga Reserved Forest and its hilly terrain that are extensions of the Meghalaya hills. A railway track passes through the southern side of the wetland almost parallel to a road which has been recently renovated as an important route between the Gauhati Airport and the main city of Guwahati. The eastern side has the National Highway-37 and several small and big industries and factories. The northern side has the Assam Engineering College Campus, the Jalukbari hills skirting the Gauhati University Campus further in the north, the National Highway-37, and a few villages. The western boundary has the Matia Hills, Camp of the Central Reserve Police Force along with a few villages.

The Deepor Beel is characterised by an active hydrologic regime having hydrological connectivity to nearby rivers through inlets and outlets fulfilling the conditions of an open wetland. The main source of water in this water body is rainfall and runoff from the Basistha and Bahini rivers that flow from the Meghalaya hills on its southern fringe as well as the Mora Bharalu River that inflows from the northern side. Some contribution also comes from a small rivulet called Kalmoni originating from the Rani-Garbhanga hills on the southwest of the wetland. However, this contribution is prominent in the summer season only. The Beel drains into the Brahmaputra River, located about 5 km away to the north through a small rivulet called Khanajan also called the Khana Nadi (Das and Das, 2019)[3].

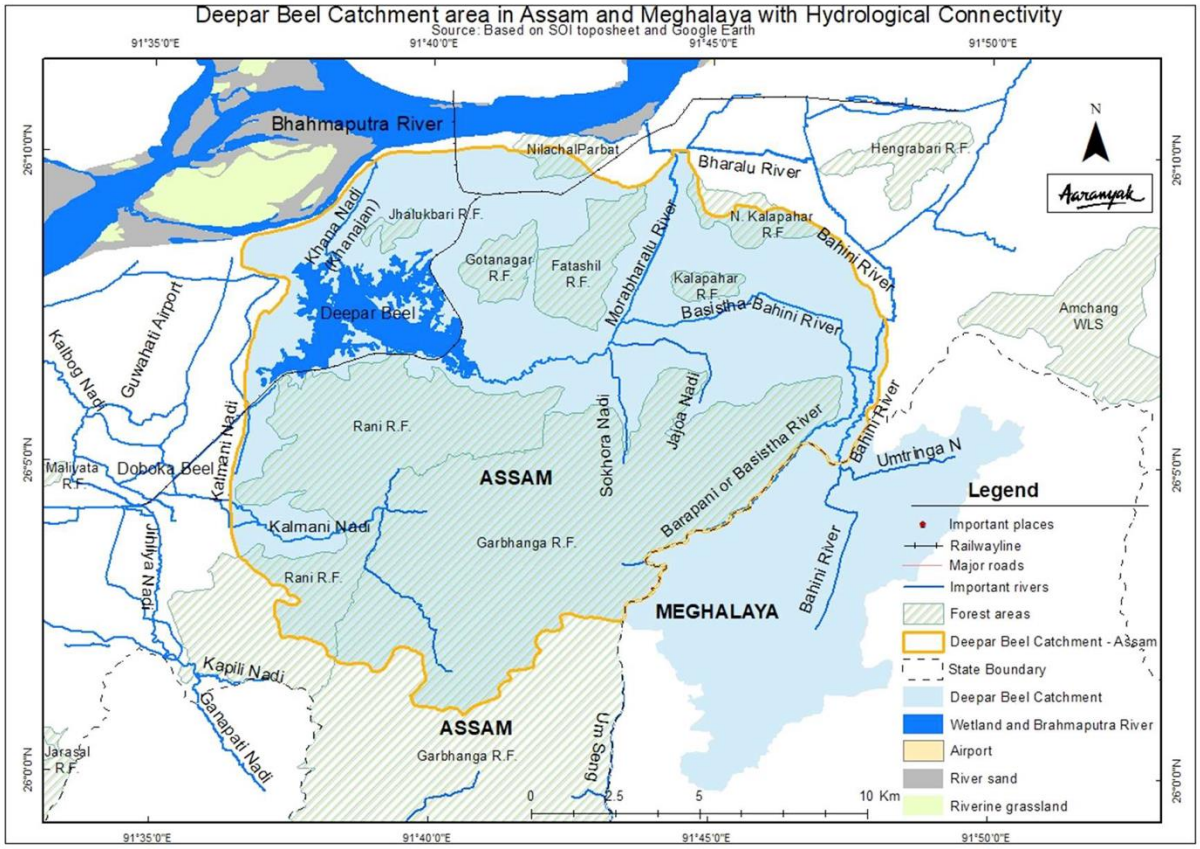


Figure 1: Deepor Beel: Location, catchment, and hydrological connectivity

A large variety of aquatic flora of tropical wetlands is found in the Deepor Beel and its adjoining areas. The giant water lily (Euryale ferox), also called Makhana and locally known as nikori, used as a source of nutritious food, also grows here. This plant has considerable economic importance. Many wetland vegetables, fruits, and medicinal plants have been found in this wetland, which helps, directly or indirectly, the sustenance of the villagers in the fringe areas.

The Deepor Beel is home to a significant population of endangered and rare residential as well as migratory birds. Around 150 species of birds have been recorded so far in and around. the wetland, including nine threatened species. Because of the avifaunal richness of the wetland, it was designated as a Ramsar Site in November 2002. It is also an IBA (Important Bird Area) declared by Birdlife International (UK) in 2004. An area of 4.14 km2 of the wetland was declared as a wildlife sanctuary by the Government of Assam in the year 2009.

The southern side of the lake is contiguous with the Rani-Garbhanga Reserve Forest, which is a good habitat for Asiatic elephants, leopards, and some other mammals. Elephants in herds frequently come down from these forests to the wetland for watering in the summer. The Government of Assam declared its intention to demarcate about 117 square km of land of this RF as the Garbhanga Wildlife Sanctuary in March 2022.

.

The beel is a major fish breeding ground for many fish species and it provides fish stocks to nearby wetlands and rivers. The diversity and concentration of indigenous freshwater fish species are very high in the Deepor beel owing to the diverse habitat types and high productivity of the wetland. About 50 species of fish belonging to 19 families are already identified in this wetland.

This wetland provides all types of ecosystem services recognised in the Millennium Ecosystem Assessment (MEA, 2005) such as provisioning, regulating, cultural and supporting services to the people living on its banks which help people sustain their lives and livelihoods in various ways and means.

The water body acts as a stormwater reservoir for a larger part of the city of Guwahati and thereby helps in the moderation of urban flooding. The wetland also plays an important role in the local water supply, provides natural resources and products, fodder, and food for both domestic and commercial use of local people, and facilitates water transport, recreation, and eco-tourism.

Being a major source of fish resources, the beel has become the main source of livelihood for a large population, especially the fishing communities living in nearby villages. More than five thousand people depend for their livelihoods on the rich fish stock of the wetlands (Das et al., 2014)[5]. According to a survey conducted by Das (2007)[6] in 14 villages located on the bank of the wetland, about 23% of people use the beel for commercial fishing, while 17% are associated with agriculture (mainly paddy) on the banks of the wetland. Besides, some people earn money by making traditional pottery and collecting and selling firewood, aquatic plants like water hyacinth and Makhana (fox nut or Euryale ferox) and molluscs. These livelihoods are supported directly by the ecosystem services of the wetland.

The rapid socioeconomic survey conducted by Das et. al. (2014), in 8 villages located in the immediate vicinity of the main wetland, the inlet (Basistha-Bahini), and the outlet (Khanajan) showed that about 41.53% of total households depended on fishing as their only source of livelihood. 13.84% still depended on agriculture.

The wetland has high recreational value as it attracts a good number of tourists because of its scenic beauty and large number of local picnickers. Scientists, researchers, nature lovers, nature photographers, and bird watchers also throng the wetland throughout the year making ecotourism a source of livelihood for the local people some of whom act as nature guides and boatmen for the tourists. There are a few resorts and food joints coming up in nearby areas to provide service to the growing number of people visiting the wetland for different purposes.

1.7. Rational for Intervention

This ecologically and socioeconomically important wetland is under tremendous pressure and facing grave threats due to multiple anthropogenic factors such as changing land use on its

[4]Chetry, G. (1999). Limnology of Deepor Beel with special reference to its Biodiversity, and Pollution Status. Unpublished Ph.D. Thesis, Gauhati University, Assam.

[5]Das, P.J., Hazarika, M.A. and Das, A. (2014). Status and trends in wetlands with reference to hydrological connectivity, climate change impacts and implications for biodiversity and community livelihood: a case study in Deepar Beel, India-Phase II (2012-2014). Unpublished Technical Report submitted to IUCN-New Delhi. Study carried out under the 'Ecosystem for Life: A Bangladesh –India Initiative' of IUCN.

[6] Das, P.J. (2007). Livelihood patterns and possibilities in fringe areas of important wetlands In Assam (India): A case study of four wetlands. Report prepared by the North East Centre for Environmental Research and Development (NE-CERD), submitted to the IWMI-Tata Programme (ITP) under its North East (India) Initiative.

periphery, encroachment, landfilling, pollution, stone quarrying, soil-cutting in the nearby hills, garbage dumping, excessive fishing, eutrophication, and accelerated siltation resulting in overall ecological degradation, fragmentation of the aquatic habitat and consequent reduction in its ecosystem services.

The number and diversity of migratory birds that used to visit the beel have drastically come down in the last decade. For ages, the beel has been used for basking and cooling by elephants that come from the Rani Garbhanga hills located on the southern side of the water body through well-demarcated corridors. Several elephants have been killed by speeding trains that run on the tracks that pass through the southern margins of the wetland.

The administrative system in place for managing the wetlands is complex in nature with a top-down mode of governance in which the local community does not find much space for participation. The communities have grievances that they are not adequately entitled to their rights and access to the resources of the wetlands and are thus deprived of the equitable benefits of participatory management. The riparian people of the area also have resentment about the fact that the threats and pressures confronted by the wetland have not been addressed properly which has led to more adverse impacts and vulnerability of the wetland as well as the people.

The disgruntlement of the local people has been manifesting in the form of various campaigns, protests, media releases, and other organised activities by several organisations and individuals. Mobilised public opinion in the city of Guwahati and many other parts of the state also has strengthened the demand for the protection and conservation of the wetland. On several occasions, enforcement of some administrative decisions and management practices introduced by the concerned authorities have affected their socio-cultural and economic activities and livelihood security. Such occasions have led to various conflicting situations between the community and government agencies. As a result, several court cases have been litigated in the past. Some are still under judicial considerations.

On the other hand, communities have contributed to the cause of protecting and conserving the wetland through their own initiatives mobilised by several local NGOs. They have also supported the projects of many NGOs over the years that have worked for the socioeconomic empowerment of the local populace and the ecological health of the wetland.

There is no doubt that the Deepor Beel cannot be fully conserved or protected without the support of the community to the actions undertaken by the government and non-government organisations. Socioecological and development activities cannot be successful without the participation of the local people. The precarious co-existence of cooperation and conflicts and the singular importance of the community's present and future role in managing the wetland efficiently, have made it necessary to study the fundamental issues that have triggered the aforesaid diabolical situations vis-à-vis the multi-stakeholder milieu of the wetland and its riparian territory. Since the welfare of the community is deeply linked to the well-being of the wetland, it is important to understand how the communities are doing in terms of their present socioeconomic and livelihood situations.

The idea of the present study is the result of brainstorming on the perplexing situation regarding the wetland the concerns for its safe existence, and the need for an integrated plan of action for its sustainable management.

Objectives

The project has the following three broad objectives-

- Conducting a Socioeconomic and Livelihood Assessment (SELA) in the stakeholder communities living on the banks of the Deepor Beel.
- Compilation of Research done on Deepor Beel and recommendations on uses of research outputs in the implementation of the IWMP of Deepor Beel.
- Recommendations for addressing existing conflicts as well as for avoiding further conflicts

Methodology of the assessment

This assessment uses mainly the methods of Participatory Rural Appraisal (PRA) for generating information from communities. The Focus Group Discussion (FGD), Key Informant Interview (KII), and the Transect Walk (TW) are the three main techniques of PRA used during this community-based assessment. The FGDs and KIIs were conducted based on a semi-structured questionnaire as attached as Annexure.

Participatory Rural Appraisal (PRA)

Participatory Rural Appraisal (PRA) is a popular and effective approach to gathering information in rural areas. This approach was developed in the early 1990s with a considerable shift in paradigm from a top-down to a bottom-up approach, and from a blueprint to the learning process. It is a shift from extractive survey questionnaires to experience sharing by local people. PRA is based on village experiences where communities effectively manage their natural resources. The basic concept of PRA is to learn from rural people (Cavestro, 2003)[7].PRA is an approach and method for learning about rural life and conditions from, with, and by rural people and it extends into analysis, planning, and action involving villagers and local officials in the process (Chambers, 1992)[8]. PRA refers to a family of approaches and methods to enable rural people to share, enhance, and analyse their knowledge of life and conditions, to plan and to act. The scope of PRA now also includes urban residents and other populations such as refugees (Sandham et al., 2019)[9].

The concept and practice of PRA have evolved and transformed over the years to give rise to various other methodological tools and techniques. Many users now refer to it as Participatory Learning and Action (PLA) to reflect its broader application and to emphasise that the process is designed to help set in motion locally-led action (Napier and Simister, 2017)[10].

---

[7] Cavestro, L. (2003). P.R.A. - Participatory Rural Appraisal Concepts Methodologies, and Techniques. https://liberiafti.files.wordpress.com/2013/08/cavestro_participatory-rural-appraisal-concepts-methodologies-techniques.pdf

[8] Chambers, R. 1992. Rural Appraisal: Rapid, Relaxed and Participatory. Institute for Development Studies Discussion Paper 311, University of Sussex, Sussex.

[9] Sandham, L. A., Chabalala, J. J., & Spaling, H. H. (2019). Participatory Rural Appraisal Approaches for Public Participation in EIA: Lessons from South Africa. Land, 8(10), 150. https://doi.org/10.3390/land8100150

[10] Alison Napier and Nigel Simister (2017). Participatory Learning and Action (PLA), https://www.intrac.org/wpcms/wp-content/uploads/2017/01/Participatory-learning-and-action.pdf

Participatory Learning and Action (PLA) is a type of qualitative research, that can be used to gain an in-depth understanding of a community or situation. It is widely used in work involving local communities. PLA is a participatory methodology and should always be conducted with the full and active participation of community members. The main purpose of PLA is to support people within communities to analyse their own situation, rather than have it analysed by outsiders, and to ensure that any learning is then translated into action (Gosling and Edwards 2003) [11].

Focus Group Discussion (FGD): (Sourced from www.herd.org.np)[12]

A focus group discussion involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest. It is a form of qualitative research where questions are asked about their perceptions attitudes, beliefs, opinions, or ideas. In focus group discussion participants are free to talk with other group members; unlike other research methods, it encourages discussions with other participants. It generally involves group interviewing in which a small group of usually 8 to 12 people. It is led by a moderator (interviewer) in a loosely structured discussion of various topics of interest.

The group's composition and the group discussion should be carefully planned to create a non-intimidating environment so that participants feel free to talk openly and give honest opinions. Since participants are actively encouraged to not only express their own opinions, but also respond to other members and questions posed by the leader, focus groups offer depth, nuance, and variety to the discussion that would not be available through surveys.

Additionally, as FGDs are structured and directed, but also expressive, they can yield a lot of information in a relatively short time. Therefore, FGDs are a good way to gather in-depth information about a community's thoughts and opinions on a topic. The course of the discussion is usually planned and most moderators rely on an outline, or guide, to ensure that all topics of interest are covered.

Key Features of FGDs

- Involves organized discussion with a selected group of individuals to gain information about their views and experiences of a topic
- Particularly suited for obtaining several perspectives on the same topic
- Helps in gaining insights into people's shared understanding of everyday life and how individuals are influenced by others in a group situation

Pros and Cons of Using FGDs

The advantages of focus group discussion are as follows:

- Free and open discussion among the respondents results in the generation of new ideas that can be very useful for decision-making.
- A focus group is not static. The moderator can bring any changes to better facilitate the

---

[11] Gosling, L and Edwards, M (2003). Toolkits: A practical guide to assessment, monitoring, review, and evaluation. Second edition. Save the Children, UK.

[12]https://www.herd.org.np/uploads/frontend/Publications/PublicationsAttachments1/1485497050-Focus%20Group%20Discussion_0.pdf

discussion during the group discussion. This dynamism allows better results in terms of information derived by a focus group.
- Expressions other than those in verbal form such as gestures and stimulated activities can provide the researcher with useful insights.

The disadvantages of using focus group discussion are as follows:
- Though the moderator can control the discussion, the extent to which he/she can control the discussion depends on his/her experience. Inexperienced moderators may face problems in controlling some participants who try to dominate the group.
- Respondents may be reluctant to share some sensitive ideas and concerns publicly.
- Due to the small sample size and heterogeneity of individuals, the findings may not be adequate to make projections or a composite picture of the situation.
- Occasionally, an FGD can be a very artificial set-up that influences the respondents to express and act unnaturally. The findings may be far from the actual.

Key Informant Interview: (Sourced from Kumar, 1989)[13]

Simply stated, key informant interviews involve interviewing a select group of individuals who are likely to provide needed information, ideas, and insights on a particular subject. Two characteristics of key informant interviews need special mention.

First, only a small number of informants are interviewed. Such informants are selected because they possess information or ideas that can be solicited by the investigator. Depending on the nature and scope of an inquiry, the investigator identifies appropriate groups from which the key informants are drawn and then selects a few individuals from each group. The number of key informants usually ranges from 15 to 35. Such interviews should not, however, be confused with formal and informal surveys in which a relatively large number of people are interviewed.

Second, key informant interviews are essentially qualitative interviews. they are conducted using interview guides that list the topics and issues to be covered during a session. The interviewer frames the actual questions in the course of interviews. The atmosphere in these interviews is informal, resembling a conversation among acquaintances. The interviewer subtly probes informants to elicit more information and takes elaborate notes, which are developed later. If all the relevant items are not covered in a session, the interviewer goes back to the key informant. It is the unstructured nature of the interviews that invests them with special meaning and relevance in the present discussion.

---

[13]A Krishna Kumar (1989). Conducting Key Informant Interviews in Developing Countries, A.I.D. Program Design and Evaluation Methodology Report No. 13, Agency for International Development, https://www.participatorymethods.org/sites/participatorymethods.org/files/conducting%20key%20informant%20interviews_kumar.pdf

Clarifications about the methodology adopted:

- The PRA techniques viz. FGDs and KIIs were employed to generate mainly qualitative data using a semi-structured questionnaire.
- A transect walk was resorted to get familiar with the landscape of the Human Settlement Unit (HSU)[14]s surveyed in the study.
- In most cases, the quantitative demographic information was derived from government sources through the Panchayat offices, village heads, Anganwadi workers, ASHA workers, and owners of the Public Distribution System (PDS) shops.
- In those HSUs, which consist of one or more sub-villages or neighbourhoods (locally called *paras*), the data were collected at the level of the paras and then merged to the level of the HSU (Please refer to Chapter II).
- Some more quantitative data about socioeconomic and livelihood activities were also received from the community through FGDs and KIIs since the local people were confident about their information and knowledge about the small sub-villages/paras.
- The quantitative data collected from the community may have marginal uncertainties, not exceeding a (+/-) 5% error both on the positive and negative sides.
- We conducted 26 FGDs and 39 KIIs covering all HSUs in the area where 92 men and 155 women participated taking the total number of persons(informants) involved to 247. About 62% of the total respondents were women. This population does not account for the individuals whom we contacted and interacted with for obtaining quantitative data, for example, officials in Panchayats, Anganwadi workers, ASHA ladies etc. This enumeration is presented in Table 1.

Table 1: Number of FGDs, KIIs and informants (both man and woman) who participated in the PRA exercises during the study:

SN	Name of Survey Village	Names of sub-villages/Neighbourhood	Number of FGDs	Number of KIIs	Number of participants in PRA-Male	Number of participants in PRA-Female	Total number of participants in PRA
1	Deochotal	Karbipara, Nepalipara	2	3	4	24	28
2	Chakardeo	Mikirpara, Kalitapara, Majpara	3	2	6	5	11
3	Matia	Hatihala, Upor Keotpara, Natun Basti, Ganeshpara,	2	3	10	21	31
4	Haorapar		1	3	5	1	6
5	Keotpara		1	4	5	16	21
6	Hatuapara		1	1	1	8	9
7	Hirapara		1	1	1	11	12
8	Nowapara		1	1	2	10	12
9	Konapara		1	1	1	8	9
10	Natun Basti		1	1	3	7	10

[14] Here the term Human Settlement Unit (HSU) is used for the villages and the urban Municipal Wards that come under the stakeholder area of the Deepor Beel. The term is further explained in Chapter II of this report.

11	Medhipara		1	1	6	1	7
12	Borbori		1	1	7	1	8
13	Tetelia	Jarpara, Boripara, Ghoshpara, Boripara	1	3	8	3	11
14	Pamohi	Karbipara, Moinakhurung, Maghuapara	1	3	4	9	13
15	Paschim Boragaon	Vigyan Path, Milan Nagar Byelane I, Milan Nagar Byelane II, Shivam Path, Brindaban Nagar	1	4	5	8	13
16	Paschim Jalukbari		2	2	3	7	10
17	Dakhin Jalukbari		2	1	3	3	6
18	Maj Jalukbari		1	2	5	8	13
19	Khanamukh-(Rural & Urban)	Janarpar, Namaxudro, Phukanpara	2	2	13	4	17
	Total		26	39	92	155	247

Table 2: Tasks and methods followed for the SELA in Deepor Beel

SN	Major activity	Methodology
1	Acquisition of basic information about the wetland and its riparian zone	Secondary literature survey that included standard scientistic literature published in research journals, technical reports, newspaper articles and news items (April-May 2023).
2	Community meetings	Eight small community meetings, twelve individual interviews, and two consultations were arranged covering 10 stakeholder villages for understanding community's perception about the present major issues around them and the wetland (April-May 20-23).
3	Identification of stakeholder villages	Sourcing information from Aaranyak's past studies, and discussion with the Forest Department; (week 1, June 2023)
4	Preparation of questionnaire	A semi-structured questionnaire was developed based on Aaranyak's experience of working in the area, existing knowledge in Aaranyak and taking cues from some secondary literature and the mandate of the project; (Week 3 of May-Week 1 of June 2023).
5	Orientation to the survey team	A day-long workshop was organised as 'Orientation Session on Socio-economic and Livelihood Assessment in the fringe villages of Deepor Beel, Assam' on June 3, 2023, for the research staff involved in the Deepor Beel study. The

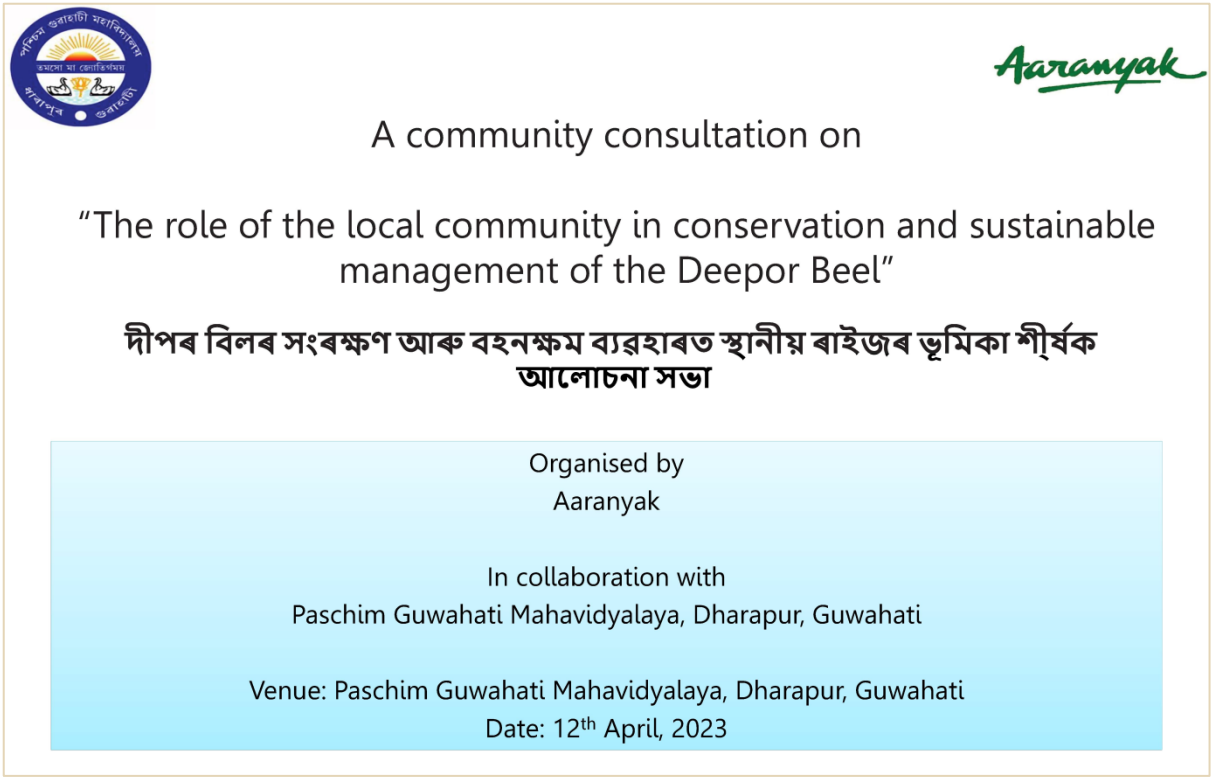
		session resource persons were Partha J Das, Bibhuti P Lahkar, Arup Kr Das and Pranab Kr Goswami, all from Aaranyak.
6	Recce of stakeholder villages and validation of the questionnaire	Rapid visits for reconnaissance to the selected stakeholder communities over a week; Getting introduced to the communities; Icebreaking with communities through random interactions; Piloting of the questionnaire in randomly selected communities covering about half the number of stakeholder villages (Week 2 of June 2023).
7	SELA survey in 19 Human Settlement Unit (HSU)s	Participatory Rapid Appraisal (PRA) techniques, mainly Focus Group Discussions (FGD), Key Informant Interview (KII) and Transect Walk (TW). (June week 3-September week 3, 2023).
8	Data entry and data analysis	Data integration from the level of sub-villages (or locally called para or neighbourhood) to the villages/HSU level followed by analysis interpretation using standard statistical techniques (August-September 2023).
9	Report writing	September week 3 to October week 4
10	Report submission	Week 1 of November, 2023

Photo 1: A moment during the Orientation Session where the survey team was trained on the PRA methodology by the resource persons of Aaranyak.

A short report on the community consultation organized during April-May 2023

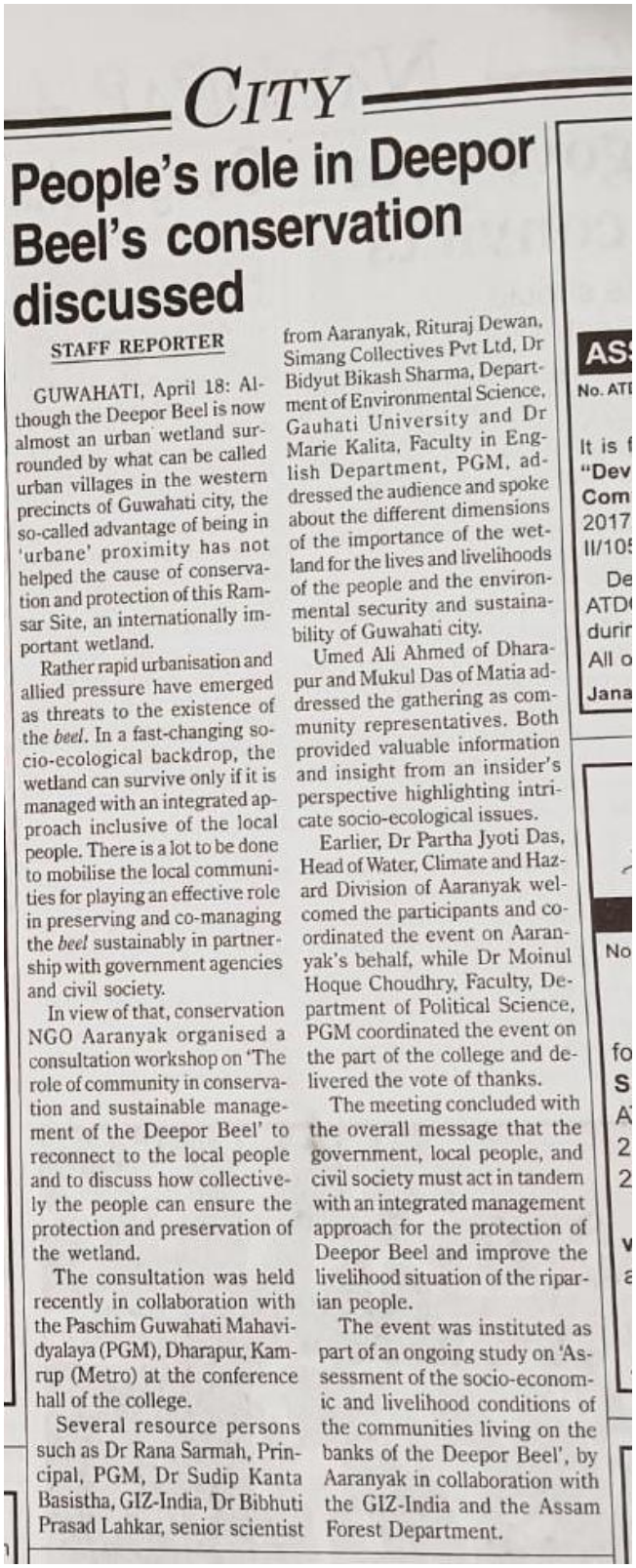
Event 1: "The role of community in conservation and sustainable management of the Deepor Beel", organised by Aaranyak, in collaboration with the Paschim Guwahati Mahavidyalaya, Dharapur, Kamrup Metropolitan District, Venue: Conference Hall, Paschim Guwahati Mahavidyalaya, Date: April 12, 2023.

Although the Deepor Beel is now almost an 'urban wetland' surrounded by what can be called 'urban villages' in the western precincts of Guwahati city, the so-called advantage of being in 'urbane' proximity has not helped the cause of conservation and protection of this Ramsar Site, an internationally important wetland. Rather rapid urbanisation and allied pressure have emerged as threats to the existence of the beel. In a fast-changing socioecological backdrop, the wetland can survive only if it is managed with an integrated approach inclusive of the local people. There is a lot to be done to mobilise the local communities for playing an effective role in preserving and co-managing the beel sustainably in partnership with government agencies and civil society.



Aaranyak organised a consultation on 'The role of community in conservation and sustainable management of the Deepor Beel" to reconnect to the local people and to discuss how collectively we can ensure the protection and preservation of the Beel. The consultation was held on April 12, 2023, in collaboration with the Paschim Guwahati Mahavidyalaya, Dharapur, Kamrup Metropolitan District at the conference hall of the college.

Several resource persons such as Dr. Rana Sarmah(Principal, PGM), Dr. Sudip Kanta Basistha(GIZ-India), Dr. Bibhuti Prasad Lahkar(Aaranyak), Sri Rituraj Dewan(Simang Collectives Pvt Ltd.) and Dr. Bidyut Bikash Sharma(Department of Environmental Science, Gauhati University) and Dr. Marie Kalita(Faculty in English Department, PGM) addressed the audience and spoke about different dimensions of the importance of the wetland for the lives and livelihoods of the people and the environmental security and sustainability of the Guwahati city. Sri Umed Ali Ahmed of Dharapur and Sri Mukul Das of Matia addressed the gathering as community representatives. Both provided valuable information and insight from an insider's perspective, highlighting intricate socioecological issues.



CITY

People's role in Deepor Beel's conservation discussed

STAFF REPORTER

GUWAHATI, April 18: Although the Deepor Beel is now almost an urban wetland surrounded by what can be called urban villages in the western precincts of Guwahati city, the so-called advantage of being in 'urbane' proximity has not helped the cause of conservation and protection of this Ramsar Site, an internationally important wetland.

Rather rapid urbanisation and allied pressure have emerged as threats to the existence of the *beel*. In a fast-changing socio-ecological backdrop, the wetland can survive only if it is managed with an integrated approach inclusive of the local people. There is a lot to be done to mobilise the local communities for playing an effective role in preserving and co-managing the *beel* sustainably in partnership with government agencies and civil society.

In view of that, conservation NGO Aaranyak organised a consultation workshop on 'The role of community in conservation and sustainable management of the Deepor Beel' to reconnect to the local people and to discuss how collectively the people can ensure the protection and preservation of the wetland.

The consultation was held recently in collaboration with the Paschim Guwahati Mahavidyalaya (PGM), Dharapur, Kamrup (Metro) at the conference hall of the college.

Several resource persons such as Dr Rana Sarmah, Principal, PGM, Dr Sudip Kanta Basistha, GIZ-India, Dr Bibhuti Prasad Lahkar, senior scientist from Aaranyak, Rituraj Dewan, Simang Collectives Pvt Ltd, Dr Bidyut Bikash Sharma, Department of Environmental Science, Gauhati University and Dr Marie Kalita, Faculty in English Department, PGM, addressed the audience and spoke about the different dimensions of the importance of the wetland for the lives and livelihoods of the people and the environmental security and sustainability of Guwahati city.

Umed Ali Ahmed of Dharapur and Mukul Das of Matia addressed the gathering as community representatives. Both provided valuable information and insight from an insider's perspective highlighting intricate socio-ecological issues.

Earlier, Dr Partha Jyoti Das, Head of Water, Climate and Hazard Division of Aaranyak welcomed the participants and coordinated the event on Aaranyak's behalf, while Dr Moinul Hoque Choudhry, Faculty, Department of Political Science, PGM coordinated the event on the part of the college and delivered the vote of thanks.

The meeting concluded with the overall message that the government, local people, and civil society must act in tandem with an integrated management approach for the protection of Deepor Beel and improve the livelihood situation of the riparian people.

The event was instituted as part of an ongoing study on 'Assessment of the socio-economic and livelihood conditions of the communities living on the banks of the Deepor Beel', by Aaranyak in collaboration with the GIZ-India and the Assam Forest Department.

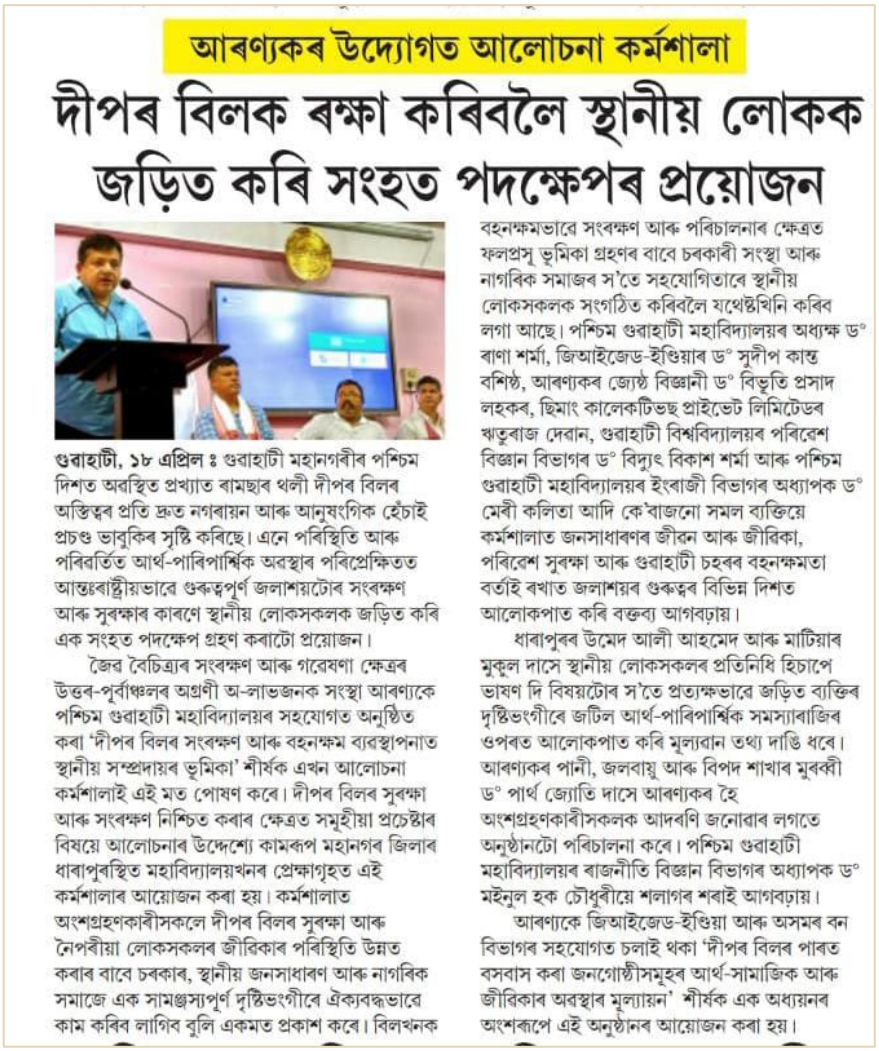
Dr. Partha Jyoti Das (Head, Water, Climate and Hazard Division) welcomed the participants and coordinated the event on Aaranyak's behalf, while Dr. Moinul Hoque Choudhry, Faculty, Department of Political Science, PGM coordinated the event on the part of the college and delivered the vote of thanks. Aaranyak thanks all faculties, students, and officials of the PGM as well as the community representatives for their participation and informative deliberations.

The meeting concluded with the overall message that the government, local people, and civil society must act in tandem with an integrated management approach for the protection of the Deepor Beel and improve the livelihood situation of the riparian people. The event was instituted as part of an ongoing study on ‘Assessment of the socio-economic and livelihood conditions of the communities living on the banks of the Deepor Beel’, by Aaranyak in collaboration with the GIZ-India and the Assam Forest Department.

Photo 2: Dr. Sudip Kanta Basistha speaking in the consultation on 12th April 2023 in Pachim Guwahati College

Photo 3: Resource persons who spoke about various issues on Deepor Beel in the consultation in Pachim Guwahati College on April 12

Photo 4: Local community leader Umed Ali interacting with the resource persons in the meeting.



আৰণ্যকৰ উদ্যোগত আলোচনা কৰ্মশালা

দীপৰ বিলক ৰক্ষা কৰিবলৈ স্থানীয় লোকক জড়িত কৰি সংহত পদক্ষেপৰ প্ৰয়োজন

গুৱাহাটী, ১৮ এপ্ৰিল ঃ গুৱাহাটী মহানগৰীৰ পশ্চিম দিশত অৱস্থিত প্ৰখ্যাত ৰামছাৰ থলী দীপৰ বিলৰ অস্তিত্ব প্ৰতি দ্ৰুত নগৰায়ন আৰু আনুষংগিক হেঁচাই প্ৰচণ্ড ভাবুকিৰ সৃষ্টি কৰিছে। এনে পৰিস্থিতি আৰু পৰিবৰ্তিত আৰ্থ-পাৰিপাৰ্শ্বিক অৱস্থাৰ পৰিপ্ৰেক্ষিতত আন্তঃৰাষ্ট্ৰীয়ভাৱে গুৰুত্বপূৰ্ণ জলাশয়টোৰ সংৰক্ষণ আৰু সুৰক্ষাৰ কাৰণে স্থানীয় লোকসকলক জড়িত কৰি এক সংহত পদক্ষেপ গ্ৰহণ কৰাটো প্ৰয়োজন।

জৈৱ বৈচিত্ৰ্যৰ সংৰক্ষণ আৰু গৱেষণা ক্ষেত্ৰৰ উত্তৰ-পূৰ্বাঞ্চলৰ অগ্ৰণী অ-লাভজনক সংস্থা আৰণ্যকে পশ্চিম গুৱাহাটী মহাবিদ্যালয়ৰ সহযোগত অনুষ্ঠিত কৰা 'দীপৰ বিলৰ সংৰক্ষণ আৰু বহনক্ষম ব্যৱস্থাপনাত স্থানীয় সম্প্ৰদায়ৰ ভূমিকা' শীৰ্ষক এখন আলোচনা কৰ্মশালাই এই মত পোষণ কৰে। দীপৰ বিলৰ সুৰক্ষা আৰু সংৰক্ষণ নিশ্চিত কৰাৰ ক্ষেত্ৰত সমূহীয়া প্ৰচেষ্টাৰ বিষয়ে আলোচনাৰ উদ্দেশ্যে কামৰূপ মহানগৰ জিলাৰ ধাৰাপুৰস্থিত মহাবিদ্যালয়খনৰ প্ৰেক্ষাগৃহত এই কৰ্মশালাৰ আয়োজন কৰা হয়। কৰ্মশালাত অংশগ্ৰহণকাৰীসকলে দীপৰ বিলৰ সুৰক্ষা আৰু নৈপৰীয়া লোকসকলৰ জীৱিকাৰ পৰিস্থিতি উন্নত কৰাৰ বাবে চৰকাৰ, স্থানীয় জনসাধাৰণ আৰু নাগৰিক সমাজে এক সামঞ্জস্যপূৰ্ণ দৃষ্টিভংগীৰে ঐক্যবদ্ধভাৱে কাম কৰিব লাগিব বুলি একমত প্ৰকাশ কৰে। বিলখনক বহনক্ষমভাৱে সংৰক্ষণ আৰু পৰিচালনাৰ ক্ষেত্ৰত ফলপ্ৰসূ ভূমিকা গ্ৰহণৰ বাবে চৰকাৰী সংস্থা আৰু নাগৰিক সমাজৰ স'তে সহযোগিতাৰে স্থানীয় লোকসকলক সংগঠিত কৰিবলৈ যথেষ্টখিনি কৰিব লগা আছে। পশ্চিম গুৱাহাটী মহাবিদ্যালয়ৰ অধ্যক্ষ ড° ৰাণা শৰ্মা, জিআইজেড-ইণ্ডিয়াৰ ড° সুদীপ কান্ত বশিষ্ঠ, আৰণ্যকৰ জ্যেষ্ঠ বিজ্ঞানী ড° বিভূতি প্ৰসাদ লহকৰ, ছিমাং কালেকটিভছ প্ৰাইভেট লিমিটেডৰ ঋতুৰাজ দেৱান, গুৱাহাটী বিশ্ববিদ্যালয়ৰ পৰিৱেশ বিজ্ঞান বিভাগৰ ড° বিদ্যুৎ বিকাশ শৰ্মা আৰু পশ্চিম গুৱাহাটী মহাবিদ্যালয়ৰ ইংৰাজী বিভাগৰ অধ্যাপক ড° মেৰী কলিতা আদি কে'বাজনো সমল ব্যক্তিয়ে কৰ্মশালাত জনসাধাৰণৰ জীৱন আৰু জীৱিকা, পৰিৱেশ সুৰক্ষা আৰু গুৱাহাটী চহৰৰ বহনক্ষমতা বৰ্তাই ৰখাত জলাশয়ৰ গুৰুত্বৰ বিভিন্ন দিশত আলোকপাত কৰি বক্তব্য আগবঢ়ায়।

ধাৰাপুৰৰ উমেদ আলী আহমেদ আৰু মাটিয়াৰ মুকুল দাসে স্থানীয় লোকসকলৰ প্ৰতিনিধি হিচাপে ভাষণ দি বিষয়টোৰ স'তে প্ৰত্যক্ষভাৱে জড়িত ব্যক্তিৰ দৃষ্টিভংগীৰে জটিল আৰ্থ-পাৰিপাৰ্শ্বিক সমস্যাবাজিৰ ওপৰত আলোকপাত কৰি মূল্যবান তথ্য দাঙি ধৰে। আৰণ্যকৰ পানী, জলবায়ু আৰু বিপদ শাখাৰ মুৰব্বী ড° পাৰ্থ জ্যোতি দাসে আৰণ্যকৰ হৈ অংশগ্ৰহণকাৰীসকলক আদৰণি জনোৱাৰ লগতে অনুষ্ঠানটো পৰিচালনা কৰে। পশ্চিম গুৱাহাটী মহাবিদ্যালয়ৰ ৰাজনীতি বিজ্ঞান বিভাগৰ অধ্যাপক ড° মইনুল হক চৌধুৰীয়ে শলাগৰ শৰাই আগবঢ়ায়।

আৰণ্যকে জিআইজেড-ইণ্ডিয়া আৰু অসমৰ বন বিভাগৰ সহযোগত চলাই থকা 'দীপৰ বিলৰ পাৰত বসবাস কৰা জনগোষ্ঠীসমূহৰ আৰ্থ-সামাজিক আৰু জীৱিকাৰ অৱস্থাৰ মূল্যায়ন' শীৰ্ষক এক অধ্যয়নৰ অংশৰূপে এই অনুষ্ঠানৰ আয়োজন কৰা হয়।

Event 2: Conservation of Deepor Beel and Development of the Riparian Community, May 17, 2023, Venue: Chakardeo Kali Mandir Premises, Matia Village.

The meeting was organised to learn from the local villagers about their views on various issues of the Deepor Beel and different aspects of their socioeconomic and livelihood conditions. Another objective was to apprise the people about the socioeconomic and livelihood survey that Aaranyak would be doing soon among the villagers and to seek support for the same.

The meeting was presided over by Sri Gopal Koibarta, President of, the Mikirpara Chakardeo Development Committee. Ms. Ganga Ingti, Head Teacher of the Mikirpara Chakardeo LP School and Sri Harmohan Ingti, Gaonburha of the Matia village spoke as invitee guests. Mr. Umed Ali, a prominent citizen of the Dharapur area also participated as an invited speaker.

The speakers and the local public identified poverty, landlessness, lack of literacy and higher education and marginalisation as the main problems of their lives. The wetland is drying up and being encroached on several sides. The waters of the beel were getting polluted mainly from the incoming rivers like the Basistha, Bahini, and Morabharalu as well as from the garbage dumping site near Boragaon. Pollution was a major cause of the declining population of fish which has affected the livelihood of the fishermen which comprises a major portion of the population in this area.

Photo 5: A glimpse from the consultation at Matia village on May 17, 2023

The communities expressed dissatisfaction with the designation of several additional elephant corridors in that area because of which many of them were affected since the new elephant corridors we found to cover their privately owned land. Because of this, there are no restrictions on them regarding the use of their land. They cannot make any permanent construction and they are debarred from many activities that they may want to take up in connection with agriculture. They identified this development also to be affecting their livelihood.

The people think that the development of ecotourism in a big way by the government with incentives to the local youth can benefit them. They also look forward to taking up cultured fisheries and therefore want the restrictions of the elephant corridors to be removed. They wanted the Deepor Beel should be protected and restored, while the conditions of the people living in the surroundings should also be developed through specially conceived welfare schemes by the government. They agreed to cooperate with government agencies or NGOs if they work for their development.

Photo 6: A view of the rural woman participating in the Matia meeting on May 17, 2023

Photo 7: Women strongly raising their voices during the Matia meeting.

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

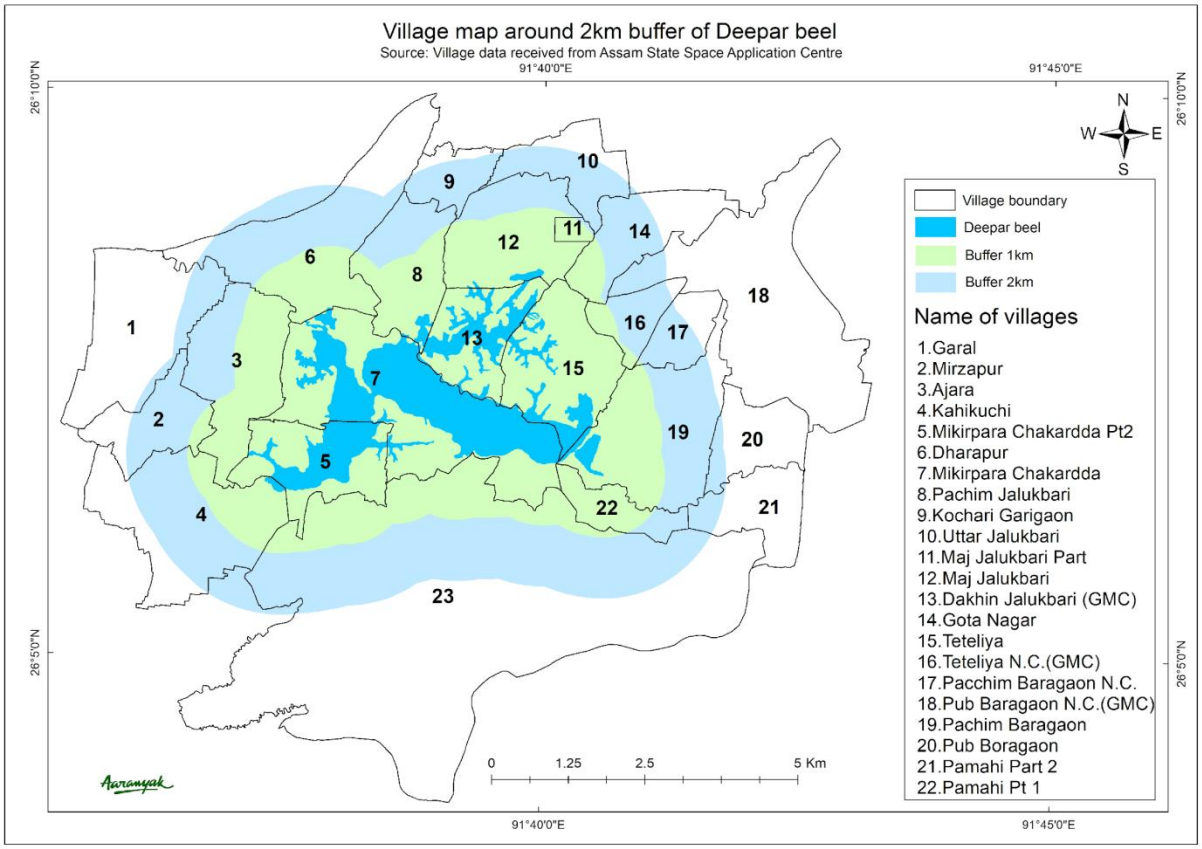
Photo 16

Photographs 8-16: The project team is seen conducting various PRA exercises with the communities of the study area.

Socio-Demographic Profile of the Study Area

2. Socio-Demographic Profile of the Study Area

Location of the Study area: There are several Human settlement units (HSU) surrounding the Deepor Beel that can be categorized into Revenue Villages and Municipal Wards based on whether they belong to Revenue Circles or the Guwahati Municipal Corporation (GMC) area. The Revenue villages are usually large geographical and administrative units that have several sub-units or neighbourhoods, generally called 'para'. Similarly, the GMC wards are also made of clusters of bylanes or paras. Map 1 shows the HSUs lying within a buffer area of 2 km and 1 km respectively. There are 22 HSUs within the 2 km buffer zone around the Beel. However, considering the intensity and extent of interactions of the communities with the Beel, we selected 19 HSUs (Map 2). to include the proposed Socioeconomic and Livelihood Assessment (SELA). The names of the villages in green colour indicate those HSUs that are designated as stakeholder villages by the Guwahati Wildlife Division of the Assam Forest Department.



Map 1: Location of various HSUs in the fringe area of the Deepor Beel within 1 km and 2 km buffer zones

Besides, the Revenue villages like Azara and Dharapur are large and therefore, only certain parts of these villages are located on the immediate banks of the Deepor Beel where communities have some impact on the wetland. This is the reason why we have not considered the entire Dharapur and Azara villages as a stakeholder of HSU. Only selected parts (paras) of these villages have been included in the study area. Table 1 contains basic information about the HSUS that we have included in the study area for the survey.

Table 1: Basic information on the HSUs and survey

Serial Number	Name of Survey Village	Name of Revenue Village or GMC Ward Number	Names of sub-villages/Neighbourhood	CD Block	Revenue Circle	Gaon Panchayat	Ward Number
1	Deochotal	Mikirpara-Chakardeo	Karbipara, Nepalipara	Rani	Azara	Azara	
2	Chakardeo	Chakardeo	Mikirpara, Kalitapara, Majpara	Rani	Azara	Azara	
3	Matia	Kahikuchi	Hatihala, Opor Keotpara, Natun Basti, Ganeshpara	Rani	Azara	Kahikuchi	
4	Haorapar	Dharapur		Rani	Azara	Dharapur	
5	Keotpara	Azara		Rani	Azara	Azara	
6	Hatuapara	Azara		Rani	Azara	Azara	
7	Hirapara	Azara		Rani	Azara	Azara	
8	Nowapara	Azara		Rani	Azara	Azara	
9	Konapara	Azara		Rani	Azara	Azara	
10	Natun Basti	Azara		Rani	Azara	Azara	
11	Medhipara	Azara		Rani	Azara	Azara	
12	Borbori	Azara		Rani	Azara	Azara	
13	Tetelia	Ward Number 10-GMC	Jarpara, Boripara, Ghoshpara, Boripara				Ward Number 10-GMC
14	Pamohi	Pamohi	Karbipara, Moinakhurung, Maghuapara	Rani	Azara	Azara	
15	Paschim Boragaon	Ward Number 10-GMC	Vigyan Path, Milan Nagar Byelane I, Milan Nagar Byelane II, Shivam Path, Brindaban Nagar				Ward Number 10-GMC
16	Paschim Jalukbari	Ward Number 02-GMC					Ward Number 02-GMC
17	Dakhin Jalukbari	Ward Number 02-GMC					Ward Number 02-GMC
18	Maj Jalukbari	Ward Number 02-GMC					Ward Number 02-GMC
19	Khanamukh-(Rural & Urban)	Dharapur& Ward Number-1: GMC	Janarpar, Namaxudro, Phukanpara	Rani	Azara	Dharapur	Ward Number 01-GMC

Table 2 presents the basic demographic features of the study area. The study area has a population of about 19,400 living in about 3972 households (HH). The male and female population is 53.89% and 46.11% respectively (Figure 1). These figures have been derived from a combination of sources such as the records maintained by the local Panchayats and Village Head Men, The Anganwadi Kendras and the ASHA workers etc. It is to be noted here that some quantitative information provided by the community was for the households (HHs), while some other data were of a number of persons(population). This fact needs to be borne in mind for understanding the results and findings of this survey as narrated in this and subsequent chapters.

Caste-wise population figures are currently not available officially since there was no general population census or special caste census in the last decade. We have estimated the presence of various castes of people in different HSUs, which is presented in Table 3.

Table 2: The demographic features of the selected HSUs

Serial Number	Name of the village	Area of the villages: (In Square feet):	Number of HH	Population	Male	% of population	Female	% of population
1	Deochotal	28,80,000	110	500	275	55.00	225	45.00
2	Chakardeo	1,296,000	121	610	335	54.92	275	45.08
3	Matia	2,592,000	313	1630	876	53.74	754	46.26
4	Haorapar	576,000	60	300	165	55.00	135	45.00
5	Keotpara	1,440,000	300	1510	790	52.32	720	47.68
6	Hatuapara	288,000	58	400	208	52.00	192	48.00
7	Hirapara	1,152,000	109	550	302	54.91	248	45.09
8	Nowapara	619,200	60	300	165	55.00	135	45.00
9	Konapara	316,800	45	230	118	51.30	112	48.70
10	Natun Basti	648000	100	510	270	52.94	240	47.06
11	Medhipara	288000	56	220	120	54.55	100	45.45
12	Borbori	1612800	220	1200	620	51.67	580	48.33
13	Tetelia	1296000	400	2000	1100	55.00	900	45.00
14	Pamohi	2160000	150	760	395	51.97	365	48.03
15	Paschim Boragaon	14400000	1150	5000	2750	55.00	2250	45.00
16	Paschim Jalukbari	216000	140	700	385	55.00	315	45.00
17	Dakhin Jalukbari	115200	80	400	220	55.00	180	45.00
18	Maj Jalukbari	720000	300	1500	780	52.00	720	48.00
19	Khanamukh- (Rural & Urban)	1584000	200	1080	580	53.70	500	46.30
Total			**3972**	**19400**	**10454**	**53.89**	**8946**	**46.11**

Distribution of caste, religious and ethnic groups in the study area: Table 3 shows the distribution of various caste groups, religious communities, and ethnic communities in the HSUs of the study area.

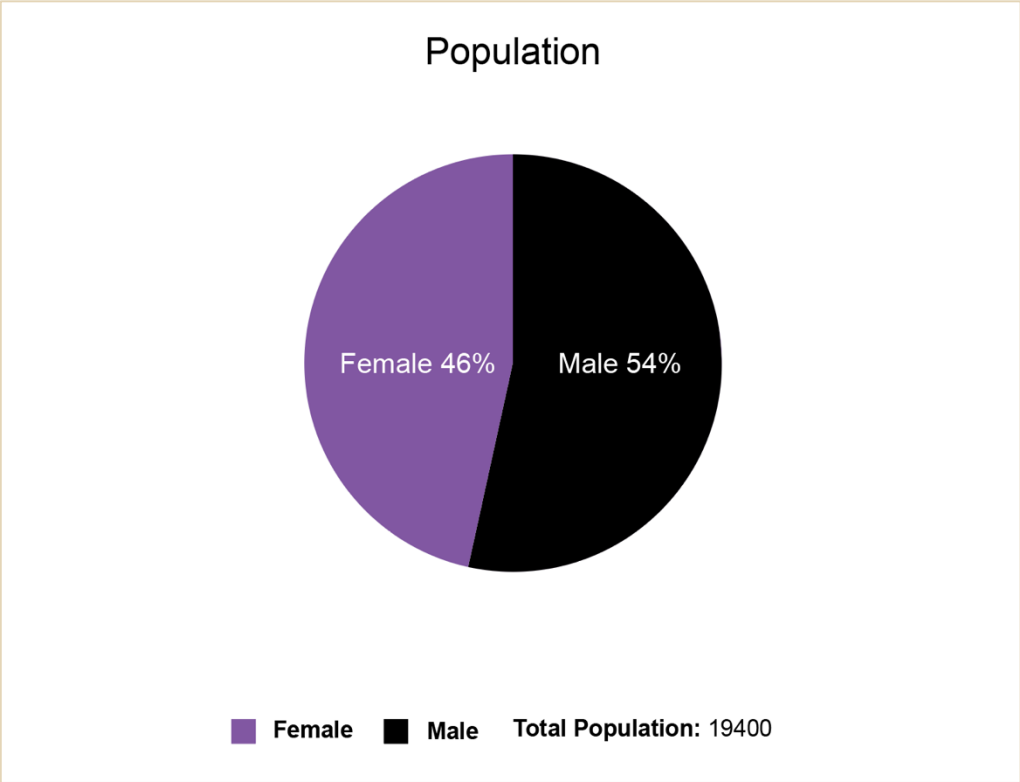


Figure 1: Male-female population ratio in the study area

Table 3: Presence of caste, religion, and ethnic/linguistic groups in the HSUs

Serial Number	Name of the HSU	Caste groups present	Religious groups present	Ethnic groups present
1	Deochotal	ST, OBC	Hindu, Christian	Assamese, Karbi, Bodo, Rabha, Nepali
2	Chakardeo	ST, SC, OBC, GENERAL	Hindu	Assamese, Karbi, Bodo, Garo, Koch
3	Matia	ST, SC, OBC, GENERAL	Hindu, Muslim	Assamese, Bodo, Rabha
4	Haorapar	OBC, GENERAL	Hindu, Sikh	Assamese, Punjabi
5	Keotpara	SC	Hindu	Assamese
6	Hatuapara	SC, OBC, GENERAL	Hindu	Assamese
7	Hirapara	SC, GENERAL	Hindu	Assamese
8	Nowapara	SC	Hindu	Assamese
9	Konapara	SC, OBC, GENERAL	Hindu	Assamese

10	Natun Basti	SC	Hindu	Assamese
11	Medhipara	SC, GENERAL	Hindu	Assamese
12	Borbori	ST, SC, GENERAL	Hindu	Assamese, Bodo
13	Tetelia	ST, SC, OBC, GENERAL	Hindu, Muslim	Assamese, Bengali, Karbi, Bodo, Garo
14	Pamohi	ST, SC, OBC, GENERAL	Hindu	Assamese, Karbi, Bodo
15	Paschim Boragaon	ST, SC, OBC, GENERAL	Hindu, Muslim	Assamese, Bengali, Karbi, Bodo, Garo, Rabha, Koch
16	Paschim Jalukbari	ST, SC, OBC, GENERAL	Hindu, Muslim	Assamese, Bengali, Bihari
17	Dakhin Jalukbari	OBC, GENERAL	Hindu	Assamese
18	Maj Jalukbari	ST, SC, OBC, GENERAL	Hindu, Muslim	Assamese, Bengali, Bodo
19	Khanamukh-(Rural & Urban)	SC, OBC, GENERAL	Hindu	Assamese

As shown in Table 4, the SC caste group is most widely distributed i.e., they are found in the greatest number of HSUs (16) followed by the general caste (15), OBC (13) and the ST (9). This distribution is also expressed in Figure 2 below. Similarly, the distribution of various religious groups is shown in Table 5. Hinduism is the majority religion existing in all the 19 HSUs, followed by Islam in 5, Christianity in 1 and Sikhism in 1 HSU. This is also presented in Figure 3. Table 6 and Figure 4 depict the status of the presence of ethnic groups in the study area HSUs. Assamese is the majority community found in all the HSUs, followed by the Bodos in 8 HSUs and the Karbis in 5 HSUs. Other ethnic communities present are the Garo, Rabha, Koch, Nepali, Bengali**,** Bihari, and Punjabi. Most of these ethnic groups can be thought of as linguistic groups also since they have their own local languages which they use besides the mainstream Assamese language.

Table 4: Presence of caste groups in the HSUs

Caste Group	Number of HSUs where they are present
ST	9
SC	16
OBC	13
General	15

Table 5: Presence of caste groups in the HSUs

Religious groups	Number of HSUs where they are present
Hindu	19
Islam	5
Sikh	1
Christian	1

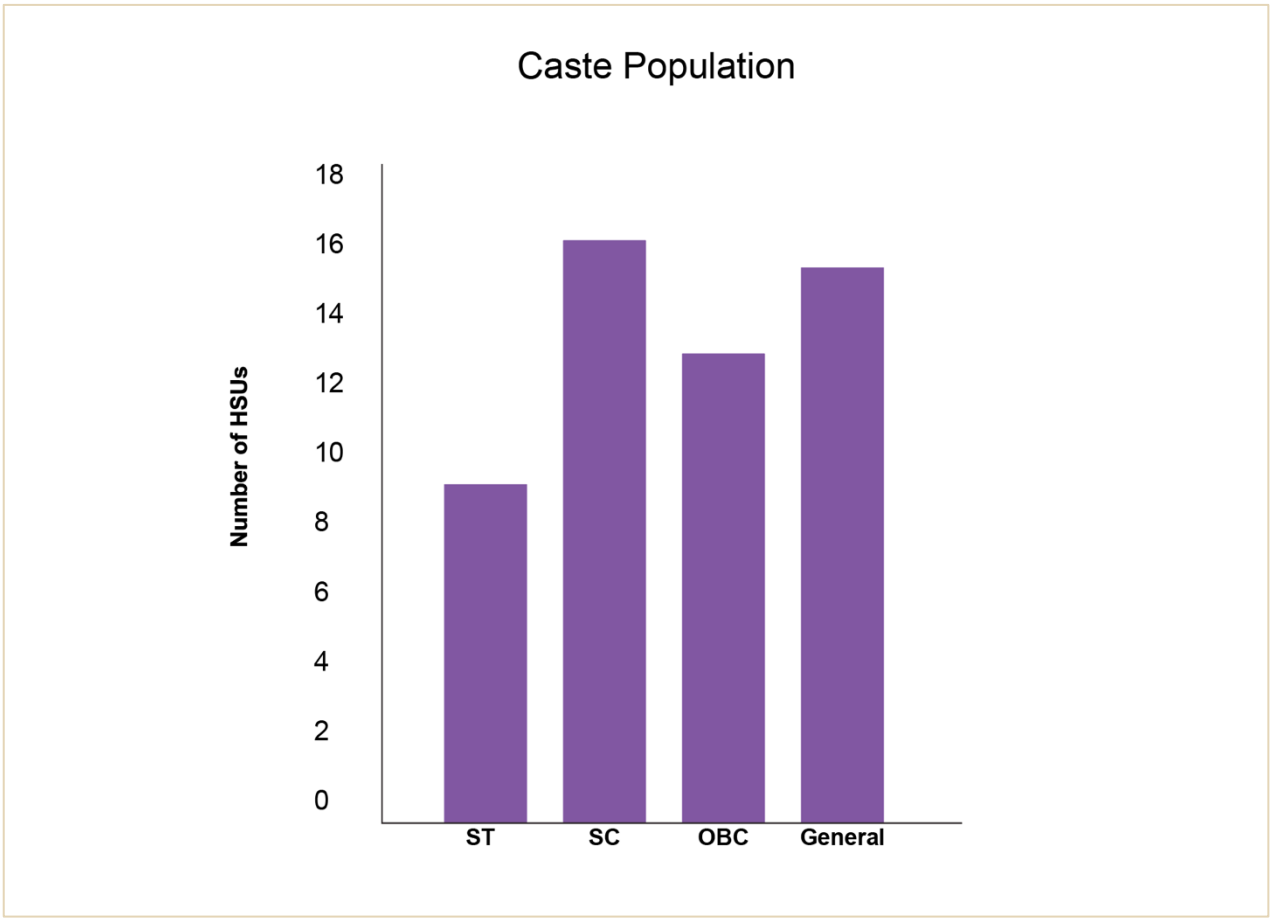


Figure 2: Presence of caste groups in the HSUs

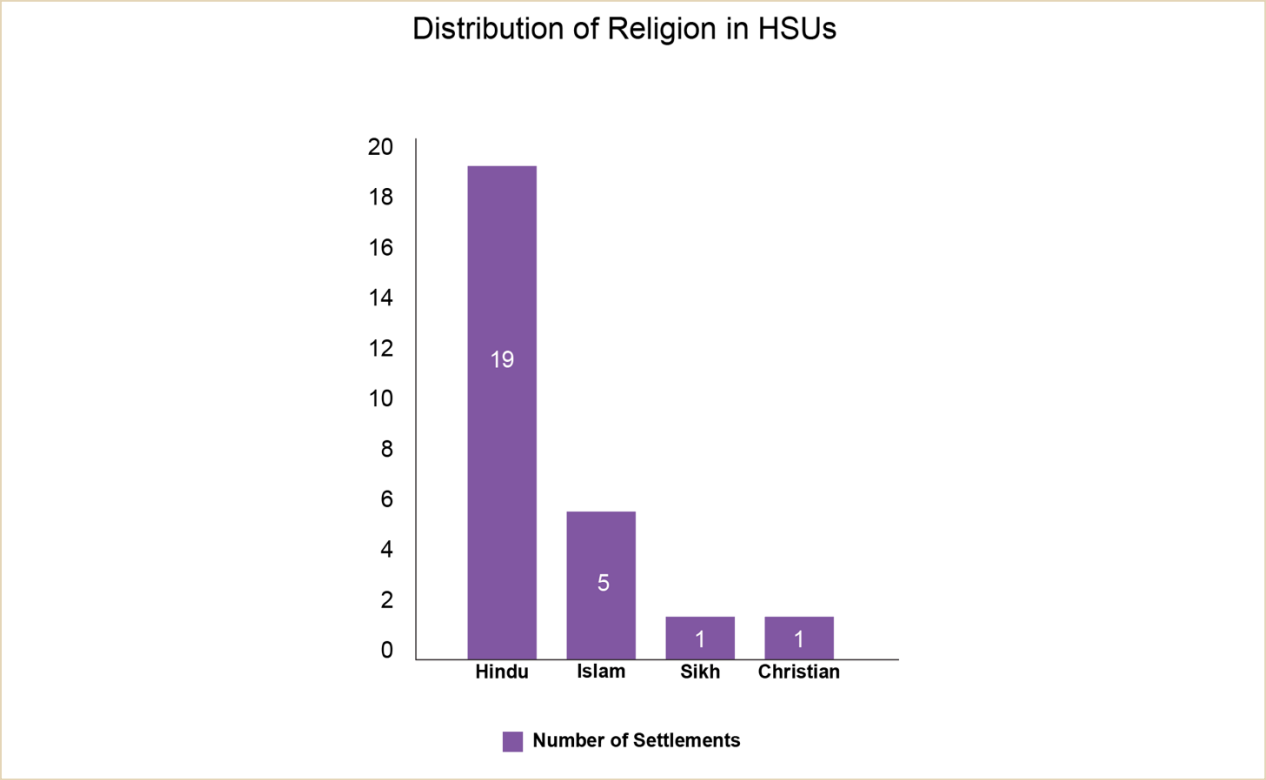


Figure 3: Presence of caste groups in the HSUs

Table 6: Presence of ethnic/linguistic groups in the HSUs

Ethnic groups	Number of HSUs where they are present
Assamese	19
Bengali	4
Karbi	5
Bodo	8
Garo	3
Rabha	3
Koch	2
Nepali	1
Bihari	1
Punjabi	1

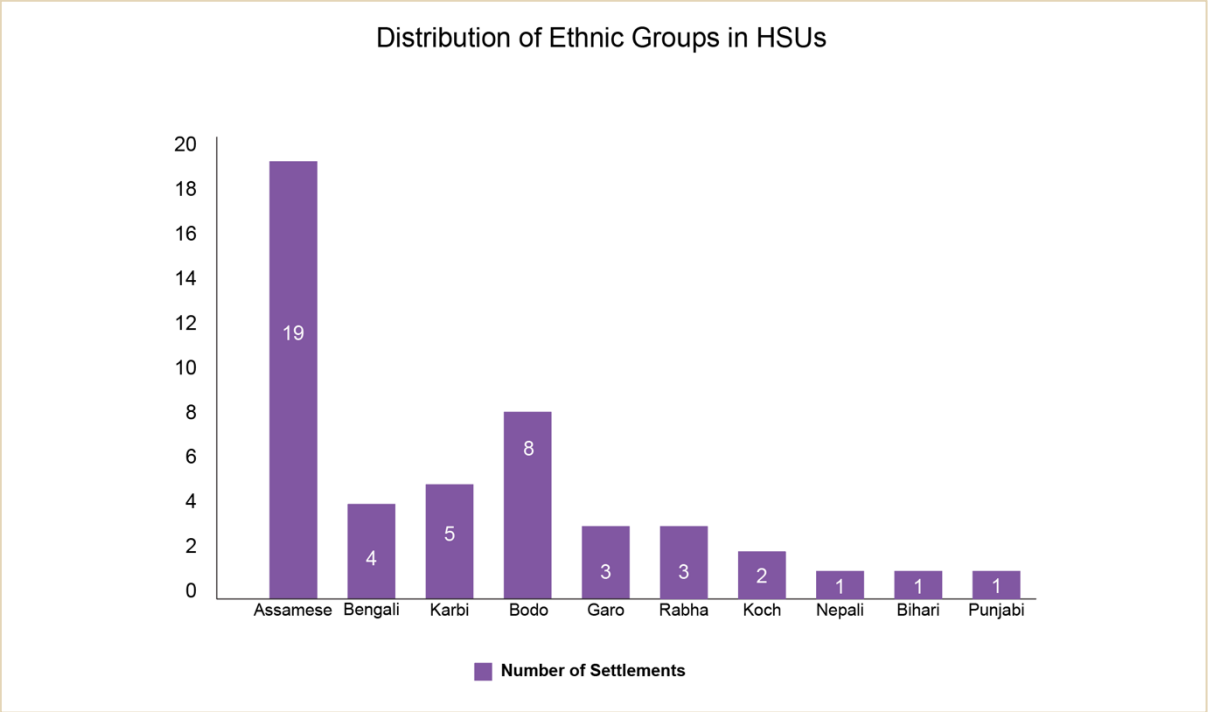


Figure 4: Presence of ethnic/linguistic groups in the HSUs

The literacy situation in the study area is depicted in Figure 5. Being located on the periphery of a vibrant and expanding city like Guwahati, it is no surprise that the literacy rate (69%) is high. The illiterate people (31%) belong mainly to the older generation. Table 7 shows the educational qualifications of the people as a percentage of the total population. Figure 6 also shows the situation graphically.

It is clear that people with higher education e.g., graduation (17.9%) and post-graduation (5.9%) are very few in the area. More significantly, there are very few people who have vocational education or skill training. This has a direct bearing on their employability in the government, corporate jobs and especially in the skilled labour sector. This is also a constraint for the young generation when it comes to taking opportunities emerging in sectors like information technology, hospitality services, sales, and marketing in private companies and the tourism sector. The lack of youth with higher education and skill training will also become a factor in preparing plans for their alternatives and livelihoods in emerging service and manufacturing sectors.

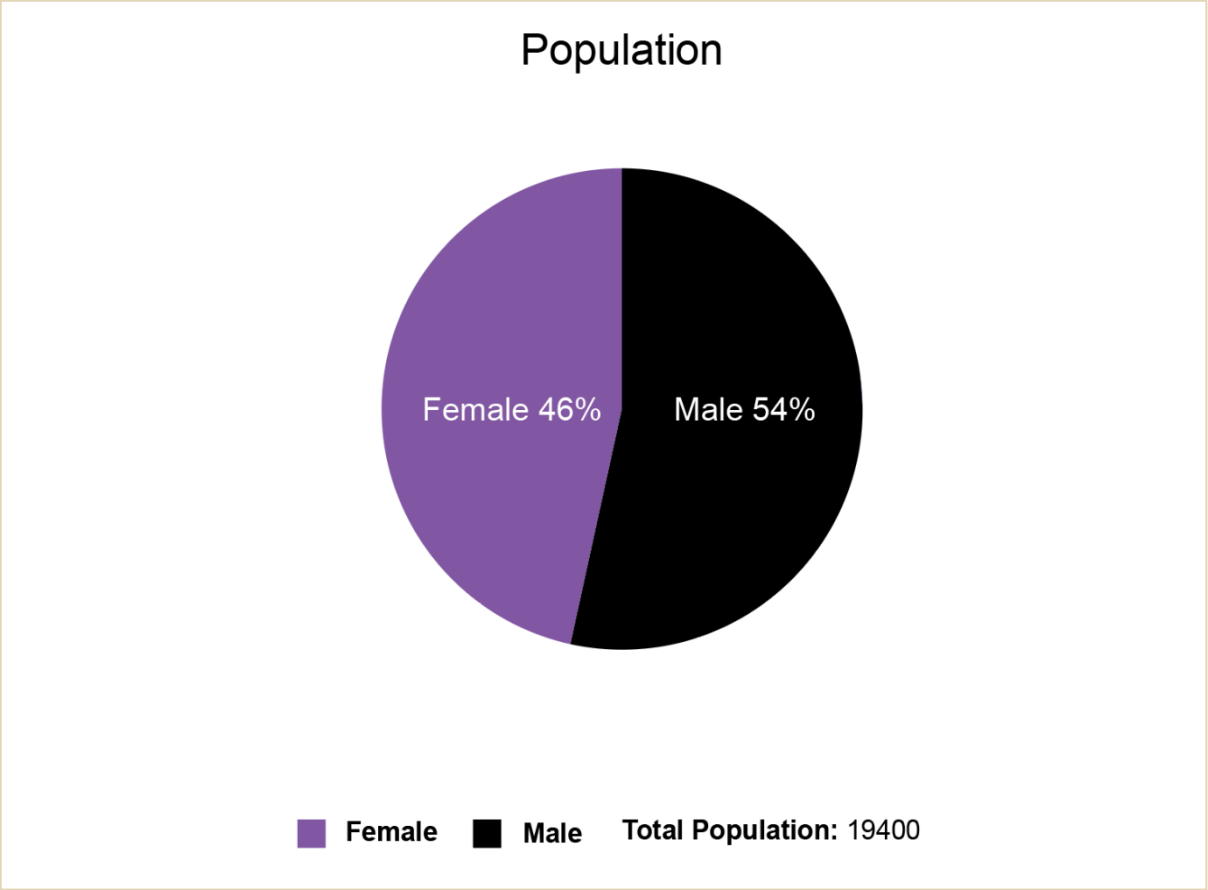


Figure 5: Literacy situation in the study area

Table 7: Educational qualification of the fringe dwellers (Compared to total population)

	Up to LP School	Up to ME School	Up to High School (Matriculate)	Up to Higher Secondary School	Graduate	Postgraduate	Technical/ Vocational/ Skill training
Percentage of Total Population	68.53	66.59	53.87	38.38	17.90	5.70	0.95

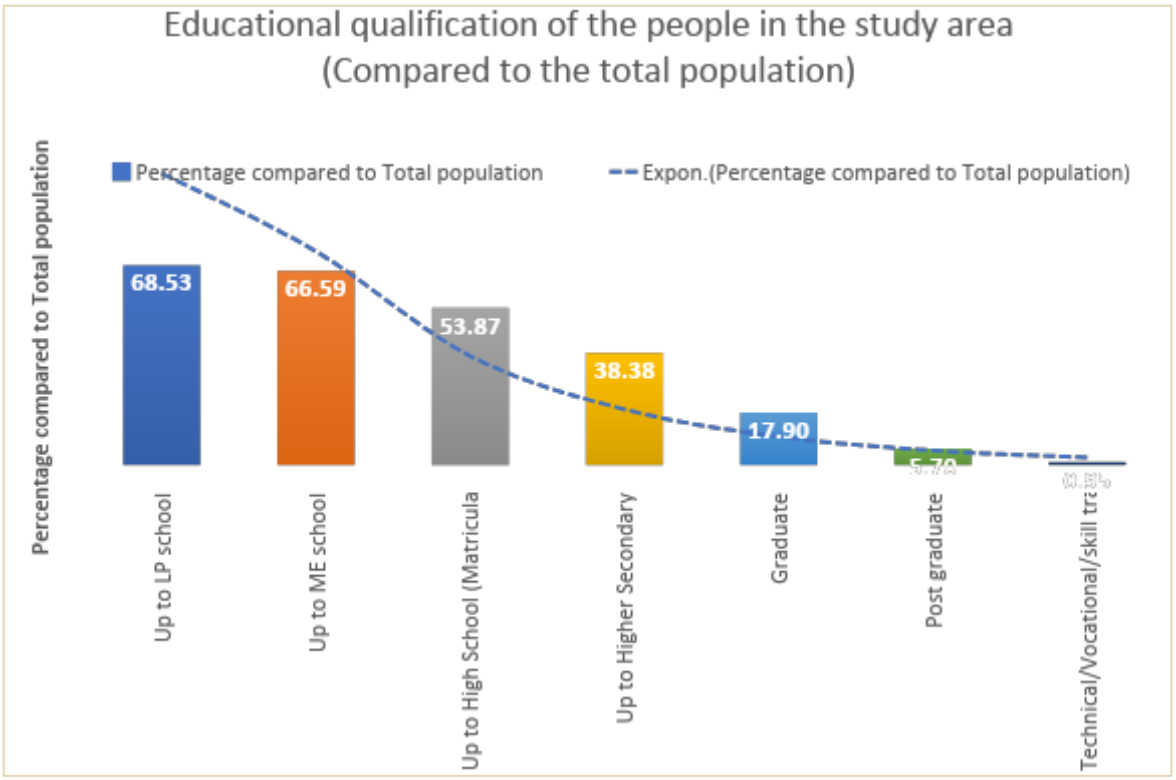


Figure 6: Educational qualifications of the people in the study area

Socio-Economic Profile of the Study Area

3. Socio-Economic Profile of the study area

The Drinking Water Situation:

The availability of water for various purposes of daily life's requirements is an important aspect of the socioeconomic and development status of an area. Especially having sustainable sources that provide safe drinking water is indispensable for the well-being of the people in any area. Table 1 shows the drinking water sources in the HSUs of our study area.

Table 1: Availability of the sources of drinking water for the HSUs of the study area.

Serial Number	Name of the village	Piped water supply at home	Piped water supply at public place	Hand pump/Tube well	Water well (Kuwan)	Boring with water pump
1	Deochotal	No	No	85	20	5
2	Chakardeo	121	No	30	20	2
3	Matia	200	Yes	45	10	3
4	Haorapar	60	Yes	55	No	5
5	Keotpara	Yes, but not working	Yes	300	No	No
6	Hatuapara	No	No	58	No	No
7	Hirapara	No	No	109	No	No
8	Nowapara	No	No	60	No	No
9	Konapara	No	No	45	No	No
10	Natun Basti	No	No	100	No	No
11	Medhipara	No	No	56	No	No
12	Borbori	220	No	185	No	No
13	Tetelia	No	No	356	No	44
14	Pamohi	No	No	120	10	20
15	Paschim Boragaon	750	No	500	No	50
16	Paschim Jalukbari	No	Yes	90	30	50
17	Dakhin Jalukbari	Yes, but not working	No	16	No	64
18	Maj Jalukbari	Yes, but not working	No	275	10	25
19	Khanamukh-(Rural & Urban)	100	No	100	No	No
	Total	1451		2585	100	268

The summary of the analysis of drinking water facilities for households and HSUs is shown in Table 2. The most prevalent source of safe drinking water, i.e., piped water supply, is benefitting 1391 households (which is 35.2 % of total households) spread over 6 HSUs, which is 31.6% of total HSUs. These HSUs are: Chakardeo, Matia, Haorapar, Borbori, Pachim Boragaon and Khanamukh. Piped water supply facilities installed in about 680(17.1%) of the households spread over 3 HSUs are not functioning at present. 10 HSUs are yet to get piped water supply. These are: Deochotal, Hatuapara, Hirapara, Nowapara, Konapara, Natun Basti, Medhipara, Tetelia, Pamohi, and Paschim Jalukbari. Only 4 HSUs have piped water supply at public places. A hand pump or tube well is the most assured source of water for a majority (65.1%) of households. All the HSUS have people with this facility.

Table 2: Summary of drinking water facilities available in the study area

S.N.	Drinking Water Source	Number of HH	% of total HH	Number of HSUs	% of total HSUs
1	Functioning piped water supply at home	1391	35.02	6	31.6
2	Non-functioning piped water supply at home	680	17.12	3	15.8
3	No piped water supply	1901	47.86	10	52.6
4	Piped water supply at public places			4	5.3
5	No piped water supply at public places			15	94.7
6	Hand pump/tube well owned by HH	2585	65.1	19	100
7	Hand pump/tube well in public places			1	5.3
				(5 numbers)	
8	Water well (Kuwan)	100	2.5	6	21.1
9	No use of Water well (Kuwan)			15	78.9
10	Groundwater boring with water pump	268	6.7	10	52.6
11	No ground water boring with water pump	3704	93.3	9	47.4
12	Number of settlements having household pond as a source of drinking water	Nil		Nil	
13	Use of water from the Deepor Beel for drinking	Nil		Nil	
14	Use of other natural sources is used for drinking water	Nil		Nil	

Table 3 and Figure 1 indicate the drinking water safety habits of the people (HH). About 90.7% of households use one or the other kind of filtering mechanism to make their drinking water safe. The fact that there is a section of people (9.3% HH) that does not use any kind of filtering system is a matter of worry for health authorities. However, some of these families have a good habit of drinking boiled water. The majority of the population is about 62. 4% of the HHs use general water filters bought from the market. Only 13.6% of the HH use homemade filters. A sizeable population (14.7%) can afford high-end filtering systems for the drinking water security of their families.

Table 3: Habit of water filtration in households in the study area

Filtering facility	Home-made filter HH	General Filter bought from market HH	High-end filtering system (Aqua guard/RO etc.) HH	No Filter
Number of HH	540	2478	584	370
% of total HH	13.6	62.4	14.7	9.3

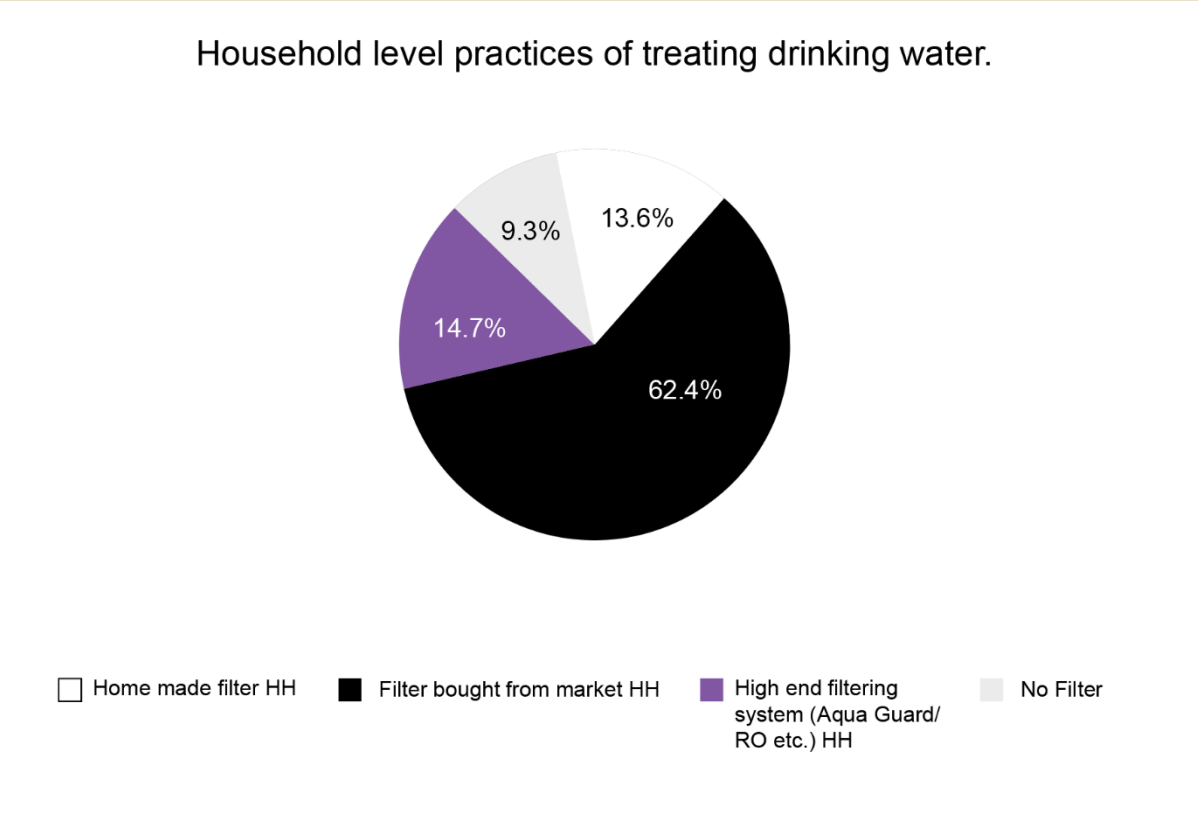


Figure 1: Household-level practices of treating drinking water.

Economic condition

The study area, being a rurban (rural as well as urban) pocket in nature, has populations exhibiting typical rural poverty and at the same time, there are a good number of people who belong to the urban middle class in terms of indicators like annual income, housing conditions, and land ownership and household assets. Table 4 presents the range of annual income to which different households belong. Figure 2 shows these classes pictorially. Table 5 summarises some indicators that reflect the economic condition of the people (HH). The majority of the population (54% of the HH) lives below the poverty level (BPL) (figure 3), which is a retrograde indicator for the development of a rapidly urbanizing area.

Table 4: Range of annual household income

	Range of household income	Number of HH
1	< 1 lakh	289
2	1-2 lakh	1544
3	2-3 lakh	1103
4	3-5 lakh	784
5	>5 lakh	252
	Total	**3972**

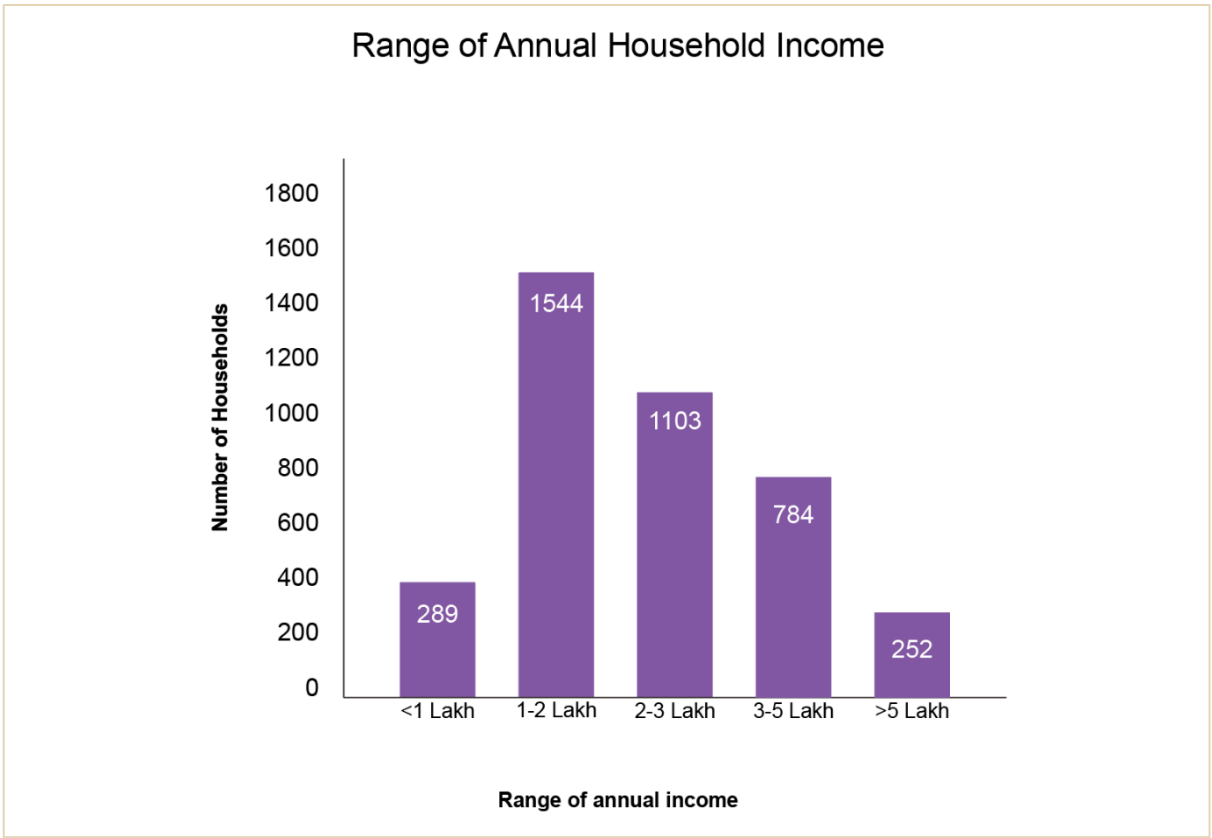


Figure 2: Range of annual household income

Table 5: Selected indicators of economic condition

	Indicators of economic condition	Number of HH
1	Number of BPL HH	1833
2	Number of APL HH	2139
3	Number of HH living in own house	3938
4	Number of HH living in own house	34
5	Number of HH living in pucca house	3276
6	Number of HH living in semi-pucca house	604
7	Number of HH living in kuchha house	92
8	Average household HH land holding	7200 sq. feet to 72000 sq. feet
9	Number of HSU where Labour Migration exists	4(17 HH): Pamohi, Deochotal, Matia, Borbori

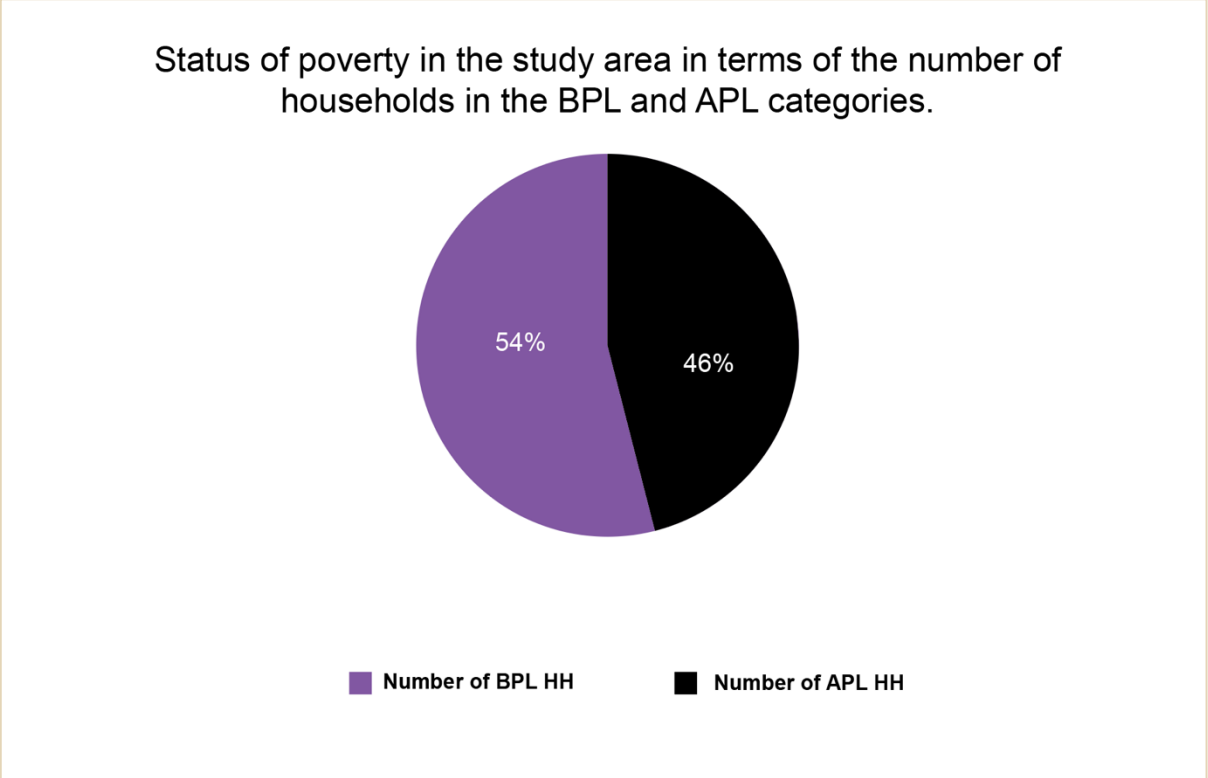


Figure 3: Status of poverty in the study area in terms of the number of households in the BPL and APL categories.

As shown in Figure 4, about 82.5% of the HH of the area lives in pucca houses, while 15.2% live in semi-pucca houses and a small chunk of families; nearly 2.3% live in such houses.

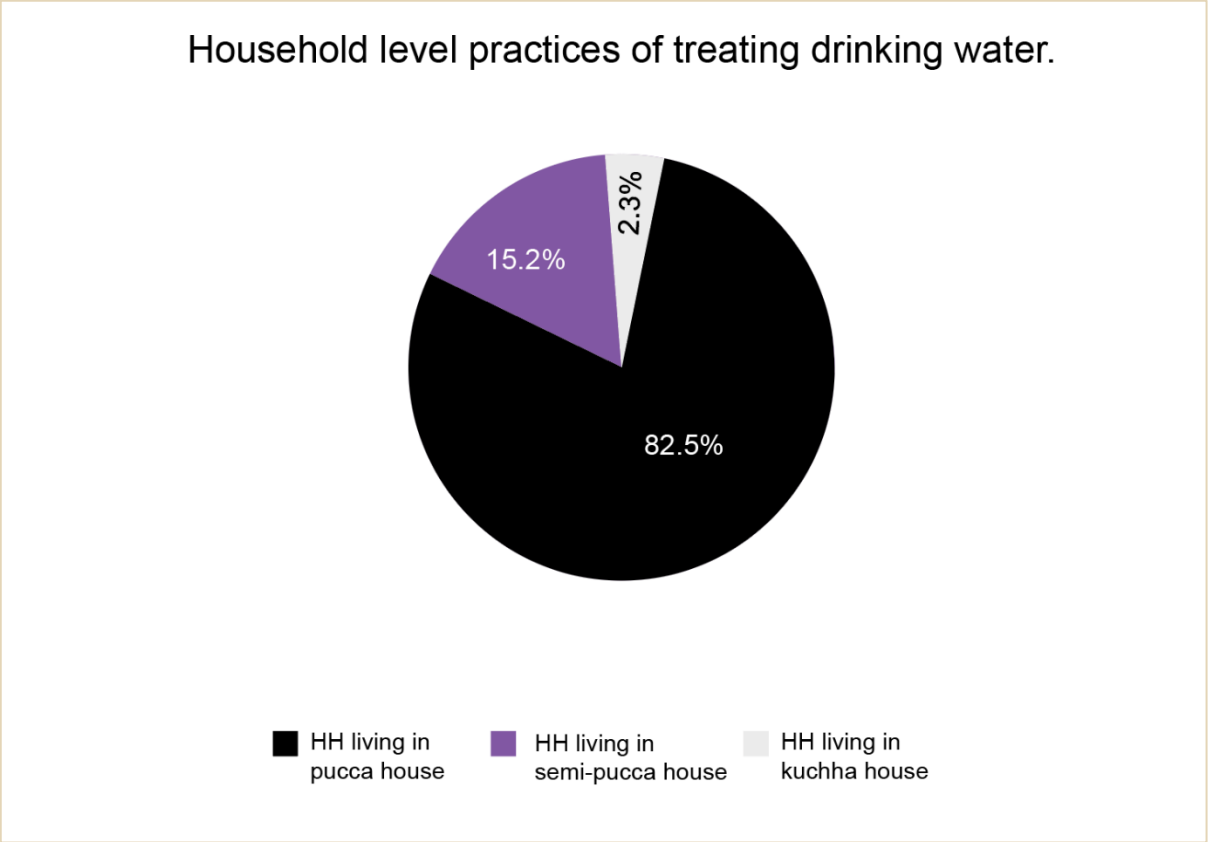


Figure 4: Housing types in the study area

Livelihood Scenario in the Study Area: An Overview

4. Livelihood Scenario in the Study Area: An Overview

The most basic meaning of livelihood for a common man is what one does to earn money and live a life. The Oxford Dictionary defines livelihood as a means of securing the necessities of life. However, the meaning and implication of the word livelihood go beyond such simple interpretations in natural resource management, social sciences and development studies. Most institutions worldwide use a few popular and common ways of defining livelihoods in a broad context for development planning.

Sustainable Development Framework(SDF)

Chambers & Conway's definition that 'livelihood comprises the capabilities, assets and activities required for a means of living (Chambers & Conway 1992)[15], is widely used by the DIFID in the Sustainable Livelihood Framework (SDF). The same scholars also referred to 'Sustainable Livelihoods' as a livelihood that is sustainable when it can cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base. Another term used in this context is 'Household Livelihood Security', which means 'adequate and sustainable access to income and resources to meet basic needs'(DIFID, 1999)[16].

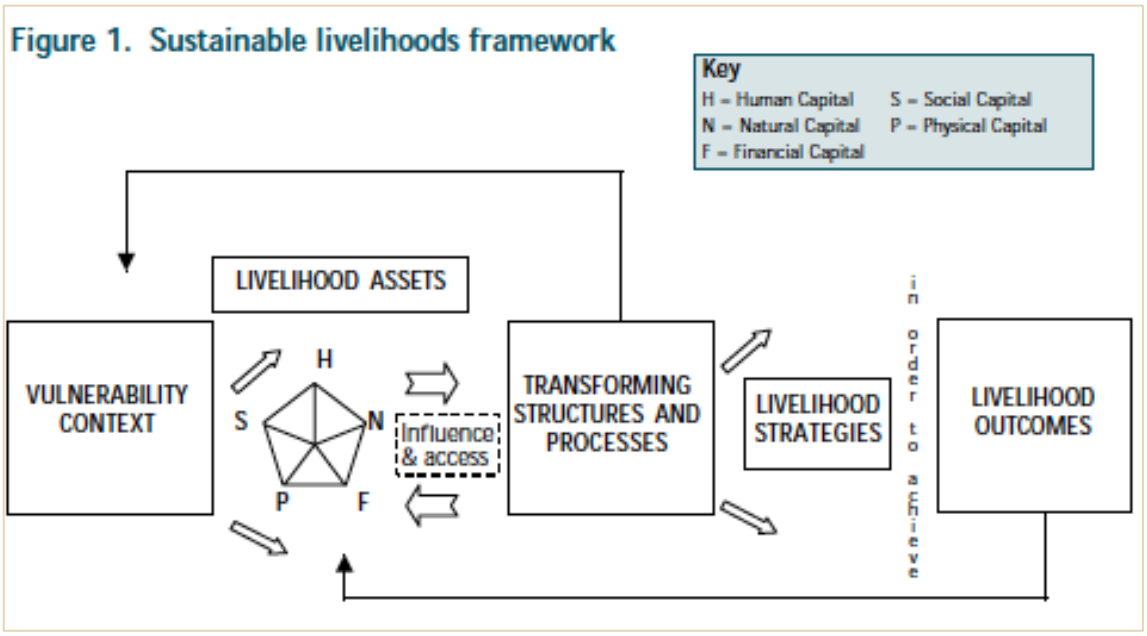


Figure 1: The Sustainable Livelihood Framework concept (as presented in DIFID, 1999). Source: DIFID (1999)

---

[15] Chambers, R. and Conway, G.R (1992) Sustainable Rural Livelihoods: Practical Concepts for the 21st Century, IDS Discussion Paper 296, Institute of Development Studies, London, Brighton: IDS, 29 p.

[16] DFID (1999) Sustainable Livelihoods Guidance Sheets, Numbers 1–8, London: Department for International Development (DIFID), https://www.livelihoodscentre.org/documents/114097690/114438878/Sustainable+livelihoods+guidance+sheets.pdf/594e5ea6-99a9-2a4e-f288-cbb4ae4bea8b?t=1569512091877

Although the framework(Figure 1), has been developed to help understand and analyse the livelihoods of the poor, it is also useful in assessing the effectiveness of existing efforts to reduce poverty. Like all frameworks, it is a simplification and not an exact representation of the complex ground reality. The full diversity and richness of livelihoods can be understood only by qualitative and participatory analysis at a local level. It is only an endeavour to provide a way of thinking about the livelihoods of poor people that will stimulate debate and reflection, thereby improving performance in poverty reduction (DIFID, 1999).

The framework views people as operating in a context of vulnerability and within this context, they have access to certain assets or poverty-reducing factors. These gain their meaning and value through the prevailing social, institutional, and organisational environment. This environment also influences the livelihood strategies – ways of combining and using assets – that are open to people in pursuit of beneficial livelihood outcomes that meet their own livelihood objectives (DIFID, 1999).

Contextualising the SLF for the present assessment

Although the DIFID SLA is one of the most popular tools for conceptualising and analysing livelihood situations in the context of broad socioeconomic and development parameters, several alternative versions of the same have been proposed over the last two decades, to accommodate the new perspectives on social, economic, political, cultural and ecological driving forces that have significantly influenced people's livelihoods, sustainability and well-being in both rural and urban domains. For example, the concerns from a political economy outlook, drastic environmental changes resulting from development policies and projects and climate change have emerged as powerful factors that interact with eight basic factors defined in the DIFID SLF. Therefore we also partly used a reformed approach

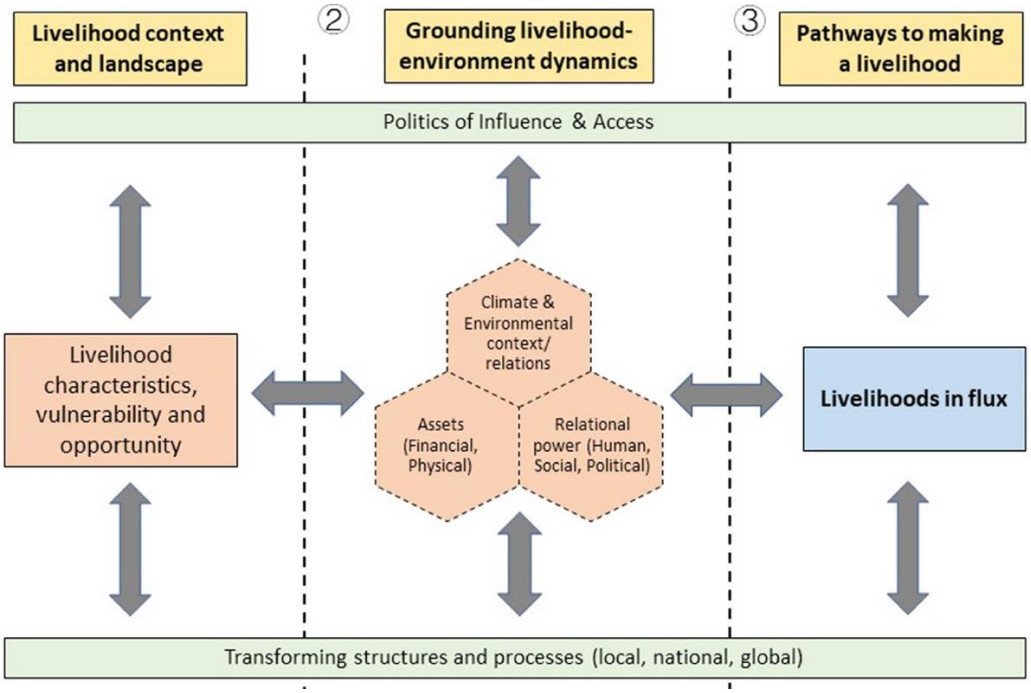


Figure 2: Reformulated framework of SLF, source: Natarajan et al., 2022

(Figure 2) proposed by Natarajan et al, (2022)[17] in explaining the livelihood situations in this case study. We have not followed the methodology of assessing the livelihood situation literally using these frameworks, but we used the essential understanding one gets out of these concepts about the drivers of change, vulnerability and outcomes. A more recent ideation of a livelihood, which is broader than the DIFID concept, defines to be comprising the assets (natural, physical, human, financial, and social capital), the activities, and the access to these (mediated by policies, institutions, and social relations) that together determine the earnings gained by the individual or household (USAID, Feed the Future, 2017)[18] quoted in Noronha (2019)[19]. The combination of the theoretical concepts presented above helps us understand the livelihood situation prevailing in our study area.

Major livelihoods in the study area

There are seven major livelihoods that the people are pursuing in the study area. These are: (i) Fishing, (ii) Weaving, (iii) Livestock rearing, (iv) Own business, (v) Private job, (vi) Daily wage earning, and (vii) Government job. Fishing is the vocation where the largest number of households(about 887 accounting for 22.3% of the HHs). The others according to the number involved are weaving(818, 20.6%), livestock rearing (776, 19.5%), and Own business(602, 15.2%) as evident from Figure 3.

As shown in Figure 4, Among those major livelihoods which are estimated in terms of the Number of Persons(NOP), the maximum number of people are involved with private jobs (2166, 11.2%) followed by daily wage earnings (1579, 8.1%) and government jobs (1217, 6.3%).

Table 1-A: Distribution of households and persons pursuing major livelihoods in the HSUs.

S.N.	Surveyed HSU	Number of HH	Population	Fishing (HH)	% of the total number of HH	Weaving (HH)	% of the total number of HH
1	Deochotal	110	500	0	0.0	20	18.2
2	Chakardeo	121	610	25	20.7	35	28.9
3	Matia	313	1630	50	16.0	67	21.4
4	Haorapar	60	300	0	0.0	15	25.0
5	Keotpara	300	1510	300	100.0	180	60.0
6	Hatuapara	58	400	25	43.1	10	17.2
7	Hirapara	109	550	73	67.0	109	100.0
8	Nowapara	60	300	60	100.0	20	33.3
9	Konapara	45	230	45	100.0	36	80.0

[17] Natarajan, N., Newsham, A., Rigg, J., & Suhardiman, D. (2022). A sustainable livelihoods framework for the 21st century. World Development, 155, 105898. https://doi.org/10.1016/j.worlddev.2022.105898

[18] USAID Feed the Future. (2017). GFSS Technical Guidance: Diversifying Livelihoods, Resilience, and Pathways Out of Poverty.

[19] Noronha, T. (2019). Alternative Livelihoods Working Glossary. Produced by Mercy Corps as part of the SCALE Award.

S.N.	Surveyed HSU	Number of HH	Population	Fishing (HH)	% of the total number of HH	Weaving (HH)	% of the total number of HH
10	Natun Basti	100	510	100	100.0	55	55.0
11	Medhipara	56	220	45	80.4	3	5.4
12	Borbori	220	1200	108	49.1	190	86.4
13	Tetelia	400	2000	55	13.8	25	6.3
14	Pamohi	150	760	0	0.0	3	2.0
15	Paschim Boragaon	1150	5000	0	0.0	10	0.9
16	Paschim Jalukbari	140	700	0	0.0	2	1.4
17	Dakhin Jalukbari	80	400	0	0.0	3	3.8
18	Maj Jalukbari	300	1500	0	0.0	15	5.0
19	Khanamukh-(Rural & Urban)	200	1080	1	0.5	20	10.0
	Total	**3972**	**19400**	**887**	**22.3**	**818**	**20.6**

Table 1-B: Distribution of households and persons pursuing major livelihoods in the HSUs.

S.N.	Surveyed HSU	Number of HH	Population	Livestock rearing (HH)	% of the total number of HH	Own business (HH)	% of the total number of HH
1	Deochotal	110	500	7	6.4	30	27.3
2	Chakardeo	121	610	40	33.1	5	4.1
3	Matia	313	1630	73	23.3	61	19.5
4	Haorapar	60	300	14	23.3	12	20.0
5	Keotpara	300	1510	180	60.0	60	20.0
6	Hatuapara	58	400	8	13.8	6	10.3
7	Hirapara	109	550	5	4.6	15	13.8
8	Nowapara	60	300	40	66.7	12	20.0
9	Konapara	45	230	10	22.2	2	4.4
10	Natun Basti	100	510	63	63.0	3	3.0
11	Medhipara	56	220	3	5.4	6	10.7
12	Borbori	220	1200	10	4.5	20	9.1
13	Tetelia	400	2000	150	37.5	85	21.3
14	Pamohi	150	760	20	13.3	30	20.0
15	Paschim Boragaon	1150	5000	100	8.7	100	8.7

16	Paschim Jalukbari	140	700	0	0.0	105	75.0
17	Dakhin Jalukbari	80	400	5	6.3	10	12.5
18	Maj Jalukbari	300	1500	8	2.7	25	8.3
19	Khanamukh-(Rural & Urban)	200	1080	40	20.0	15	7.5
	Total	3972	19400	776	19.5	602	15.2

Table 1-C: Distribution of households and persons pursuing major livelihoods in the HSUs.

S. N.	Surveyed HSU	Number of HH	Population	Job-Private (NOP)	% of total population	Daily wage-earning (NOP)	% of total population	Job-Government (NOP)	% of total population
1	Deochotal	110	500	30	6.0	90	18.0	15	3.0
2	Chakardeo	121	610	110	18.0	40	6.6	18	3.0
3	Matia	313	1630	69	4.2	160	9.8	35	2.1
4	Haorapar	60	300	25	8.3	5	1.7	25	8.3
5	Keotpara	300	1510	180	11.9	140	9.3	80	5.3
6	Hatuapara	58	400	30	7.5	7	1.8	6	1.5
7	Hirapara	109	550	80	14.5	10	1.8	37	6.7
8	Nowapara	60	300	12	4.0	20	6.7	5	1.7
9	Konapara	45	230	15	6.5	10	4.3	25	10.9
10	Natun Basti	100	510	30	5.9	32	6.3	9	1.8
11	Medhipara	56	220	15	6.8	15	6.8	15	6.8
12	Borbori	220	1200	20	1.7	100	8.3	12	1.0
13	Tetelia	400	2000	220	11.0	150	7.5	150	7.5
14	Pamohi	150	760	20	2.6	30	3.9	50	6.6
15	Paschim Boragaon	1150	5000	600	12.0	500	10.0	160	3.2
16	Paschim Jalukbari	140	700	280	40.0	70	10.0	230	32.9
17	Dakhin Jalukbari	80	400	180	45.0	10	2.5	120	30.0

18	Maj Jalukbari	300	1500	150	10.0	50	3.3	200	13.3
19	Khanamukh-(Rural & Urban)	200	1080	100	9.3	140	13.0	25	2.3
	Total	3972	19400	2166	11.2	1579	8.1	1217	6.3

Table 2: Households associated with major livelihoods: Fishing, weaving, livestock rearing, and owning a business.

Livelihood	Fishing	Weaving	Livestock Rearing (HH)	Own Business
Number of HH	887	818	776	602
Percentage of total HH	22.3%	20.6%	19.5%	15.2%

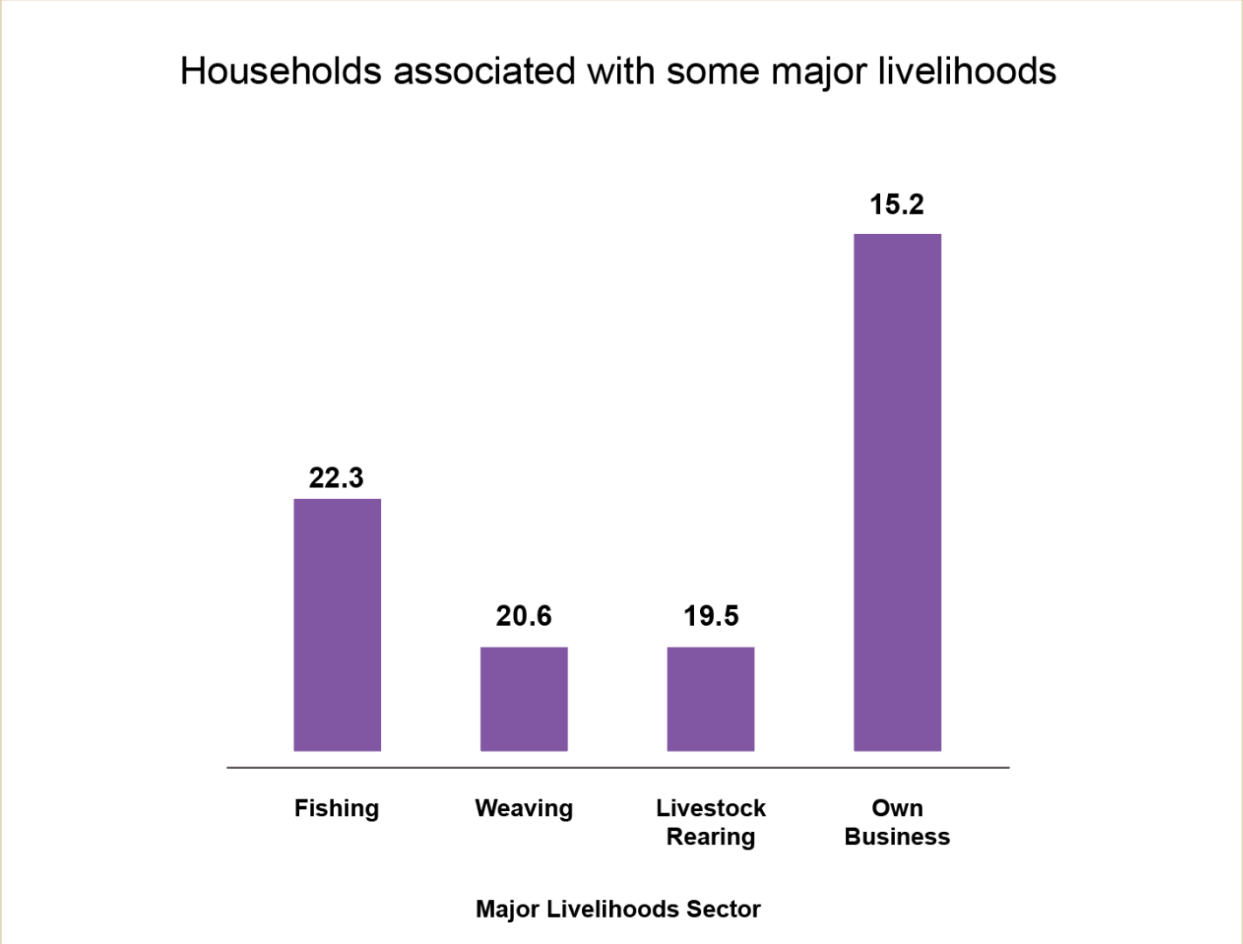


Figure 3: Households associated with some major livelihoods.

Table 3: Populations associated with major livelihoods: Private job daily wage-earning Government job.

Livelihood	Private job	Daily wage-earning	Government job
Number of Persons	2166	1579	1217
Percentage of total Population	11.2%	8.1%	6.3%

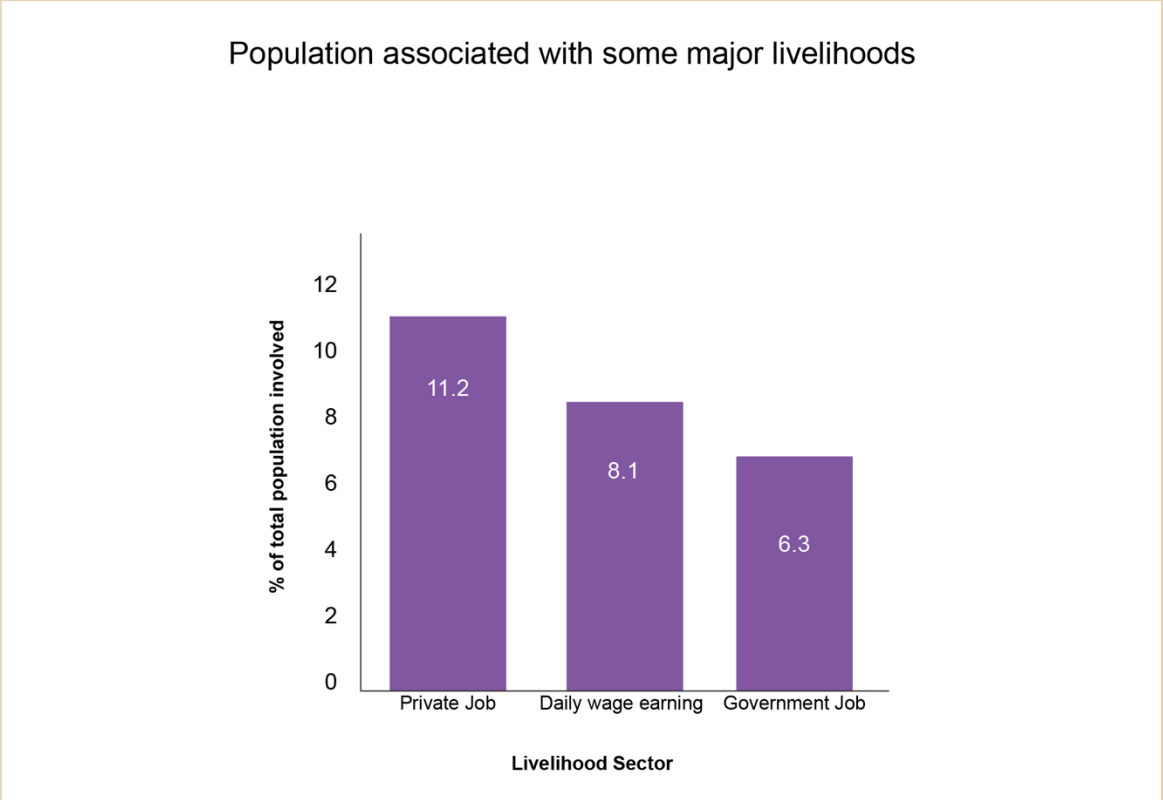


Figure 4: Population associated with some major livelihoods.

Table 4: Distribution of households pursuing minor livelihoods in the HSUs

Serial Number	Surveyed HSU	Number of HH	Dairy	% of total HH	Collection of NTFP from the beel's banks and nearby forests	% of total HH	Collection of aquatic resources other than fish	% of total HH	Agriculture	% of total HH
1	Deochotal	110	3	2.7	0	0.0	0	0.0	0	0.0
2	Chakardeo	121	25	20.7	55	45.5	15	12.4	20	16.5
3	Matia	313	16	5.1	0	0.0	36	11.5	5	1.6
4	Haorapar	60	10	16.7	0	0.0	0	0.0	12	20.0
5	Keotpara	300	40	13.3	0	0.0	50	16.7	40	13.3
6	Hatuapara	58	8	13.8	0	0.0	3	5.2	15	25.9
7	Hirapara	109	1	0.9	0	0.0	10	9.2	15	13.8
8	Nowapara	60	5	8.3	0	0.0	2	3.3	5	8.3

9	Konapara	45	2	4.4	0	0.0	2	4.4	10	22.2
10	Natun Basti	100	15	15.0	0	0.0	45	45.0	20	20.0
11	Medhipara	56	2	3.6	0	0.0	2	3.6	0	0.0
12	Borbori	220	20	9.1	0	0.0	37	16.8	3	1.4
13	Tetelia	400	15	3.8	0	0.0	35	8.8	0	0.0
14	Pamohi	150	1	0.7	0	0.0	0	0.0	0	0.0
15	Paschim Boragaon	1150	10	0.9	0	0.0	0	0.0	0	0.0
16	Paschim Jalukbari	140	5	3.6	0	0.0	0	0.0	0	0.0
17	Dakhin Jalukbari	80	5	6.3	0	0.0	0	0.0	0	0.0
18	Maj Jalukbari	300	4	1.3	0	0.0	0	0.0	0	0.0
19	Khanamukh-(Rural & Urban)	200	2	1.0	0	0.0	0	0.0	50	25.0
		3972	189	4.8	55	1.4	237	6.0	195	4.9

Table 5: Households associated with minor livelihoods: Dairy, Collection of NTFP

Livelihood	Dairy	Collection of NTFP from the beel's banks and nearby forests (HH)	Collection of aquatic resources other than fish (HH)	Agriculture
Number of HH	189	55	237	195
Percentage of total HH	4.8%	1.4%	6.0%	4.9%

We have identified four main minor livelihoods in the area which are (i)Dairy, (ii)Collection of NTFP from the beel's banks and nearby forests, (iii) Collection of aquatic resources other than fish (HH) and (iv) Agriculture, based on the number of people(households) who are practising them. A relatively smaller number of families adopt sources of income, but their contribution to their monthly or annual kitty of income cannot be ignored. Table 5 and Figure 5 show the number and percentage of households that are practicing some minor livelihoods viz.

Livestock rearing, which is a major livelihood, involves the rearing of cattle (cow, buffalo), goat, poultry (chicken, duck) and beekeeping. Dairy, especially in the form of milk is a by-product of some of these families doing animal husbandry.

Non-Timber Forest Product (NTFP) collection is a source of income for only 55 households from only one village (Chakardeo). The villagers usually collect firewood and wild edible fruits like Fern (Dhekia), Bamboo shoots, Elephant Apple (Outenga), Mushroom and Taro (Kosu), Olsohora, Paduli Lata, Dhekia, Mejenga paat, Bonkosu, Abutenga, Mushroom and Bamboo shoot from the nearby Rani-Garbhanga Reserve Forest; They also, which has been recently notified as a probable wildlife sanctuary. Although NTFP collection is allowed by the state forest department in the WLS in some situations, there is a possibility that this source of income may become uncertain for these villagers once the final notification is declared converting this reserve forest to a WLS.

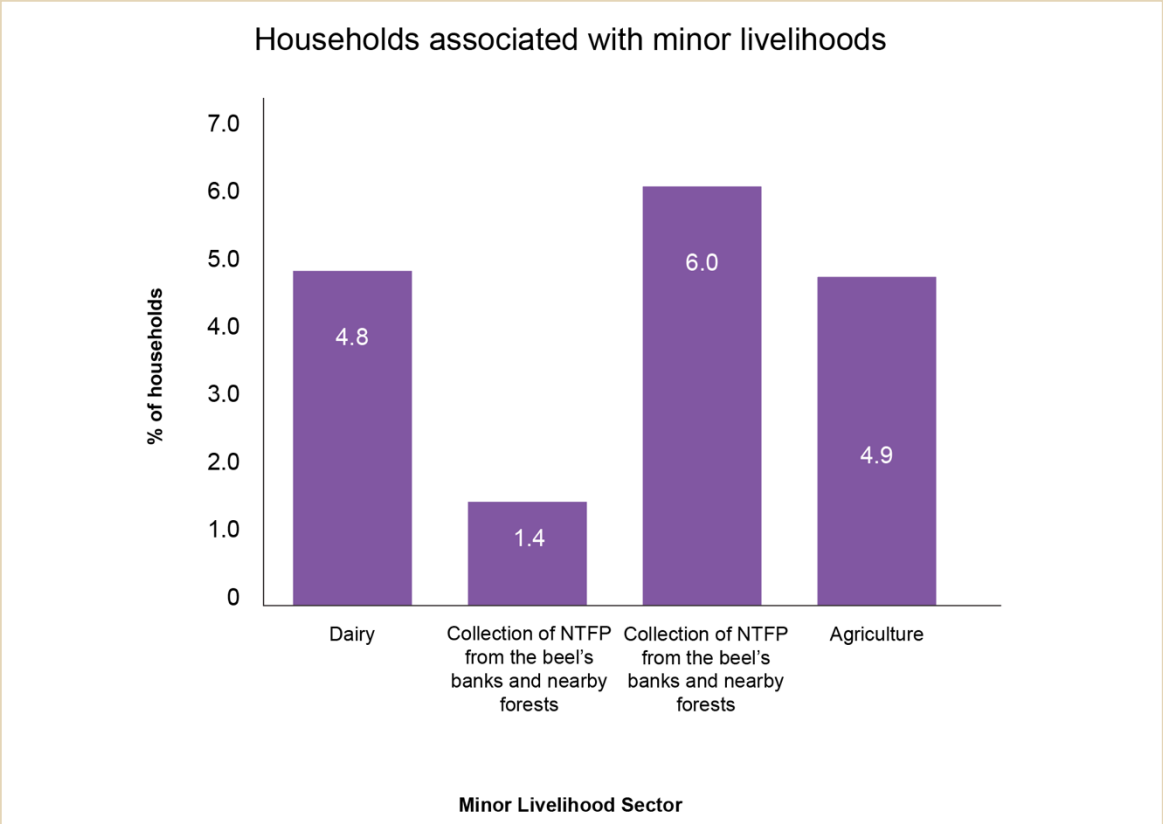


Figure 5: Households involved with minor livelihoods.

Aquatic resources (flora and fauna) other than fish that are collected by the villagers for commercial purposes include: Among aquatic flora and fruits, the main resources that they collect are: Fox nut or Makhana (Nikori), Nymphaea flowers (Water lily), Nymphaea nuts, Xeluk, Singrikata, Panisingra, Nikirikata or Tingrikata, Makua, Panisingra, Lotus etc. Besides they also get aquatic organisms like Snails, Crab, and molluscs. Moreover, they harvest grasses and some other fodder for domestic cattle, vegetables, flowers, aquatic seeds, and water hyacinths.

Among these, the Makhana (Euryale Ferox), Nicor in Assamese is a high-value food, which grows in plenty in the Deepor Beel. Local people, mostly fishermen collect and sell them in nearby markets. Nikori itself is edible and used in several cuisines by Assamese people. However, the processed food called Makhana is considered highly nutritious and sold at expensive prices in the market. Cultivating and harvesting the makhana in an organized way has the potential to become an important source of earning for more households in the Deepor Beel fringe area in the future.

What is most notable here is the fact that agriculture has emerged as a minor livelihood on which very few households depend for income. Even a decade back, agriculture used to be counted as a major livelihood in the area which is far losing its importance because of several reasons, which will be explained later in this report when we discuss the agriculture sector in more detail. Paddy is the major agricultural crop and the varieties that they cultivate in small plots of land are Sali, Aizong, Joha, Borni, Moinagiri, Aijuni, Badumguri, Bao, Aahu, Boro etc.

Table 6: Distribution of households with single livelihood sources in the HSUs of the study area

Serial Number	Name of HSU	Total number of HH in HSU	Only agriculture (HH)	% of HH in HSU	Only fishing (HH)	% of HH in HSU
1	Deochotal	110	0	0.0	0	0.0
2	Chakardeo	121	0	0.0	15	12.4
3	Matia	313	2	0.6	38	12.1
4	Haorapar	60	7	11.7	0	0.0
5	Keotpara	300	20	6.7	160	53.3
6	Hatuapara	58	0	0.0	25	43.1
7	Hirapara	109	0	0.0	64	58.7
8	Nowapara	60	0	0.0	32	53.3
9	Konapara	45	0	0.0	10	22.2
10	Natun Basti	100	5	5.0	55	55.0
11	Medhipara	56	0	0.0	4	7.1
12	Borbori	220	1	0.5	50	22.7
13	Tetelia	400	0	0.0	15	3.8
14	Pamohi	150	0	0.0	0	0.0
15	Paschim Boragaon	1150	0	0.0	0	0.0
16	Paschim Jalukbari	140	0	0.0	0	0.0
17	Dakhin Jalukbari	80	0	0.0	0	0.0
18	Maj Jalukbari	300	0	0.0	0	0.0
19	Khanamukh-(Rural & Urban)	200	1	0.5	1	0.5
	Total	3972	36	0.9	469	11.8

Table 7: Distribution of the number of persons with single livelihood sources in the HSUs of the study area

Serial Number	Name of HSU	Total population	Only daily wage earning. (NOP)	% of NOP in HSU	Only service (any kind of job) (NOP)	% of NOP in HSU
1	Deochotal	500	50	10.0	15	3.0
2	Chakardeo	610	20	3.3	50	8.2
3	Matia	1630	42	2.6	40	2.5
4	Haorapar	300	5	1.7	37	12.3
5	Keotpara	1510	10	0.7	50	3.3
6	Hatuapara	400	3	0.8	18	4.5
7	Hirapara	550	5	0.9	50	9.1
8	Nowapara	300	5	1.7	10	3.3
9	Konapara	230	0	0.0	15	6.5
10	Natun Basti	510	8	1.6	17	3.3

11	Medhipara	220	10	4.5	15	6.8
12	Borbori	1200	60	5.0	12	1.0
13	Tetelia	2000	90	4.5	70	3.5
14	Pamohi	760	20	2.6	60	7.9
15	Paschim Boragaon	5000	230	4.6	200	4.0
16	Paschim Jalukbari	700	0	0.0	28	4.0
17	Dakhin Jalukbari	400	5	1.3	35	8.8
18	Maj Jalukbari	1500	15	1.0	110	7.3
19	Khanamukh-(Rural & Urban)	1080	20	1.9	65	6.0
		19400	598	3.1	897	4.6

Table 8: Number of Households pursuing single livelihoods in agriculture and fishing and Number of Persons having single livelihoods in daily wage earning and service (private /public)

Livelihood sector	Only agriculture (HH)	Only fishing (HH)	Total HH with only Agriculture and Only fishery	Only daily wage earning. (NOP)	Only service (any kind of job) (NOP)	**Total**
Number of HH	36	469	505			
% of total households (3972) number of persons in study area	0.9	11.8	12.7			**50.4**
Number of persons				598	897	**1495**
% of total number of persons in study area (19400)				3.1	4.6	**7.7**

One important finding of the survey is that most households have more than one source of livelihood and income in the form of several members of the household(family) pursuing different activities for earning money. To help explain this finding, let us refer to the two more conceptual terms as defined below.

Livelihoods diversification: Diversification of livelihood refers to those individual, household, and community-level strategies and objectives that are pursued alongside, or in lieu of, traditional agricultural activities to diversify income streams and reduce risk. Livelihoods

diversification is the approach of having more than one income stream across on-farm, off-farm, non-farm work, etc. (USAID, 2017).

One important finding of the survey is that most households have more than one source of livelihood and income in the form of several members of the household(family) pursuing different activities for earning money. To help explain this finding, let us refer to the two more conceptual terms as defined below.

Livelihoods diversification: Diversification of livelihood refers to those individual, household, and community-level strategies and objectives that are pursued alongside, or in lieu of, traditional agricultural activities to diversify income streams and reduce risk. Livelihoods diversification is the approach of having more than one income stream across on-farm, off-farm, non-farm work, etc. (USAID, 2017)[20].

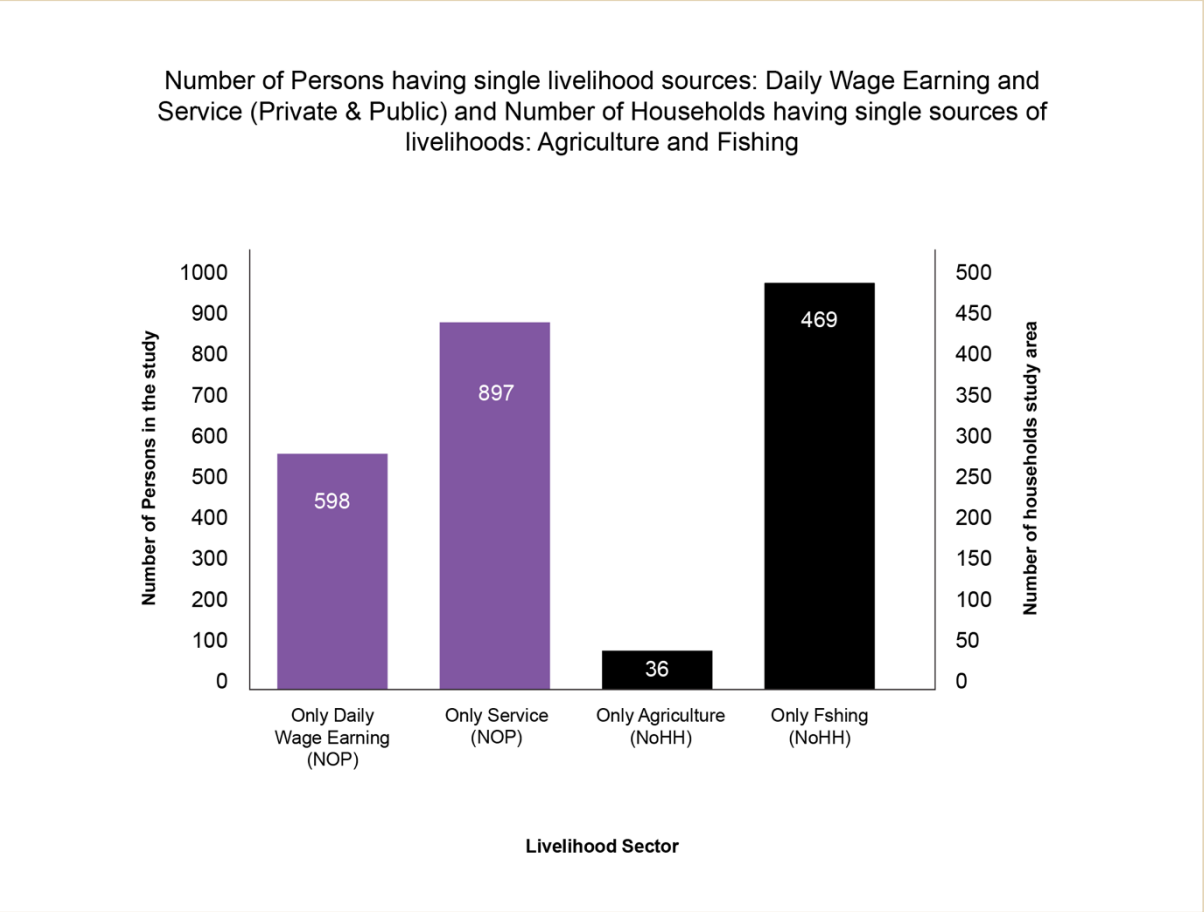


Figure 6: Number of Persons having single livelihood sources: Daily Wage Earning and Service (Private & Public) and Number of Households having single sources of livelihoods: Agriculture and Fishing

[20] USAID. (2017). Livelihoods Diversification Analysis (LDA): Literature Review. USAID/Senegal.

Mixed livelihoods: Mixed livelihoods, also referred to as 'portfolios of work' or 'poly-employment', occur when individuals earn income from multiple, diversified sources, from agriculture to casual labour to petty trade and formal work, in part because it mitigates the risk and seasonality inherent in any one source, and because it is often not possible to sustain sufficient income from a single occupation(Blattman and Ralston, 2015).
Thus, it is seen that the communities in our study area are seen to be indulging in both livelihood diversification and mixed livelihoods, which helps them reduce the risk of relying on only one particular occupation.

Households with single livelihood
However, there is a small fraction of the households and the population that depends only on a single source of livelihood, as shown in Tables 6, 7 and 8 and presented in Figure 4. This is an important parameter to understand the livelihood situation from the vulnerability perspective. Families having more than one source of vocation are less at risk from the point of view of livelihood security because if one source of income is not working well there are other members in the family who can compensate from other income-generating activities. But the families, that are dependent on a single livelihood are more at risk since if that particular livelihood fails at times there is no way to compensate the same.

In such cases, we need to understand the reliability and sustainability of the existing livelihoods. Agriculture is losing importance as a main livelihood due to declining land ownership, lack of interest in the communities due to diminishing returns, changing landuse patterns and environmental pollution. Fishing, the most practised livelihood, especially for the traditional fisherfolks, is intrinsically vulnerable to the changing hydrological regime of the wetland, climate change, water pollution and excessive fishing pressure. Daily wage earning, is the sector where many people have resorted to earning their daily meals; but these opportunities are not regularly available to all of them. These jobs are affected by social and political situations and many other factors that are beyond the control and anticipation of the people. Government and public jobs are relatively stable and therefore this is the only section of the people who are least vulnerable among the single livelihood holders. Thus, it is seen that the households that have only one source of livelihood need special attention while planning for the livelihood security of the fringe communities of the Deepor Beel.

We studied various aspects of the current livelihoods compared to the findings from our own surveys done back in 2018, 2014 and 2006. Based on these comparisons we have identified the following trends in the livelihoods as presented in Table 9.

Table 9: Trends in the livelihoods in 2023

Serial Number	Major Livelihood Types as of 2023	% of HH/NOP		Trend compared to 2000
1	Fishing	22.9	HH	Decreasing
2	Weaving	22.1	HH	Increasing
3	Livestock rearing	17.3	HH	Increasing
4	Own business	16.9	HH	Increasing

[21]Blattman, C. and Ralston, L. (2015). Generating Employment in Poor and Fragile States: Evidence from Labor Market and Entrepreneurship Programs. The World Bank.

5	Private job	12.7	NOP	Increasing
6	Daily wage-earning	11.7	NOP	Increasing
7	Government job	11.6	NOP	Increasing
8	Dairy	4.9	HH	Increasing
9	Agriculture	4.4	HH	Decreasing
10	Non-fish aquatic resources	6.9	HH	Decreasing
11	Collection of NTFP	1.6	HH	Decreasing

Migration of people, especially the youth, both men and women to other parts of the state or other states in search of jobs, small business opportunities and other sources of income is common in the area. Labour migration was found to be more rampant in the urban villages than in the rural villages. This trend is explained by the fact that the rural youth are less adventurous and more rooted in their place of living and the urban youth are educationally advanced than their rural counterpart.

This chapter provided only an overview of the livelihood scenario existing in the study area at present. A detailed analysis of the major livelihoods is presented in the next chapter on detailed analysis of livelihoods.

Detailed Analysis-Fishing as a Livelihood

5. Detailed Analysis-Fishing as a livelihood

The Deepor Beel is a major fish breeding ground for a large number of fish species and provides fish stocks to nearby wetlands and rivers. The diversity and concentration of indigenous freshwater fish species are very high in the Deepor Beel area owing to the diverse habitat types and high productivity of the wetland. Deepor Beel is a permanent deep and shallow water wetland; hence, the natural breeding of some of them takes place within the beel itself. The diversity and concentration of indigenous freshwater fish species are very high in the Deepor Beel area owing to the diverse habitat types and high productivity of the wetland with about 50 species of fish belonging to 19 families already identified in this wetland (Chetry, 1999), which was also reported in the Ramsar proposal on the Deepor Beel. Being a permanent deep and shallow water wetland, the natural breeding of some of the fish species takes place within the beel itself.

Saikia (2005)[22] reported 61 species from the Deepor Beel of which, 5 fish species were exotic and 54 species were indigenous fishes of Assam. The 8 endangered fish species recorded were Cirrhinus reba, Ompok bimaculatus, Ompok pabda, Botia derio, Nandus nandus, Rasbora alenga, Bracidanio rario and Channa barca. Out of the 20 economically important large fish species were found in the wetland more important ones were Labio rohita, Catla catla, Labio calbasu, Channa marulius, Channa striatus, Notopterus chitala, Notopterus notopterus, Cirrhinus mrigala, and Wallago attu. Moreover, about 11 species of ornamental fish were also reported and these included Badis badis, Colisa lalia, Colisa fasciatus, Pseudomabius ranga, Chanda nama, Botia Dario, Danio deverio, Bracidanio verio. B. rario, Parluciosoma daniconius, Puntius ssp (more than one species). A list of fish species identified by a study of Aaranyak (Das et al., 2014) is presented as Annexure II.

Demography of the fishing community

Fishing in the Deepor Beel is the major livelihood of the largest number of people in the study area. The fishing population is found mainly in 12 out of the 19 HSUs. About 887 families are involved in fishing which accounts for about 22.3% of the total number of households. As mentioned earlier, there are about 469 HHs that are solely dependent on fishing as a source of livelihood. Figure 1 presents the distribution of these households in the HSUs across the study area. There are four villages, viz. Keotpara, Nowapara, Konapara and Natun Basti, where all households are involved in fishing.

[22]Saikia, P. K. (2005). Qualitative and quantitative study of lower and higher organisms and their functional role in the Deepor Beel ecosystem. Project report submitted to North Eastern Space Applications Centre (NESAC), Department of Space, Government of India, Umium, Meghalaya, Shillong, 97pp.

Table 1: Households having fishing as the main livelihood.

SN	Name of HSU	Number of HH	Population	Number of HH in Fishing (HH)	% of total number of HH in HSU	HH having Only fishing as livelihood	% of total number of HH in HSU
1	Deochotal	110	500	0	0.0	0	0.0
2	Chakardeo	121	610	25	20.7	15	12.4
3	Matia	313	1630	50	16.0	38	12.1
4	Haorapar	60	300	0	0.0	0	0.0
5	Keotpara	300	1510	300	100.0	160	53.3
6	Hatuapara	58	400	25	43.1	25	43.1
7	Hirapara	109	550	73	67.0	64	58.7
8	Nowapara	60	300	60	100.0	32	53.3
9	Konapara	45	230	45	100.0	10	22.2
10	Natun Basti	100	510	100	100.0	55	55.0
11	Medhipara	56	220	45	80.4	4	7.1
12	Borbori	220	1200	108	49.1	50	22.7
13	Tetelia	400	2000	55	13.8	15	3.8
14	Pamohi	150	760	0	0.0	0	0.0
15	Paschim Boragaon	1150	5000	0	0.0	0	0.0
16	Paschim Jalukbari	140	700	0	0.0	0	0.0
17	Dakhin Jalukbari	80	400	0	0.0	0	0.0
18	Maj Jalukbari	300	1500	0	0.0	0	0.0
19	Khanamukh-(Rural & Urban)	200	1080	1	0.5	1	0.5
	Total	**3972**	**19400**	**887**	**22.3**	**469**	**11.8**

The other three villages where a major chunk of households is into fishing are Hirapara (67%), Medhipara (80.4%) and Borbori (49.1%).

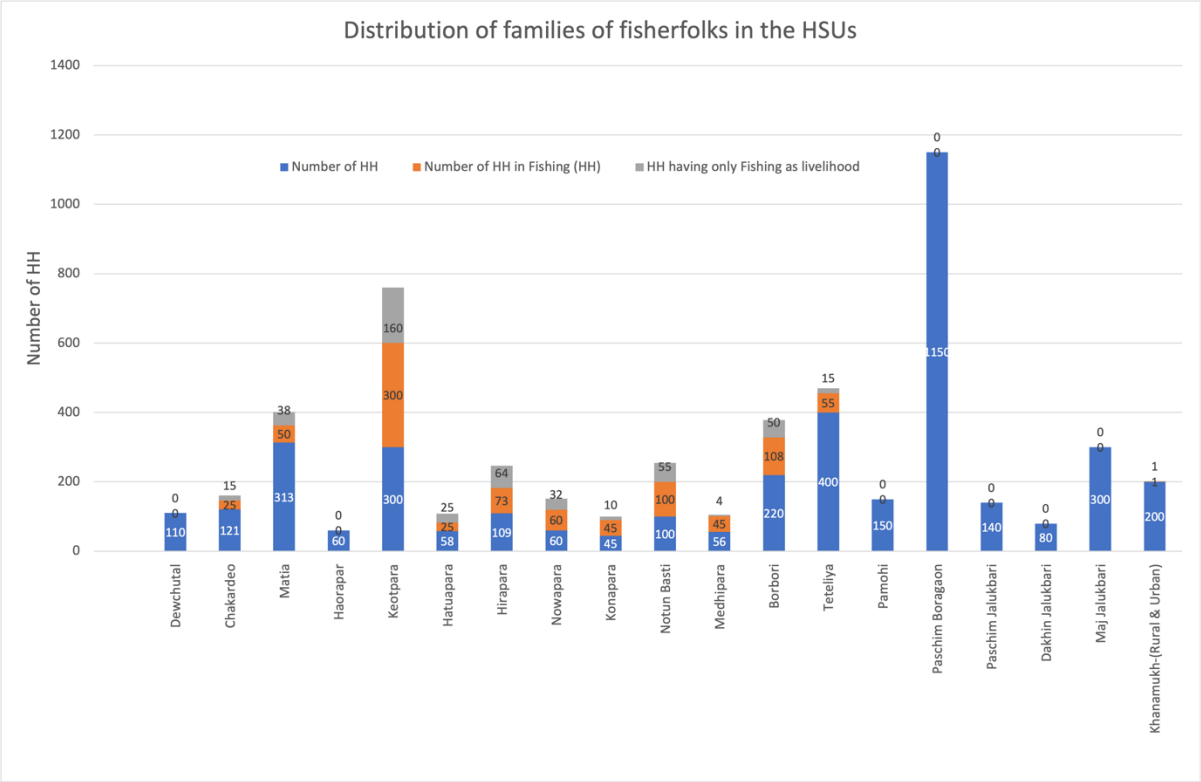


Figure 1: Distribution of the families of fisherfolks in the HSUs in the study area

Institutional arrangement: The fishing activities of the traditional fishermen communities (belonging to the SC category) are controlled and managed by the 'Paspara Samabai Samity'(PSS), a cooperative society constituted by the fishermen community of the area. The committee has formulated rules and regulations about the time of fishing, selection of zone of fishing, prohibition on fishing in certain time periods of the year etc. These rules are strictly imposed with punitive measures levied in cases of violations. The communities obey the rules and policies sincerely.

For example, the fishermen families of the Tetelia and Khanamukh areas are not members of this committee, and therefore, fishermen of these two areas are not allowed to catch fish in the core fishing area of the Deepor Beel. Therefore, the fishermen from Tetelia go for fishing in the easternmost fringe of the Deepor Beel, in a small adjoining water body locally called Borsola Beel and those of the Khanamukh area carry out their fishing activity in the Khanajan, which is a small rivulet that joins the Deepor Beel; with the Brahmaputra River and in the Karhila Beel.

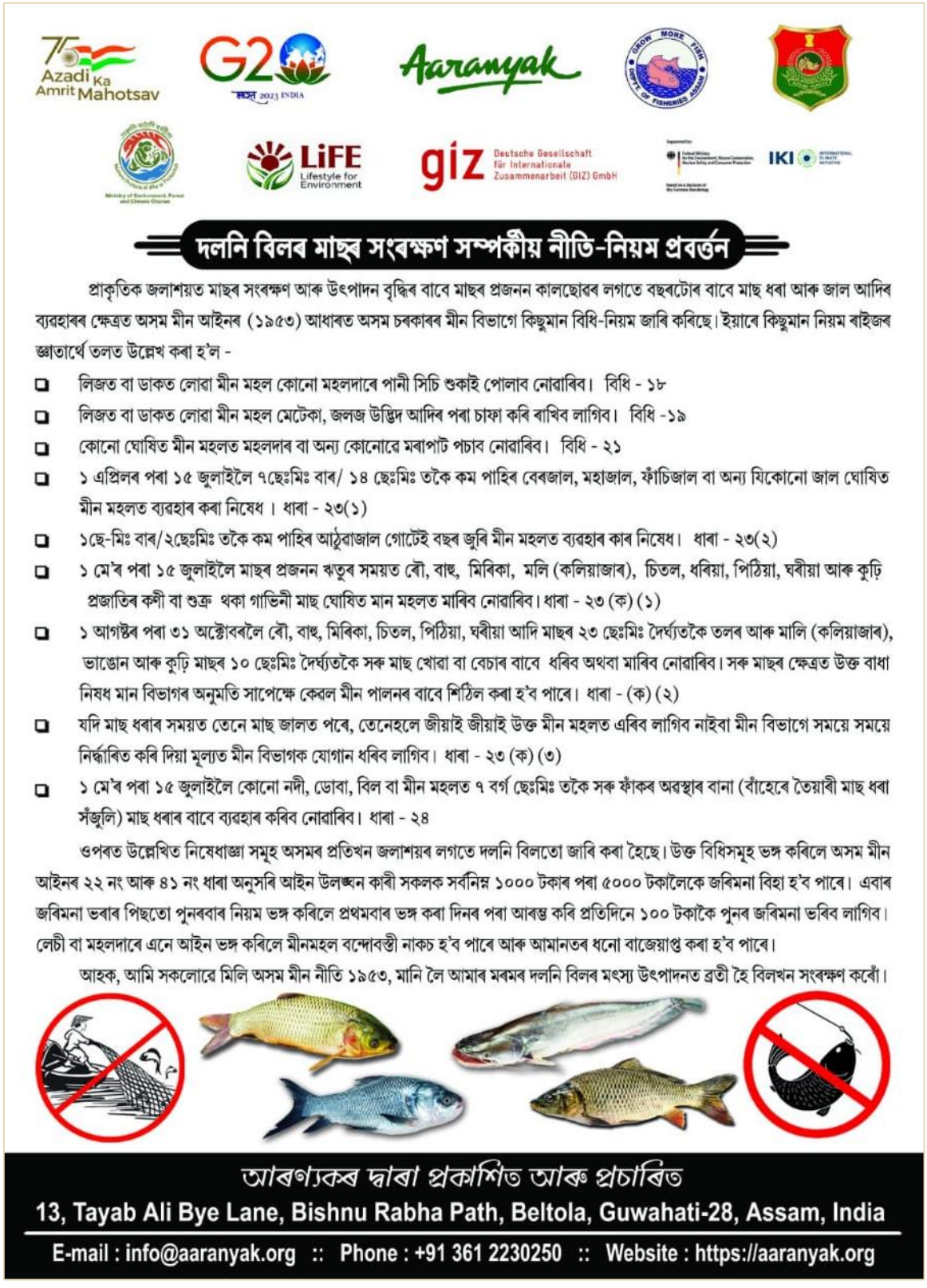


Figure 2: A leaflet on information about the fishing ban/lean period as per Government rules published by Aaranyak under the NERAQ Project for the awareness of the people living around the Doloni Beel, Bongaigaon District.

Figure 2 shows a leaflet on information about the fishing ban/lean period as per Government rules published by Aaranyak under the NERAQ Project for the awareness of the people living around the Doloni Beel, Bongaigaon District. It mentions the rules to be observed by people during the fishing ban/lean period as declared in different seasons of the year as mandated in the Assam Fisheries Act, 1953. These rules are equally relevant to the Deepor Beel and its fishermen community also.

However, the fishermen working with the PSS, do not follow the government's fishing ban rules because they don't get any compensation or other kind of support from the Government as promised in the same Act. They only follow their own regulatory practices as laid down by the PSS. For example, they cannot do fishing in the middle of the Beel, during July-August when they release fish seedlings (locally called *Masor Poona*). During this time, they have to catch fish on the outer sides of the central fish-rearing zone which is demarcated by a boundary. They are also not permitted to use mosquito nets (Mosari Jal), which is detrimental to the growth of fish seedlings. If somebody breaks these rules and goes fishing in the middle of the Beel then they will be fined with an amount of money, their fishing gear will be seized, and their license will be cancelled for one year.

Traditional knowledge: Since the fisher community has lived in that area for several generations over a historically known period of about 100 years, they are rich in traditional knowledge of the science, art, and craft of fishing and pisciculture. They possess unique knowledge about the nature and behaviour of the varieties of fish, predicting the local weather and the hydrological properties of the wetland in different seasons, the art of catching fish in various seasonal conditions and the craft of making the fishing gears and tools by themselves.

Photo 1: Jal (net)

Photo 2: Goroi Langi Jal

They are known to use about 19 different types of apparatus and paraphernalia for fishing. They use different tools and equipment for catching fish in different seasons. It is notable that they do not make. Use of any mechanized boats in fishing or for any other purpose is considered a good practice since machine boats are known to create water pollution through leakage of diesel and disturb the aquatic fauna by creating noise and vibration in the water body. This is also indirectly helping the birds to stay in the waters without getting seriously perturbed.

The fishing tools and gears that they mainly make themselves and use are mentioned below:

Box-1

Traditional nets: Langi Jal (Mua langi, Xingi Langi, Puthi Langi, Goroi Langi, Kawoi Langi, Ghoka Langi), Korongi jal, Tongi Jal, Dheki Jal, Koroni Jal, Haat Jal, etc.

Modern nets: Fasi Jaal, Karisma, Cast Net

Equipment: Jakoi, Polo, Asara, Sepa, Polua, Boroxi, Khaloi etc. These tools are used mainly for subsistence fishing)

Fishing method: Sepa Bondha, Gherao Diya, Mala Diya, Jeng Mara, Xai Mara, Jakoi Mara, Polo Mara, Jaal Mara, Ghoka Mara, Sitki etc.

Goroi Langi, Xingi Langi, Tongi Jal, Kawoi Langi, etc. Using such nets with specific mess sizes ensures the catch of the targeted fish types only, thus helping in the retention of the larger fish stock for the future. This is an example of the element of sustainability inbuilt in their traditional fishing practices. They understand the importance of sustainable harvesting of fish for the sake of their own livelihoods. For fishing, they apply various fishing methods and techniques like *Gherao, Mala Diya, Sepa Bandha, Jakoi Mara, Poloh Mara, Sitki, Ghoka Mara, Jeng Mara, Xai Mara, etc*. These methods are also known to be least harmful to the fish fauna as well as the beel and are in tune with the principle of sustainable fishing.

The Deepor Beel is well known for the large stock and diversity of its fish fauna. At the time of recognition as a Ramsar site, the beel is said to have about 50 species of fishes[23]. The common names of some of the most common fishes found in the wetland are: *Row, Bhokua, Aari, Kuhi, Haal, Hol, Borali, Sital, Kanduli, Kaljal, Silver Carp, Grass Carp, Mirika, Bhangun, Kaoi, Singi, Magur, Tingira, Gosi, Bami, Bheheri, Gedgedi, Pabhuya, Karati, Goroi, Chanda, Khalihana, Kakila, Gutu, Bordiya, Cheng, Koldumuni, Dorikona, Selkona, Mua, Puthi, Besa,* etc.

Photo 3: Dheki Jal

[23]https://rsis.ramsar.org/ris/1207

Photo 4: Poloh

Photo 5: Aska

Income from fishing

In Deepor Beel, January to March is the main fishing and this is the season when they try their best to earn as much as possible for the whole year since in other seasons the fish catch is negligible.

During this time, they get, on average, 10 to 15kg of fish per day per person. They organise a fishing festival in Deepor Beel, popularly known as 'Beel Mara' in the month of January before the Magh Bihu, especially on a Sunday every year. They have also religious beliefs related to the beel and its water. Before the Beel Mara starts they perform 'Ganga Puja' in the Deepor Beel as an offering to their 'Water Goddess'. This event is organized collectively by all households of the community that are registered with the PSS, the management committee.
In the Beel Mara festival, they get more than 100 kgs of fish per day per person. At that time, one boat is allowed for 2 persons. In the non-fishing season, they get 2 to 5 kg of fish per day per person. It is also found in the survey that few women from Keotpara, Borbori, and Nowapara also take part in fishing, especially in selling of fishes. These women go to the Gadhuli Bazar (meaning evening market), near Azara to sell the fish. It was found that they do not sell the fish in terms of weight, but they use a unit called "*Aska*". Aska is the unit of measurement for fish used by the local fishermen of Deepor Beel. One Aska is equivalent to 4-5 kgs of fish (Dutta & Sharma, 2020)[24]. Photo 5 shows the container called Aska which when full of fish, is used as the selling unit of one Aska, as shown in Photo 6.

[24]Dutta, J and Sharma, A. (2020). Valuing Fishing Activity of the Deepor Beel, Space and Culture, India 2020, 7:4 Page | 122, https://doi.org/10.20896/saci.v7i4.607

Table 2: Monthly income of fishermen during the fishing season in Deepor Beel

SN	Village/Ward	Monthly Income(Rs.)
1	Chakardeo	Rs. 6,000-10,000
2	Matia	Rs. 9,000-12,000
3	Keotpara	Rs. 6,000-10,000
4	Hatuapara	Rs. 5,000-6,000
5	Hirapara	Rs. 3,000-5,000
6	Nowapara	Less than Rs. 1,000
7	Konapara	Rs. 10,000-15,000
8	Natun Basti	Rs. 5,000-6,000
9	Medhipara	Rs. 5,000
10	Borbori	Rs. 10,000
11	Tetelia	Rs. 12,000
12	Khanamukh-(Rural & Urban)	Rs. 5000-10000

Photo 6: Fish being sold in containers called Aska which is the popular unit of volume of fish in the market.

Table 2 gives us an idea of the monthly income of the fisher families of the relevant HSUs in the fishing season. These are approximate estimations based on information provided by the community themselves.

People's concern about their livelihood: The fisherfolks of Deepor Beel are facing some formidable problems that have made them highly concerned about their livelihood. Important among them are:

(i) The survey has revealed that the quantity and the diversity of fishes are decreasing in Deepor Beel, and the quality of fish is also declining due to various causes like water pollution, overgrowth of water hyacinth and excessive pressure of fishing. Pollution of the wetland's water has a highly deleterious effect on the fish population. The water pollution is caused mainly by the incoming polluted and toxic water laden with untreated industrial and municipal sewage, from the city of Guwahati through the combined channels of the Basistha, Bahini, Morabharalau and Pamohi rivers as well as the pollutant leached out of the municipal garbage dump near Boragaon, other entries of factory wastes and local disposal of plastic and polythene garbage.

(ii) The sluice gate located on the Khanajan, a connecting channel that links the wetland to the Brahmaputra River creates obstruction on the inflow of water and movement of fish from the Brahmaputra to the beel in the summer and rainy seasons which is the breeding season of the fish and when they usually travel to eth wetland for laying eggs. This is one of the main factors that limits the stocking of fresh fish seedlings in the wetland thus resulting in a decrease in the quantity of fish over the years.

(iii) It is seen that several types of fish have become rarely available in the beel nowadays. For example, local fishermen talk of fishes like Kanduli, Mirika, Tingira, Gosi, Bheheri, Gedgedi, Karati, Khalihana, Cheng, Selkona, Koldumuni, etc., which are rarely found with some of them not seen for a long time now.

(iv) Fishes caught in many areas have developed a foul smell, which is mainly due to water pollution. As a result, the demand for fish of the Deepor Beel is coming down in the local markets, since consumers often complain about bad taste and odour. This has affected their sales, reducing their income.

(v) The bottom of the wetland is filled with debris consisting of materials like plastic bottles, polythene bags and different other waste products. Fishes hiding behind such materials are difficult to catch.

(vi) The excessive growth of water hyacinth is a major issue, as it blocks the path of the boats, and fishing nets get entangled with the water hyacinth as a result the nets get torn and destroyed.

(vii) Sometimes elephants that come to the wetland from the nearby forests of Rani-Garbhanga and spend time wallowing in the waters, also are found to destroy their fishing the fishing nets causing economic loss to the villagers.

(viii) Lack of direct access of the fishermen to the big fish markets of the city is a reason why their catch fetches them less money than they deserve to get.

(ix) There are many examples of conflict situations arising between the fishermen and the Assam Forest Department, which is a cause of concern for both parties. Sometimes the Forest Department, in the exercise of its routine duties, seizes the boats and fishing gear of some fishermen who are found to be operating inside the Deepor Beel Wildlife Sanctuary. This is one of the several issues that have remained a cause of conflicts between the fisherfolks and the forest department. Although this causes difficulty to the

fishermen, it is a fact that fishing within the waters of the WLS is illegal and therefore cannot be allowed. In January this year (2023), during community fishing (Beel Mara), the Forest Department tried to prevent them from fishing although they were given prior permission to fish during that time.

People's suggestions: During the survey fishing communities have pointed out some suggestions that could help the conservation of fish resources and the wetland ecosystem as well as sustain their livelihoods, such as (i) Dumping grounds at Boragaon and Belor Ali should be shifted away from the beel (ii) The polluted water coming from the inlet streams should be cleaned and treated before allowing to enter the wetland, (iii), The sluice gate should be redesigned and operated in such a way that the incoming fish passage is not obstructed, (iv) Water hyacinth should be removed in regular interval, (v) Restrictions and monetary fine should be imposed on those who release effluent, sewage or deposit solid wastes on the wetland, (vi) The wetland's boundary should be demarcated and protected with immediate effect, (vii)Alternative livelihood support should be provided to the fishing community as a compensation to the loss of their livelihood caused by the ban on fishing in the WLS area, (viii)The state government should get the views of the community before taking any major decision managing the wetland that could affect the livelihood interest soft eh local people, (ix) The fishermen should be provided with financial support for survival during the lean season when fishing is not productive or banned by the Government, so that they can observe the Government rules in this regard.

Photo 7: Some households are doing integrated fish and duck farming in household ponds.

Detailed Analysis- Agriculture as a Livelihood

6. Detailed Analysis-Agriculture as a livelihood

As mentioned earlier in the chapter on overview of livelihoods, agriculture at present has become a minor livelihood of the people with just 195 households, 4.9% of the total number of households involved in this sector for livelihood purposes which includes farming for subsistence as well as earning money. Figure 1 shows the households having agriculture as a livelihood in various HSUs. Out of 19 HSUs, only 11 HSUs have agricultural practices to a significant extent. Out of these 10 are villages and only one is a municipal ward (Khanamukh). However, Khanamukh has both a rural and an urban part it. The other five GMC wards didn't report any major agricultural activity. Figure 2 shows the number of such households as a percentage of the total number of households in respective HSUs.

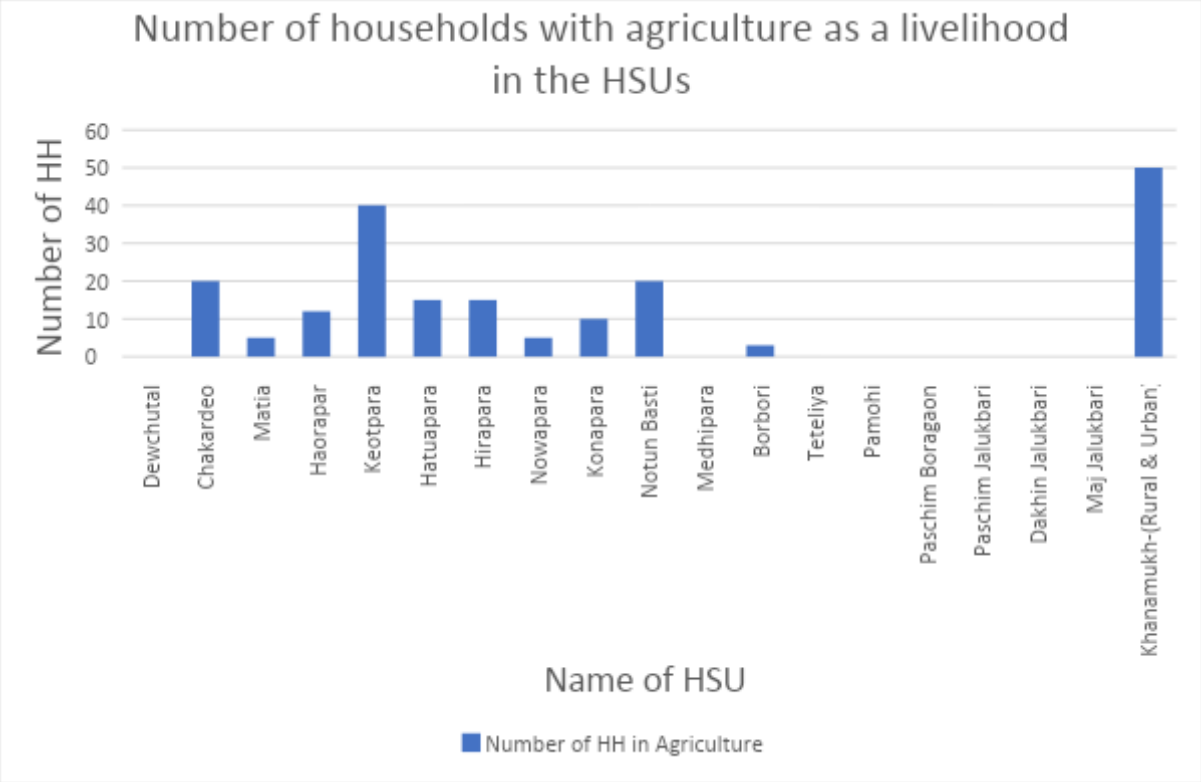


Figure 1: Number of households with agriculture as a livelihood in the HSUs

Figure 3 represents the number of households that do farming on land owned by them versus those who carry out agriculture on land that does not belong to them. In most cases, the second category of farmers using government land adjoining the wetland for farming, which they refer to as 'community land' since the allocation of land plots and other issues of collective farming are managed by the PSS, their only community institution.

About 113 households (58%) cultivate on community land, and the remaining 82 households (42%) household cultivate on their own land. In seven villages viz. Keotpara, Hatuapara, Hirapara, Nowapara, Konapara, Natun Basti, and Borbori the farmers cultivate crops in community land, managed jointly by the PSS and the communities. Chakardeo, Haorapar, and Khanamukh are the villages where most farmers cultivate on their own land. But in the village of Matia, people are engaged in other's land under the '*Adhiya* diya' system which is a form of sharecropping.

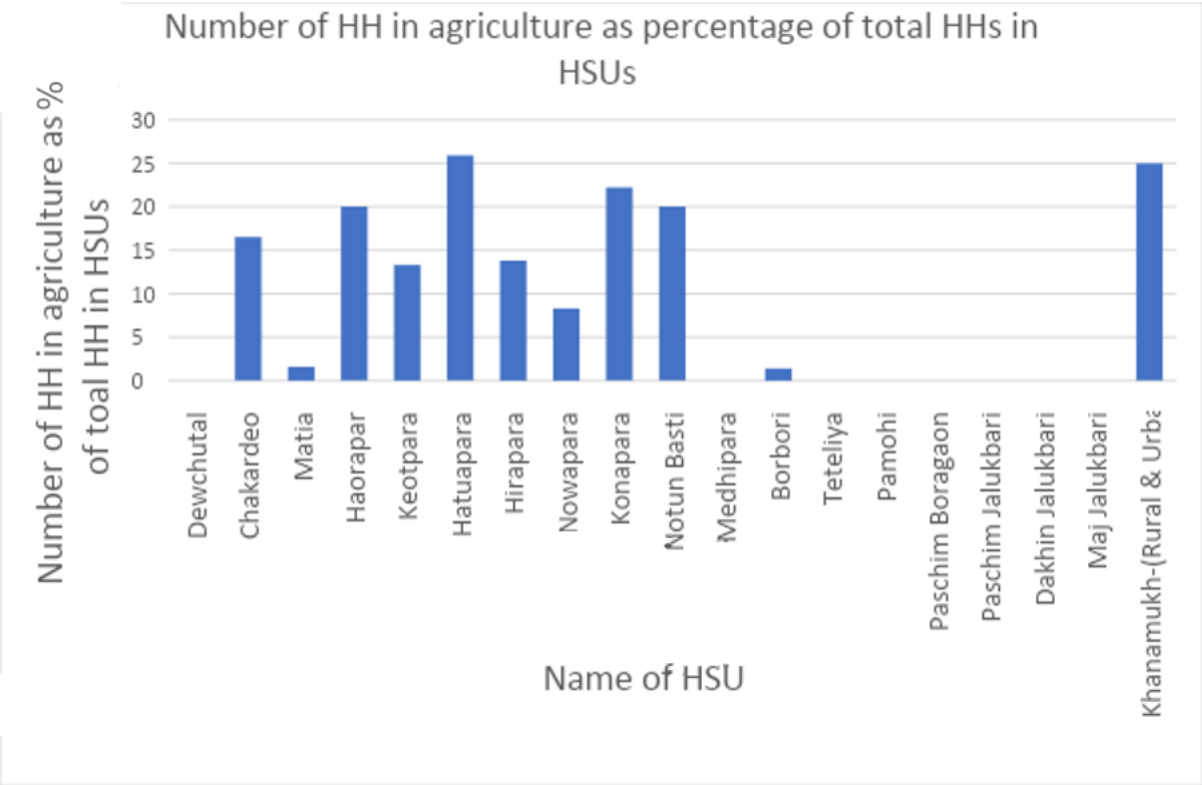


Figure 2: Number of households having the livelihood of agriculture as a percentage of the total number of households in the study area.

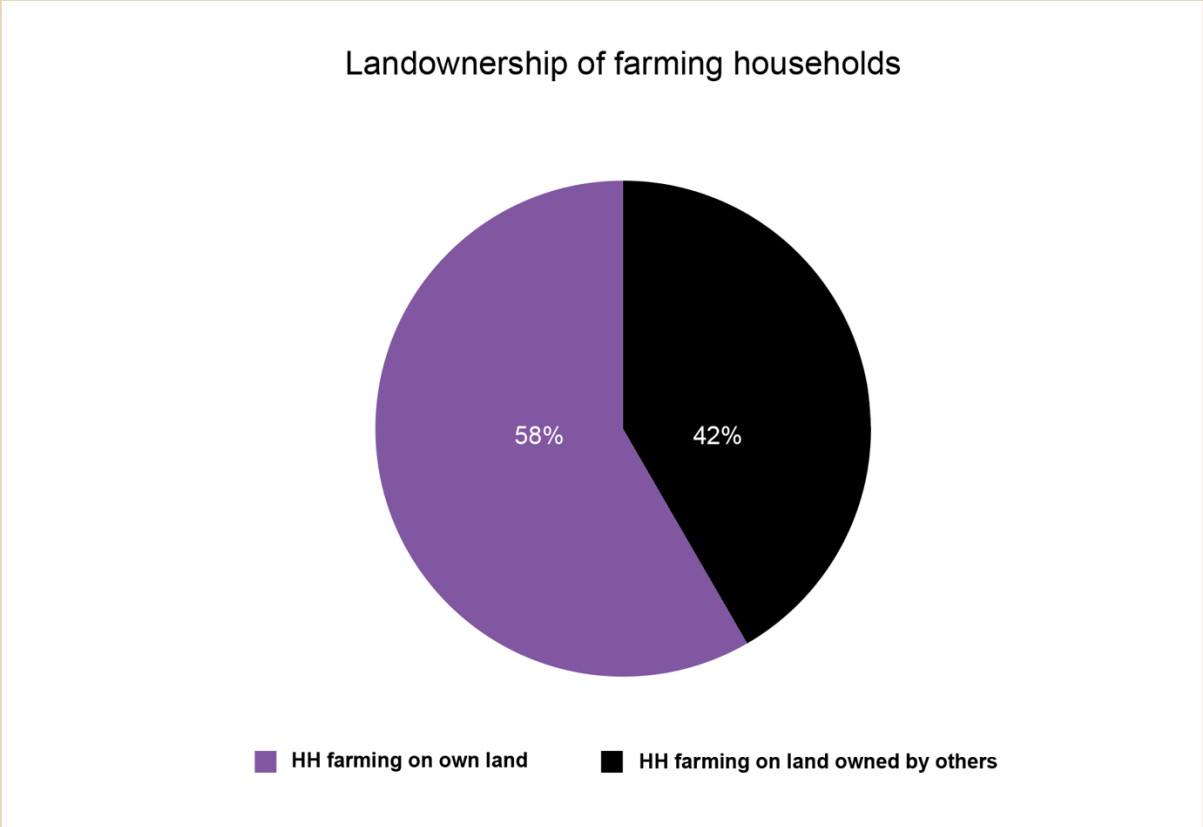


Figure 3: Number of households belonging to the two categories of land ownership.

The village Deochotal has vast areas of agricultural land, but there is a huge quantity of agricultural land but there is hardly anybody interested in doing farming since they no longer find agriculture to be a viable and futuristic vocation. Many of them have sold their land to people who are using the land for non-agricultural activities. This is also a reason for the shrinking agricultural area. Similarly, one could see a large farm plot in the Pamohi village till about a decade back. But many such plots have been rented to be used for industrial activities and several such land plots have been sold out to outsiders. Since people have seen the diminishing returns of agriculture over the years, they consider it better to rent out their land and properties than invest money in agriculture.

Table 1: Major crops cultivated by the agricultural households.

Crop cultivated	Number of HH	% of Total Agri-HH	% of total Agri-HH
Vegetable	156	195	80.0
Paddy	180	195	92.3
Oil seeds	18	195	9.2
Jute	6	195	3.1

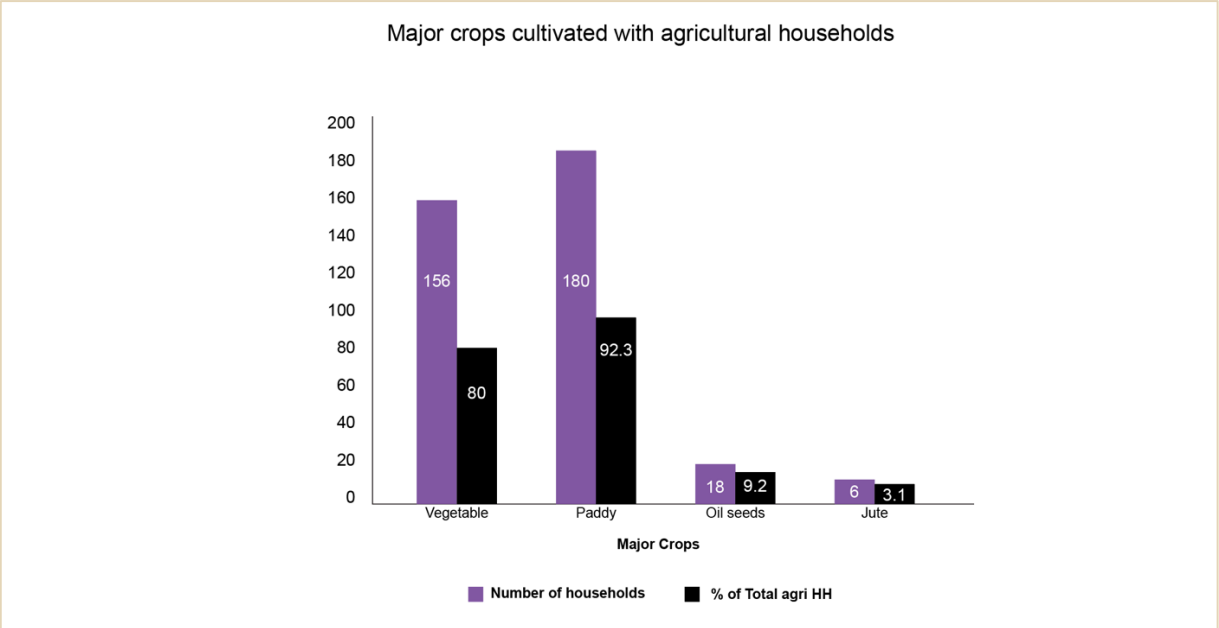


Figure 4: Number of HH producing major crops both as absolute numbers and % of agricultural HH

Paddy, vegetables, oil seeds, and jute are the major crops produced by the farmers, with paddy and vegetables being the products from the highest number of households, 92% and 80% respectively. It is to be noted that most households produce more than one crop. Chakardeodo and Matia are the two villages where most of the paddy is cultivated. Hatuapara's people are growing mainly vegetables, not paddy. The remaining villages

produce both paddy and vegetables together for both personal and commercial uses. Almost all paddy farmers are into the cultivation of the Rabi crops.
While 87 HHs grow crops for their minimal sustenance, some of them sell vegetables in the market if the harvest is good. During certain seasons, the fishing community engages themselves in seasonal agriculture as an additional source of income. not the whole year because agriculture is not their primary source of income. There are about 36 households that are dependent on agriculture as their primary source of income. Since agriculture is not earning them enough, these households should be considered highly vulnerable from the livelihood security perspective.

We found only 18 households producing oil seeds, mainly mustard (Chakardeo, Matia, Haorapar, and Hatuapara), and just 6 households cropping jute (Keotpara, Hirapara, and Borbori). cultivating jute. About 10 to 15 years ago, people in Haorapar also used to plant jute and corn crops, but they no longer do so. A few households in Haorapar were found to be doing integrated farming, Integrated farming, rearing ducks, and fish together.
Box 1 mentions the variety of paddy crops, winter vegetables, and products found in the homestead gardens of the agricultural households in the study area.

Box-2: Crop varieties available in the agricultural households of the study area.

Major paddy types: Sali, Aizong, Joha, Borni, Moinagiri, Aijuni, Badumguri, Bao, Ahu, and Boro

Winter vegetables: Potato, Spinach, Bottle gourd, Cabbage, Cauliflower, Papaya, Betel-nut, Betel leaf, Pumpkin, Sponge gourd, Ridge gourd, Onion, Coriander, Kohlrabi, Cucumber, Lady's finger, Bitter gourd, French bean, Leafy vegetables ((Lai, Lofa, Chuka, Babori, Paleng), Indian bean, Carrot, Radish, Ginger, Chilli, Ash gourd etc.

Product of the homestead gardens: Chilli, Mint, Lemon, Lady's finger, Brinjal, Cabbage, Cauliflower, Potato, Onion, Ginger, Turmeric, Indian bean, Carrot, radish, Coriander, Cucumber, Spinach, Papaya, Betelnut, Betel leaf, Pumpkin, Bottle gourd, Tomato, Ridged gourd, Sponge gourd, Bitter gourd, Spiny gourd, Ash gourd, Bean, and different types of leafy greens(Lai, Lofa, Chuka, Babori, Paleng), Banana, Mango, Coconut, jackfruit, Guava, etc.

People like having a kitchen garden in their home because it benefits the home environment, and provides them with fresh food, clean air, and a habitat for wildlife. The products of the homestead garden can help them earn some money, if needed. The plants, crops and vegetables are grown in the front yard or backyard of the home or both using organic manure and kitchen garbage. Every household has access to and cares for a home kitchen garden in each of the 19 HSUs including the urban villages but most of them use the resources for subsistence only.

Usually, pesticides are avoided in homestead gardens or kitchen gardens, where only organic manures like vermicompost and cow dung are used to produce various vegetables and food crops. Some of them use chemical manure in commercial crops for better and higher production. Organic fertilizers and pesticides being more expensive also make some of them resort to chemicals. But they are aware that chemical fertilizers and pesticides are harmful to people's health as well as plants and water bodies.

The problems and constraints faced by people doing in agriculture and related to trade and business: Figure 5 pictorially represents the problems and constraints faced by the communities in pursuing agriculture as a livelihood. These are the main factors responsible for the dwindling interest of the communities in agriculture and explain why agriculture has now become a minor livelihood for the people of the Deepor Beel area.

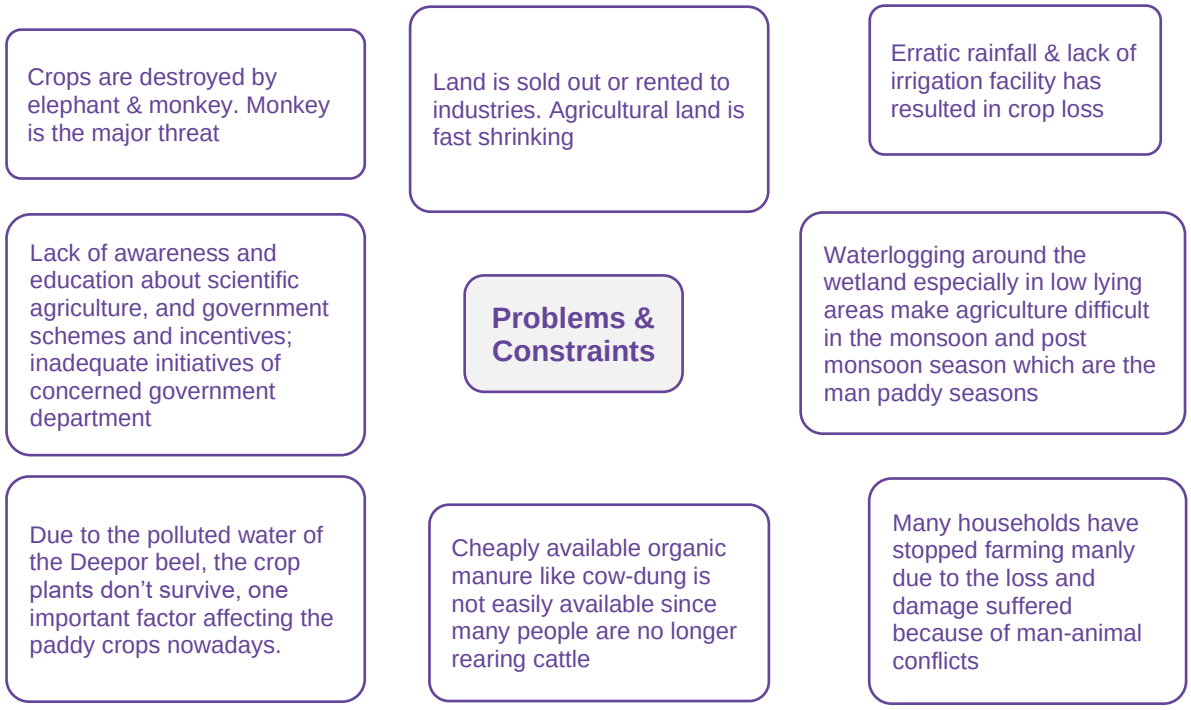


Figure 5: A flow diagram informing about the problems and constraints affecting their pursuit of agriculture as a livelihood.

Villagers' suggestions about the agriculture-related problems

- The habitats and movement corridors of the wild animals, mainly elephants and monkeys, should be restored, so that the animals do not have to wander in search of food in the human-occupied land leading to conflicts situations as a result of which both human beings and the wild animals are adversely affected. This necessitates stopping deforestation, earth cutting and indiscriminate quarrying in the adjoining hills and protection of the corridors which will also ensure the good ecological health of the Deepor Beel.
- The water of the wetland must be depolluted and cleaned. The area surrounding the wetland must be kept in a hygienic condition.
- The drainage system through which the wetland gets and sends out water through the inlet streams and the Khanajan connecting the beel to the Brahmaputra needs to be revived, redesigned, and improved so that there is no prolonged water logging and flooding around the beel in the adjoining human habitats which is a prime reason behind the failure of agriculture in these areas.
- Generate awareness regarding scientific ways of agriculture, including horticulture, needs to be enhanced followed by capacity building of the farmers with the young

generation being given special incentives to reinstate the importance of agriculture as a major source of livelihood and food security for the people of the area.

Photo 1: Although agriculture is fast losing its importance as a major income source, some households are still farming various paddy types for their own consumption as well as for business.

Photo 2: Sight of a common homestead garden of an indigenous family in the study area

Detailed analysis- Livestock Rearing and Animal Husbandry as a Livelihood.

7. Detailed analysis- Livestock Rearing and Animal Husbandry as a livelihood.

Livestock are domesticated terrestrial animals that are raised to provide a diverse array of goods and services such as traction, meat, milk, eggs, hides, fibres, and feathers. Animal husbandry is the branch of agriculture where animals(livestock) are reared, bred, and raised for meat, fibre, eggs, milk, and other food products.

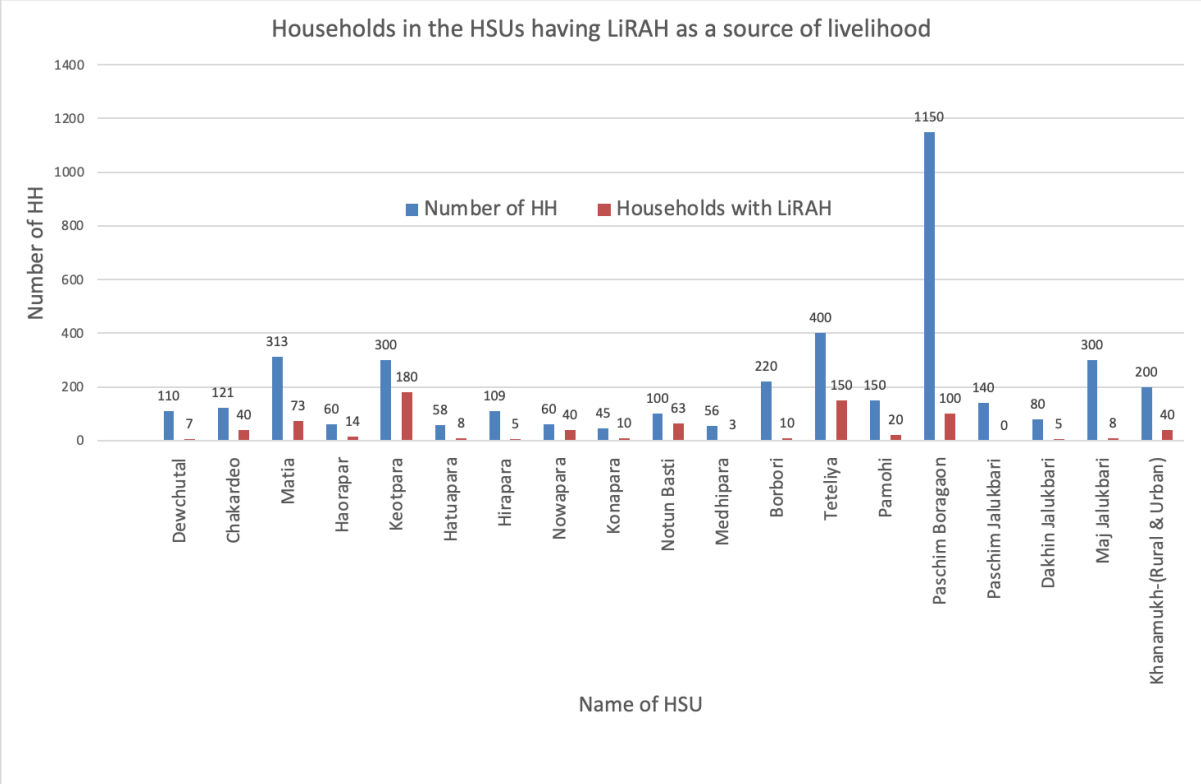


Figure 1: Distribution of households having LiRAH as a livelihood in the HSUs compared to the total number of HHs of the HSUs in the study area.

Livestock Rearing and Animal Husbandry (LiRAH) is an important and major source of livelihood for the people of the study area around the Deepor beel. About 776 households, accounting for 19.5% of the total HHs are involved with this sector as a major livelihood. There are about 1220 other households that domesticate animals and practice PIRAH, but mainly for their own consumption. Many households have more than one livestock asset.

Figure 1 shows the HSU-wise distribution of households having LiRAH as a livelihood, pitted against the total number of HH in each of the HSUs. In terms of the absolute number of households, Keotpara (180), Tetelia (150) and Pachim Boragaon (100) have the highest numbers of LiRAH households. Figure 2 shows the number of the same households as a percentage of the total number of households in the respective HSUs. Nowapara (67%), Natun Basti (63%), and Keotpara (60%) have the largest percentage of households having Liar compared to the total number of households in these villages.

Table 1 shows the number of households engaged with the rearing of various livestock assets(animals). Figure 3 represents the same situation pictorially. Figure 4 presents the households having various livestock types as % of total HH with LiRAH. It is seen that in terms of the number of HHs, poultry dominates the livestock scene with 1086 HJHs associated with it, followed by cow (789 HH) and goat (615 HH). The cow is the most common asset (41.9%) followed by Poultry (30.4%), Goat (23.7%), Pig (3.7%) and Buffalo (0.3%).

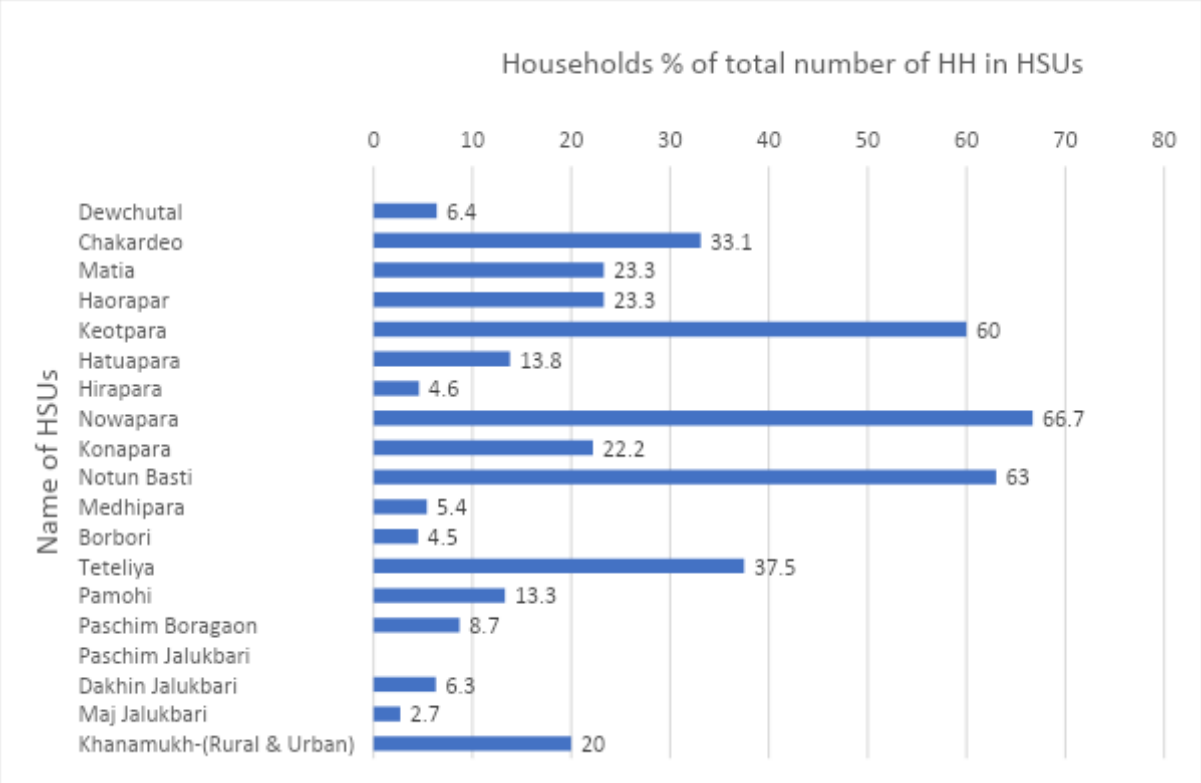


Figure 2: Households with LiRAH as % of the total number of HH in HSUs

Table 1: Number of households engaged with the rearing of various livestock assets(animals)

Livestock	Cow	Goat	Buffalo	Pigs	Poultry	Total
No of HH	789	615	7	95	1086	2592
% of number of LiRAH HH	30.4	23.7	0.3	3.7	41.9	100

The underlying motivations for engaging in livestock rearing primarily revolve around subsistence, primarily driven by the deep-seated cultural significance it holds, as well as the indispensable role it plays in providing manure for homestead agriculture. While it is not uncommon for households to occasionally vend surplus milk, often during festive or celebratory occasions, it is noteworthy that this transaction is typically not regarded as a commercial venture. Instead, it remains entrenched in the fabric of tradition and community life, reaffirming the intrinsic value of these livestock practices beyond mere economic considerations.

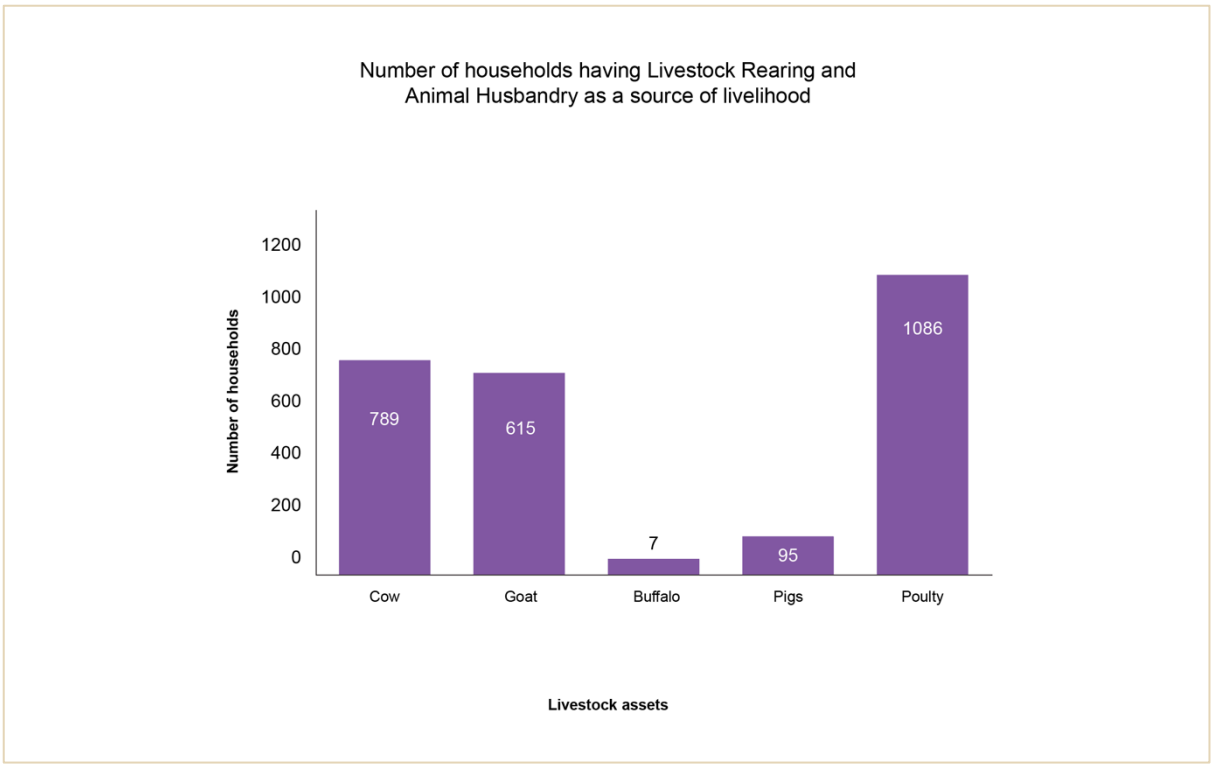


Figure 3: Number of households having Livestock Rearing and Animal Husbandry as a source of livelihood

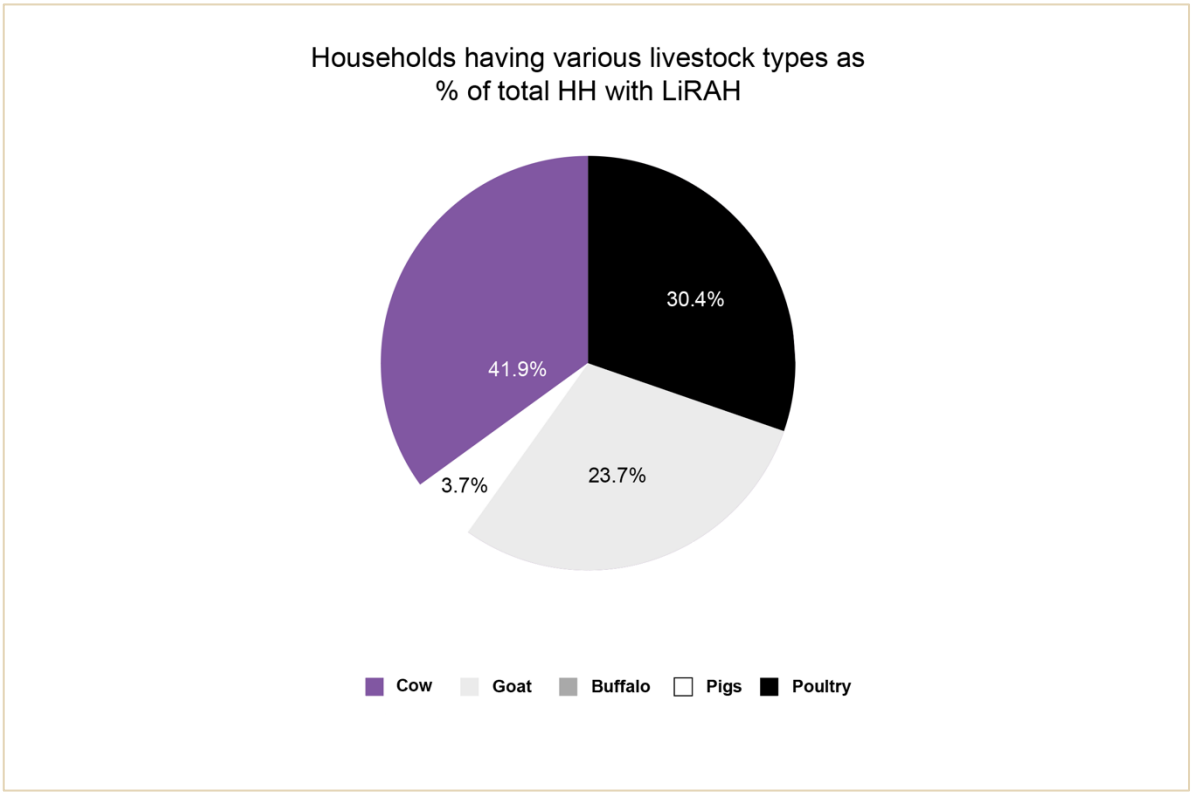


Figure 4: Households having various livestock types as tt% of total HH with LiRAH

Table 2: shows the number of HHs that are engaged in livestock rearing for subsistence (to fulfil their own needs) and income generation.

Number of HH pursuing LIRAH for subsistence	Number of HH pursuing LIRAH for income	Total Number LIRA HH
1220	776	2592

The vast majority, nearly 96%, of the entire livestock population comprises poultry, cows, and goats. Among these, poultry, goats, and piggery are predominantly managed for commercial endeavours, serving as vital sources of supplementary income for the households. This domain of livestock husbandry is primarily entrusted to the care of women within the household or individuals who do not hold the role of primary breadwinners.

Usually, neither the residents nor their livestock utilize water from the beel for any purpose, since they are highly aware of the probable consequences of using the contaminated and highly silted water of the beel for both drinking and other activities like bathing, washing utensils or even irrigation. It is only accidentally that some domestic animals sometimes consume the water of the wetland and become ill and even succumb to death.

Concerns of the community

Vulnerability to diseases

(i). Across the northern bank spanning localities like Haorapara, Keotpara, Hatuapara, Hirapara, Nowapara, Konapara, Natun Basti, Khanamukh, and Borbori, the well-being of livestock is compromised by various diseases arising from the contamination of beel's water and an unhygienic environment. Cows, in particular, exhibit heightened vulnerability to ailments such as lumps and briskets on the side of the neck, compounded by the persisting issue of theft in these areas. The cows, goats and buffalos are seen to consume polythene material along with the fodder in some areas during grazing, which inflicts various ailments on the animals.

(ii). Participants engaged in piggery emphasize the precarious state of pig rearing, beset by challenges stemming from disease outbreaks such as the swine flu, for example in Matia. Their reflections underscore the fragility of this livelihood, subject to an array of unpredictable factors.

Lack of grazing land and fodder

(i). Being part of a rapidly urbanizing landscape, the study area has an acute dearth of open spaces suitable for livestock grazing, resulting in a stark reduction in the local populace's dependence on livestock for sustenance as well as income generation. Many of these animals are relegated to graze near the beel, where they inadvertently partake of its polluted waters, with fatal consequences. This concern is deep in the people in two settlements, Medhipara and Khanamukh, due to the lack of open spaces and grazing areas for their livestock.

(ii). Further to the west, residents of Khanamukh and Tetelia voice their grievances regarding the scarcity of fodder during the rainy season, primarily attributable to flooding. This

scarcity necessitates the acquisition of fodder from the market, constituting an economically unsustainable practice.

(ii). Since ponds or other smaller water bodies are not available in nearby areas, many villagers are not able to venture into duckery, although they are keenly interested in rearing ducks.

Photo 1: A typical cattle shed in a household.

Livestock death in accidents

(i). The pastoral tradition faces a shared existential threat emanating from the pervasive presence of roadways and railways in the region, which has given rise to frequent accidents. The perils of such mishaps are regularly experienced by localities like Deochotal, Chakardeo, Pamohi, and Matia, which find themselves situated proximate to both a core tourist zone and railway tracks, rendering such incidents virtually inescapable.

(ii). The worst affected community from physical insecurity to livestock hails from Paschim Boragaon, as the absence of grazing spaces leaves their cows in vulnerable positions, often leading to unfortunate fatalities on the National Highway due to high-speed vehicular traffic.

(iii). The inhabitants of the eastern and southern ban villagers have unequivocally attributed the exacerbation of accidents to the introduction of the Guwahati-Goalpara railway track as well as the new road connecting the Gorchuk to Azara used by many to commute between the city and the Guwahati Airport. As the roadway connectivity expanded to accommodate travel to the Azara airport and railway station, the volume of traffic has increased several times.

Livestock lifting

(i). Moreover, the endemic predicament of livestock theft looms large in villages like Matia, with instances of daylight cattle-lifting reported, affecting both animals on the roadways and those at pasture.

Effect of garbage dumping and water pollution

(i). The presence of the municipal dumping grounds, first at Surabhi Nagar in Boragaon and then at Belortol (Belor Ali) in Pachim Boragaon has remained a perennial source of death and disease for the livestock in the area. Before their establishment, animals could freely access the beel for hydration. But now not only the cattle have lost access to the water of the wetland in some places, but the animals are drinking the beel and other nearby water sources which are highly contaminated because of the incoming polluted flow from the city to the beel as well as the local impairment of the water quality caused by the garbage. Fatalities to the domestic animals following ingestion of the defiled water of the wetland are very commonplace nowadays.

The unfortunate reality of the cows subsisting on garbage, including indigestible plastics and polyethene from the dumping ground, further compounds the crisis, not only claiming their lives but also diminishing the quality of their milk production. Consequently, potential consumers eschew the purchase of milk from these cattle owners, viewing it as tainted by association with decaying refuse and plastic contaminants.

These arrays of difficulties reverberate across communities, extending to Paschim Jalukbari, Dakshin Jalukbari, and Maj Jalukbari, where the dumping ground's presence disrupts access to the beel for livestock, depriving the livestock of safe drinking water.

Impact of Environmental Change

(i). Climate change is causing and likely to bring in changes in the ecohydrological nature of the wetland and its natural environment such as flora, fauna, biodiversity, forests, water, and land. Anthropogenically induced hasty alterations in the local land use are also

affecting natural resources including fodder, grazing land, water sources and habitat the of the livestock.

Suggestions from the community

(i). The people, in general, consider livestock rearing and animal husbandry as an important source of livelihood, both for subsistence and for boosting family income. Many households that have opted for other major vocations are seen to indulge in livestock husbandry as an additional source of earnings.

The residents of Matia, Keotpara, Hatuapara, Hirapara, Nowapara, Konapara, Natun Basti, Khanamukh, and Borbori advocate for the amelioration of animal healthcare infrastructure. They call for timely government-provided animal vaccinations to maintain the health and well-being of their livestock, recognizing that a well-executed veterinary health program is crucial to their sustenance.

(ii). The community as a whole wants provision of open spaces earmarked for grazing of the domestic animals in sole locations having naturally available fodder like various types of grasses as well as cattle sheds for sheltering and protecting the livestock. Especially villagers in Khanamukh, Tetelia, and Medhipara lament the scarcity of open spaces and strongly recommend the creation of such areas within their purview.

(iii). A sizeable number of the population underscored the primacy of scientific animal husbandry and their interest in enhancing their awareness and getting trained in the basics of veterinary care to improve the health and productivity of their livestock. Sustainable livestock-rearing practices should be promoted, balancing economic gains, ecological conservation, and animal welfare.

(iv) The younger generation would like to get financial support for entrepreneurial ventures and businesses in dairy, piggery, goat farming, poultry, and egg production. Considering the involvement of the womenfolk with livestock rearing empowering women in livestock management should be taken as a priority in livelihood schemes for this area.

(v). Scientific assessment of the impact of anthropogenic environmental change (local land use and landcover), climate change, and infrastructure development (e.g., road, railway, real estate, urbanization) should be done on existing livelihood sources, mainly the farm-based vocations such as livestock rearing, agriculture, fishing etc. Governments should also be careful in decision and policymaking so that livelihoods like animal husbandry are not adversely affected.

(vi). The community's opinion in general emphasizes an imperative need for the judicious management of both railway and roadway networks to mitigate the escalating accident rates resulting in increasing death and damage to livestock. The installation of speed breakers and other measures for road safety is emphasized as an essential measure to ensure the smooth functioning of transportation systems in this precarious landscape.

(vii). The community fully understands that cleaning the water of the Deepor Beel and removing its pollution is fundamentally important for the security of their livestock as well

as their concerned livelihoods. Equally important is the removal of the municipal solid waste deposits from the old dumping site in West Boragaon as well as the garbage site at East Boragaon. This is a must for achieving the integrated management of conservation, livelihood improvement, and sustainable development of the wetland and its communities.

(vii). The need of the hour is the sustainable coexistence of traditional livestock practices with evolving economic dynamics while preserving the hydro-ecological realm of the wetland and the cultural significance of these activities. This entails fostering both subsistence and income generation, enhancing livelihoods, and reducing vulnerability to unforeseen challenges including climate change, thereby ensuring the continued well-being of the local communities.

Photo 2: Lack of grazing land is a major constraint for the people who are rearing livestock for a livelihood.

Detailed analysis- Other Livelihoods

Weaving as a Livelihood

8. Detailed analysis- Other Livelihoods Weaving as a livelihood

Weaving is a major source of income for the community, mainly for its women. About 818 HHs, accounting for about 20.6% of the total HHs making it the second largest occupation for the people. Weavers are found in every HSU. Women in the greater Assamese society a generally well skilled in weaving on conventional handlooms (Photo 1). So are the woman-folk in the Deepor Beel area where quite a few indigenous communities live. The most common handloom products are Gamosa, Mekhela, Chador, Rumal, etc.

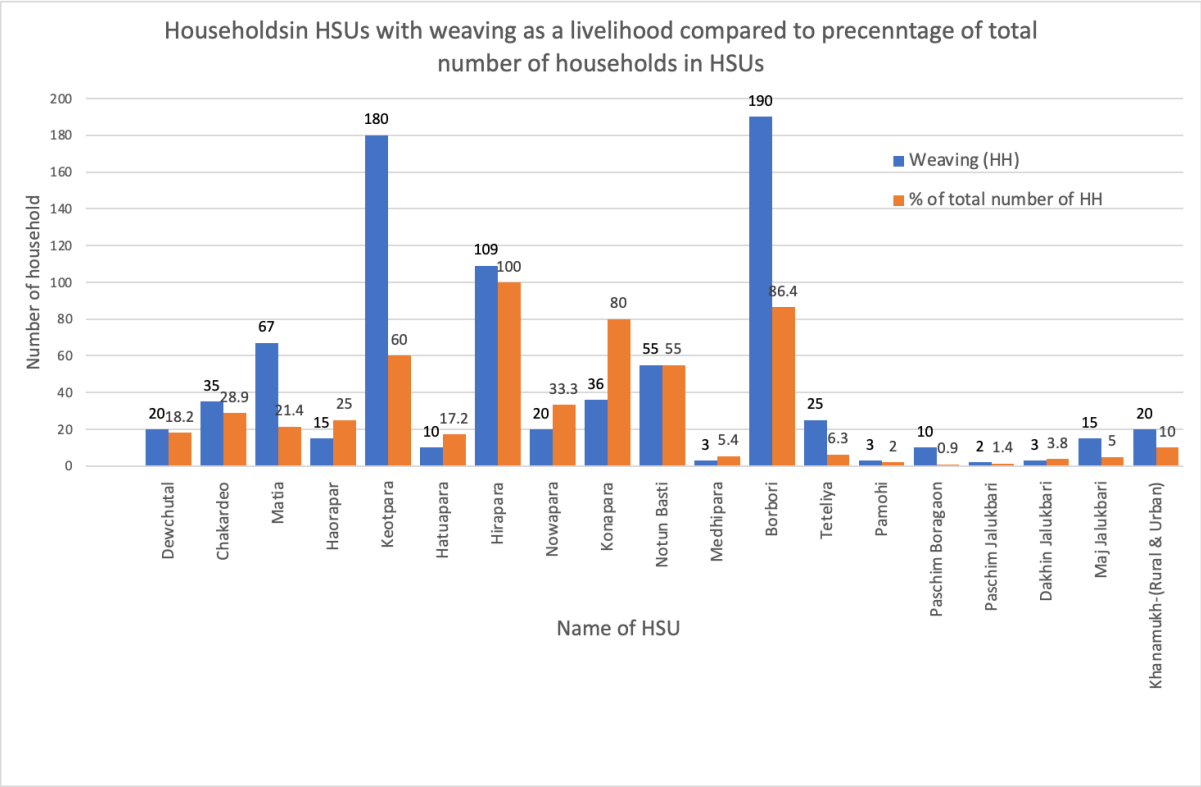


Figure 1: Number of households with weaving as a major livelihood compared to the total number of HHs in the HSUs

Figure 1 shows the number of HHs that are earning money through weaving against the percentage of the total number of HHs in the HSUs. Borbori has the highest number of HHs (190) followed by Keotpara (180) and Hirapara (109). Whereas In Hirapara, all the households (100%) are involved in weaving with Borbori (86.4%) and Keotpara (80%) following suit. It is notable that the fishing community villages are well into weaving for additional earning.

Most of the women weavers earn money through their association with the self-help groups (SHG). Some of the women sell woven products occasionally on demand. Others sell their products during festivals such as Bihu. As fishing or agriculture or daily wage does not provide sufficient income at times weaving acts as a saviour for the households and the role of women get prominence in the upkeep of family economy. It has also helped women as well girls to become independent.

Photo 1: A traditional waving loom locally called 'Tant Shal' is a common feature in every indigenous Assamese household.

However, the main constraint that has stunted the growth of this sector is the lack of a vibrant market of the handloom products in the area on one hand and the limited access of the weaving community to the large markets in the city. The clarion call from the waver sisterhood is that the government should come forward to support them, provide them loan and other incentives, and help their products get a market.

It is worthy of mention that some women in Natun Basti are making woven products from water hyacinth through an intervention of an NGO (Simang Collective) which has received financial and technological support from the North East Centre for Technology Application and Reach (NECTAR), an autonomous body under the Department of Science and Technology, Government of India[25] (Photo 2). About 55% of the households in this village are already engaged in conventional waving practices (Figure 1).

[25]https://pib.gov.in/PressReleasePage.aspx?PRID=1715872

Photo 2: The lady weavers at work in Natun Basti (also known as Natun Gaon) using the yarn derived from water hyacinth (Archive photo of Aaranyak, June 2021)

Photo 3: Yoga mat known as Moorhen Yoga Mat are produced from water hyacinth under the NECTAR -SIMAN Project in Natun Basti, Deepor beel (Archive photo of Aaranyak, June 2021).

Private jobs and government jobs as livelihoods:

As found in the survey, the area has seen an upcharge in employment of the local youth in the last one decade. About 2166 people comprising about 11.2% of the total population of the study area are engaged in sundry private jobs at present, which is much higher than the number of people (1217, 6.3%) associated with government services.

As presented in Figure 2, the larger number of private job holders, about 600, hail from the Pachim Boragaon village followed by Pachim Jalukbari (280) and Tetelia (220). In terms of percentage of HSU population, Dakhin Jalukbari (45%), Pachim Jalukbari (40%) and Chakardeo (18%) has the maximum proportion of population in private services. The 'rurban' areas that can also be called urban villages, have comparatively more people into private jobs than the rural areas. People from the fishing community also are earning from private jobs which provide them working both part time and full time. This helps them sustain in the lean fishing months.

Figure 3 shows the distribution of number of persons across the HSUs who are having government jobs set against the same as % of total population of the HSUs. About 1217 persons, consisting of 6.3% of the total population are serving with the government organisations. Pachim Jalukbari (230), Maj Jalukbari (200) and Pachim Boragaon (160) are the HSUs that have the largest government servants respective. Pachim Jalukbari (32.9%), Dakhin Jalukbari (30%) and Maj Jalukbari (13.3%) are the HSUs that have the largest percentage of their population in government services. The fishing community villages also have a section of people in government employment. Number of people working in government agencies is less in Hatuwapara, Nowpara, Natunbasti, Borbori, Medhipara, Chakardeo, and Deochotal than in the nearby villages of Keotpara, Tetelia, Pachim Jalukbari, Maj Jalukbari, and Pachim Boragaon. The urban villages located in the eastern side of the beel have more population working in government services.

It is the younger generation of the area who have been attracted more to the private sector and the government services. It has been found that the urban villages under the GMC have more people in jobs and services, both private and public, than the rural villages under the Panchayats. work in the government or the private sector. this quite expected since the number of educated people is more in the urban villages than in the others. Along with the menfolk, women are also finding employment in both private and government sectors.

.

Daily wage earning as a livelihood:

Figure 4 is a representation of the pattern in daily wage earning by the people in the HSUs compared to the percentage of the respective population of the HSUs. The HSUs where the largest number of daily wage labourers are concentrated are Pachim Boragaon (500), Matia (160) and Tetelia (140), whereas the HSUs where the highest percentage of the population is involved in daily work are Deochotal (18%), Pachim Boragaon (10%) and Pachim Jalukbari (10%). Interestingly, the people of the fishing community are much less involved in daily wage income compared to their participation in other vocations such as weaving, private jobs and government service.

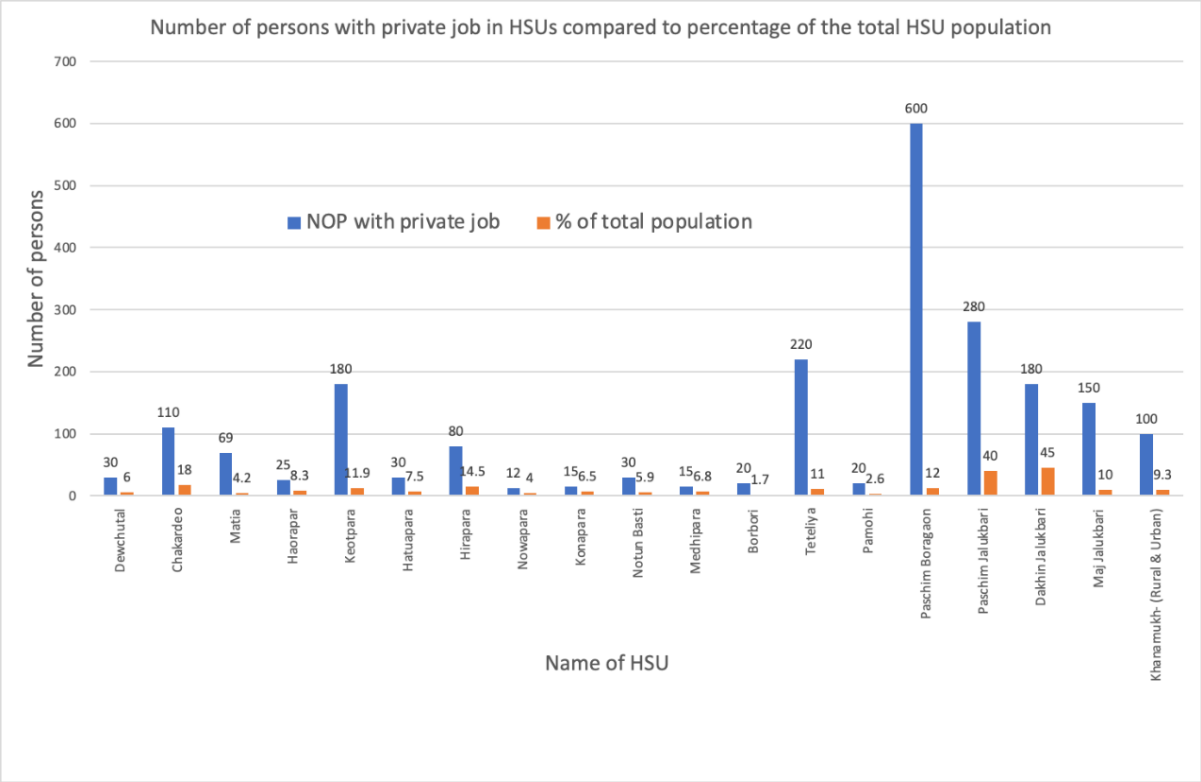


Figure 2: Number of persons earning from private jobs compared to the populations in the HSUs.

.

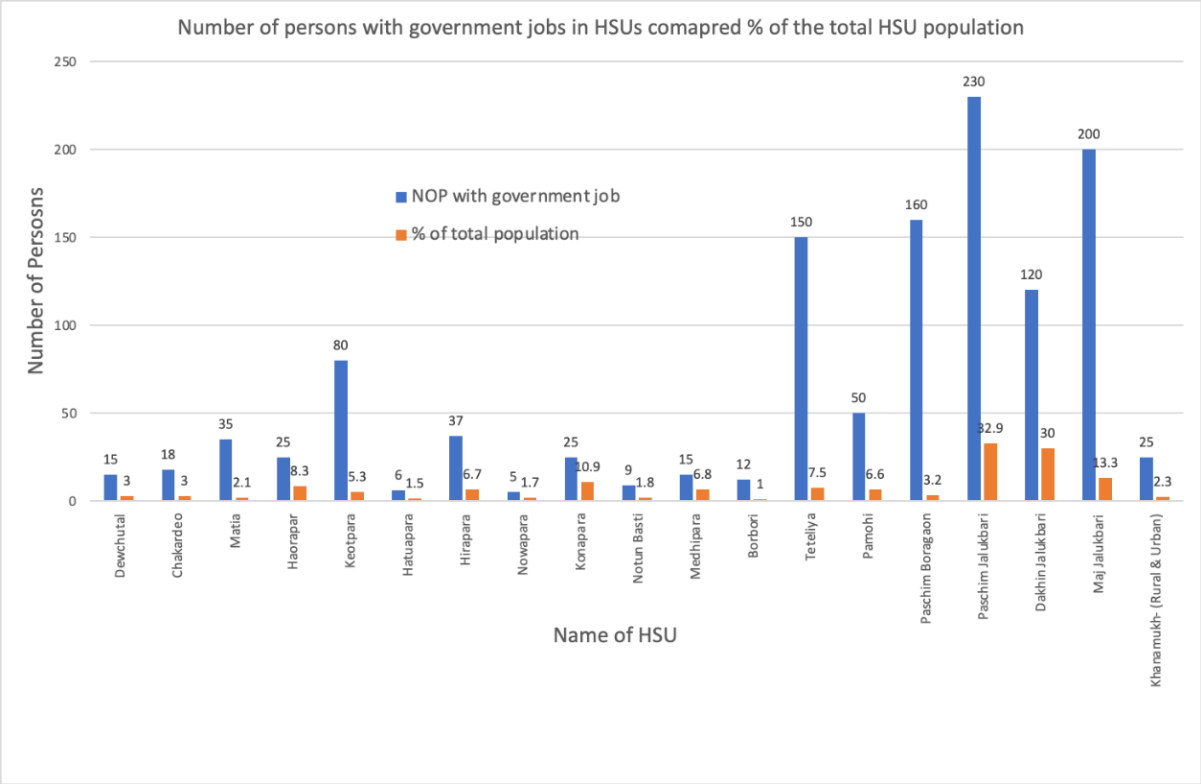


Figure 3: Number of persons having government jobs in the HSUs compared to the % of the population in the HSUs.

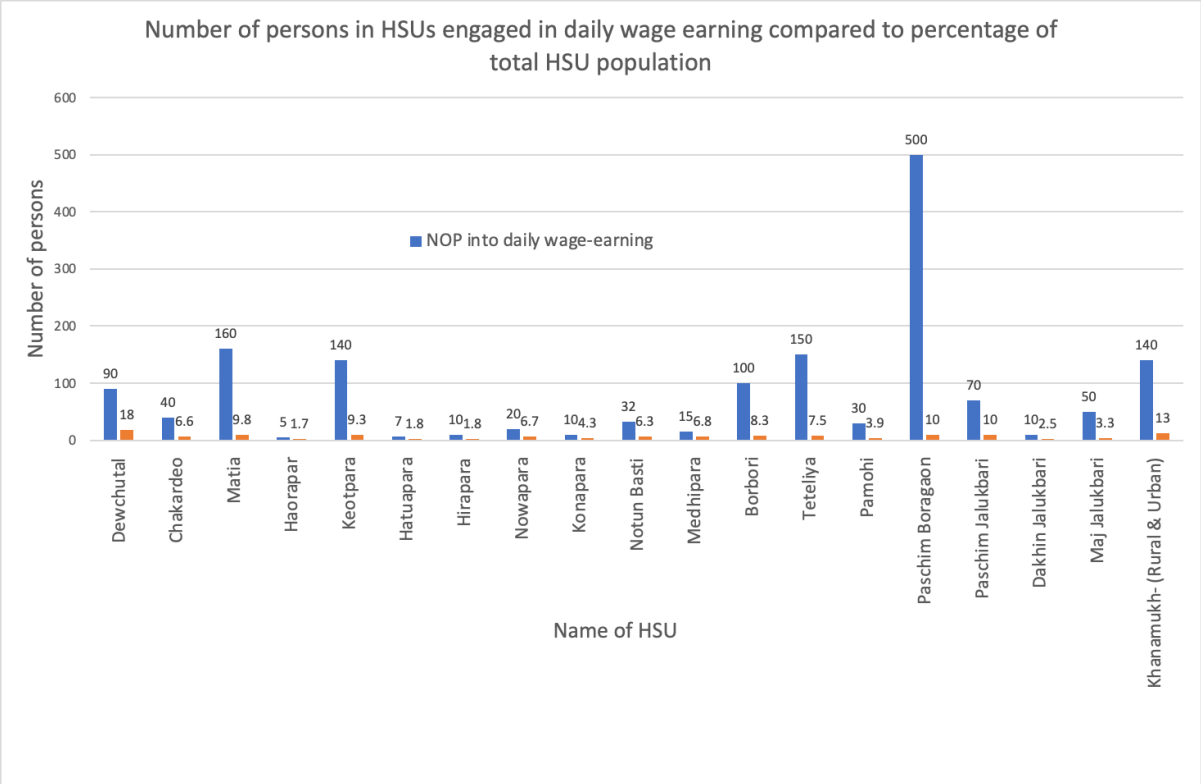


Figure 4: Number of persons earning from daily work as % of the population of the HSUs

As a means of income generating work, the daily wage earners are that it does not need high skills and training. The kind of work that they commonly find is that of physical labourers in construction, factories, carriage of goods and materials, quarrying, earth cutting, etc. Although such work gets them cash money every day, they don't earn on days when they do not work, or they don't find work. This domain of wage income is full of uncertainty as the availability of work depends on many factors like social, political, and economic situations. Besides, physical and health conditions also determine the possibility of getting work. Therefore, the daily wage earners suffer from lack of s steady income.

Working as a wage labourer is surely not the first choice of the people. A daily wage earner's family, in general, lies at the bottom of the socioeconomic class, often belonging to the BPL category. The wage earners are among the most vulnerable section lacking a sustainable livelihood. They are the people for whom rehabilitation is needed with alternative livelihoods that are suitable for their skill and capacity and at the same time more secure and durable.

Small businesses and enterprises as a livelihood:

The residents near Deepor Beel, Assam, have increasingly embraced the practice of establishing their own businesses as an alternative livelihood option. This shift indicates a growing entrepreneurial spirit within the community, driven by the need for stable income sources and the aspiration for financial independence. About 602 households forming about 15.2% of the total households of the study area have found a niche in small to medium entrepreneurial and commercial activities.

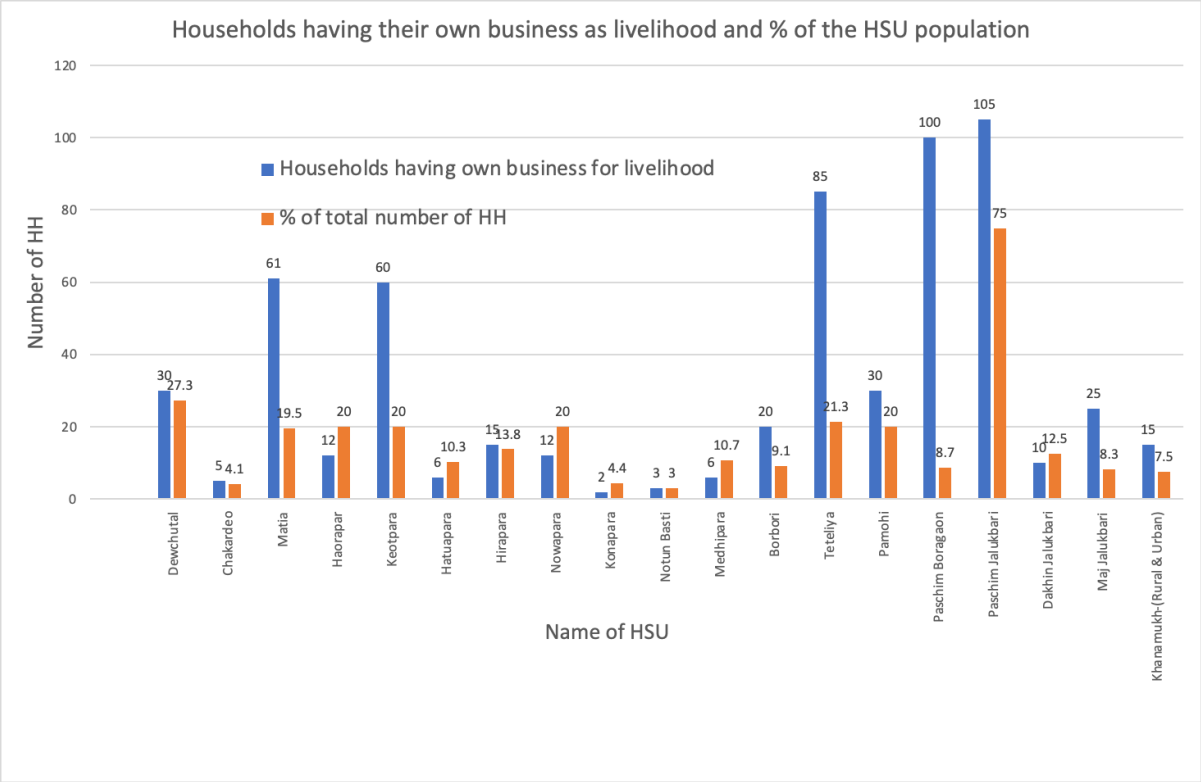


Figure 5: Households having own business as a livelihood and as % of total HSU population.

A significant number of households in the villages near Deepor Beel have actively pursued their own business ventures. The highest numbers of households who are doing one or more businesses on their own are found in Pachim Jalukbari (105), Pachim Boragaon (100) and Tetelia (85). The HSUs where the highest percentages of the number of households are involved in businesses are Pachim Jalukbari (75%), Deochotal (27.3%), and Tetelia (21.3%). Several fishing community villages have households that are also into business. As expected, the urban villages on the eastern and northern margins of the wetland are seen to have more dependence on business than the other HSUs.

The range of entrepreneurial endeavours includes vendors, godowns, machinery, restaurants, industries like tiles, marbles, cement, etc., small-scale shops like groceries, clothing, e-marketing ventures, and home-based enterprises such as soap-making, pickle-making, and incense stick production. Women, in particular, have actively participated in businesses such as weaving, mushroom cultivation, and the preparation of local delicacies, showcasing a blend of traditional knowledge and entrepreneurial skills.

The prevalence of own businesses in these settlements reflects the growing economic diversification and a shift towards self-sufficiency. The propensity for entrepreneurial ventures and small businesses is the right step to shift from climate-vulnerable farm-based sectors like fishing, agriculture, and livestock-animal husbandry to climate-resilient livelihoods. This trend is indicative of a desire for autonomy and stability in income generation. The concentration of business activities in certain villages suggests the presence of conducive factors such as relatively better market accessibility, community support, and a favourable entrepreneurial ecosystem. Additionally, the active involvement of women highlights the evolving socio-

economic dynamics and the increasing role of women in community development and empowerment.

While engagement in own businesses presents promising prospects, it also poses challenges, including limited access to finance, market competitiveness, and infrastructural constraints. Efforts to address these challenges should focus on providing financial literacy and access to micro-financing options, fostering entrepreneurial training programs, and developing infrastructure to support the growth of small-scale businesses. Additionally, creating platforms for market linkages and digital outreach can further amplify the growth potential of these ventures.

The growing prevalence of own businesses near Deepor Beel signifies a positive trend toward economic resilience and self-reliance within these communities. To further promote this trajectory, it is crucial to implement targeted interventions such as skill enhancement programs, networking opportunities, and the establishment of business development centres. Encouraging collaboration between local authorities, non-governmental organizations, and private sector entities can foster an environment conducive to the sustainable growth of these businesses. Additionally, the formulation of policies that facilitate access to resources and promote entrepreneurial culture will be instrumental in nurturing and sustaining the entrepreneurial spirit, leading to long-term economic development and community prosperity in the vicinity of Deepor Beel.

The nature of private and government jobs and the type of business where the local people have engaged themselves are mentioned in Table 1.

Table 1: Nature of private and government jobs/employment and own business done by the people in the study area.

GOVERNMENT JOB	PRIVATE JOB	OWN BUSINESS
Teacher	Security guard	Restaurant, handloom, and handicraft outlet, vendoring of consumer products
Office Assistant at circle office	Sales/ marketing	Grocery shop, Stationary shop
Clerk	Jobs in product dealer	Fishing, Clothing.
Operator	Airport customer service agent	E-marketing ventures, industries like tiles, marbles, cement.
Banking sector	Jobs in company	Home-based enterprises- soap-making, pickle-making, and incense stick production.
Managerial job	Cleaner, mechanic	Weaving, mushroom cultivation.
Officer at Handloom department	Hotel management	Godowns, Machinery.

Alternative Livelihoods: A Need Assessment

9. Alternative livelihoods: A need assessment

Introduction

Alternative Livelihood (AL)s often encapsulates various broad categories and approaches including pursuing multiple, diversified income streams; 2) moving from harmful and unsustainable activities to socio-ecologically benign sources of income and replacing agriculture-based income with other sources. Alternative livelihoods typically include both off-farm and non-farm streams of income. Rather than full dependence on one source of income, alternative livelihoods enable households and communities to have economic options, ultimately ensuring they are more resilient when shocks and stresses occur (adapted from Noronha, 2019)[26].

Alternative livelihoods often also imply mixed livelihoods with earnings from agricultural work being the primary but not sole source of income. Particularly for young people in agriculture-based economies, mixed livelihoods are comprised of four categories of income: agriculture, entrepreneurship and self-employment, wage employment, and social activities (Williams and Pompa, 2017)[27].

From a nature conservation point of view, Alternative Livelihoods can be defined as propositions leading to interventions in the form of Alternative Livelihood Projects (ALP) that aim 'to reduce the prevalence of activities deemed to be environmentally damaging by substituting them with lower impact livelihood activities that provide at least equivalent benefits' (adapted from Wright et al., 2015). The purpose of identifying and providing ALs is to reduce reliance on natural resources, generate economic benefits, and increase local support for conservation. These projects are designed to reduce the prevalence of behaviours that are considered environmentally damaging and unsustainable. ALs are expected to substitute, or lower impact, livelihood activities (Wright et al., 2015)[28].

IUCN, having assessed a number of Alternative Livelihood Projects (ALP) worldwide, passed a resolution in the World Conservation Congress in 2012 calling for a critical review of ALPs and the development of best practice guidelines to ensure sustainable benefits to species, ecosystems, and people (IUCN 2012)[29]. Such reviews identified some weaknesses in the concept and implementation of ALPs and observed that the ALP interventions were often based on "flawed assumptions about people's needs, aspirations, and the factors that influence livelihood choice" and as such they are unlikely to achieve their conservation or human development objectives. Instead, a more holistic, sustainable livelihoods approach was recommended (Wright et al., 2015).

---

[26]Noronha, T. (2019). Alternative Livelihoods Working Glossary. Produced by Mercy Corps as part of the SCALE Award.

[27] Williams, T. and Pompa, C. (2017). Invisible Lives: Understanding Youth Livelihoods in Ghana and Uganda. Toronto. The MasterCard Foundation.

[28] Wright, J.H., N.A.O. Hill, D. Roe, J.M. Rowcliffe, N.F. Kumpel, M. Day, F. Booker and E.J. Milner-Gulland. (2016). Reframing the Concept of Alternative Livelihoods. Conservation Biology 30(1): 7-13, doi:10.1111/Cobi. 2607.

[29]IUCN. 2012. Resolutions and recommendations: World Conservation Congress, Jeju, Republic of Korea, 6–15 September 2012. IUCN, Gland.

Sustainable Alternative Livelihoods Approach' (SALA) can be defined as:

"Interventions that are specifically targeted towards engaging communities to identify, create, and realise opportunities for alternative livelihoods (i.e., activities that directly support wildlife conservation efforts). This is part of a sustainable livelihood strategy aimed at enhancing the community's capabilities and assets, to increase resilience, while not undermining the natural resource base. It is important to consider that in addition to specific livelihood interventions, there may be a need for other targeted community initiatives that are aimed at building trust with the community. These initiatives usually have a short-term focus and may not be directly linked to the conservation aims of the project, but nonetheless are important to facilitate the desired attitudinal change[30].

Table 1 lists the various types of livelihoods that the communities chose for alternative livelihood that they would like to pursue with support from the government. These are not ranked in order of preference of the community, nor according to importance ascribed to the researchers of the project team. The entries are made in a random order.

Table: 1: Choice of alternative livelihoods of the community

Serial Number	Sector and activity of AL	Advantage	Risk/Challenge	Requirement
1	Weaving, handloom	Skill and experience with the women; Involvement with SHGs, demand for handloom products	Lack of market access, inexperience in marketing; Hesitation to transform from manual to mechanized mode of weaving	Support from government and NGOs in financial assistance, advancement of technology and training
2	Livestock rearing and animal husbandry(Poultry, cattle rearing, piggery)	Experience of community	Water pollution, land pollution, lack of fodder	Grazing zone, animal shelter, training in modern methods of livestock management
3	Mushroom cultivation	Experience of some communities	Unfamiliarity of new generation	Approach by entrepreneurs and access to government program
4	Food processing processing-(jam-jelly making; pickle and papad making)	Experience of some communities	Non-availability of raw material in the locality	Training, financial incentive (loan, subsidy etc.)

[30] https://www.peoplenotpoaching.org/sites/default/files/uploads/2018-11/A%20pragmatic%20evidence-based%20participatory%20approach%20to%20alternative%20livelihoods%20and%20conservation_resource.pdf

5	Ecotourism services(e.g., boating, utility shops, souvenir shops, restaurants, homestays, nature guide, nature trail, cultural shows)	Experience, cultural heritage, skill in handloom and handicraft products	Lack of infrastructure, unorganized sector	Organised tourism activity, investment, incentive, financial support, capacity building
6	Making products from water hyacinth (e.g. yoga mats, bags, floor mat, basket etc.)	Ongoing project in Natun Basti, success of local weavers	Lack of experience for most others; Capital intensive, technology involved	Awareness, training, infrastructure development for introducing advanced looms, marketing
7	Carpentry	Easy to learn and adopt, timbre available in nearby areas, huge demand in locality and nearby places, light on capital investment	Alternatives available in the form of non-wooden products	Skill training,
8	Handicraft	Experience in traditional handicraft making; Demand in tourism market,	Lack of outlets, lack of market access outside locality	Financial help in setting up large scale production units and showroom
9	Tailoring and stitching	Experience for some people, regular SHG activity for women, high local need	No tangible risk	Provision of sewing machines and raw materials, loan
10	Grocery shop	Local demand; land and space available	Lack of initial capital, want of experience for many	Financial support, loan
11	Scientific agriculture	Experience for many, traditional knowledge of farming, local need	Uncertainty due to water and solid water contamination, declining interest of young generation, diminishing returns because of the market dynamics	Awareness and training in high value agriculture, and horticulture and agro-based products and value chains/supply chain
12	Small business/enterprise	Not much capital heavy, no need of high qualification, area rich in natural resources	Lack of experience for many, not familiar with effective business ideas, lack of	Awareness, exposure, connectivity to private sector,

			entrepreneurial mindset	support for sed fund, mentoring
13	Fish processing and fish-based products(e.g. fish pickles, dry fish)	Expertise in pisciculture and fishing as a livelihood; market demand	Lack of experience	Exposure, training, monetary support, market link
14	Fish export	Availability of fish verities, Presence of skilled workers,	Safe transportation over long distances, linkage to export market	Training on packing and packaging, market link
15	Aquaculture/Pisciculture (cultured fishery on private or community land; production of ornamental fish, Farming of other aquatic organisms)	Interest in the youth, expertise, and experience in plenty,	Land for digging ponds not adequately found	Restriction on landuse due to notification of ecological sensitive zone (ESZ) and elephant corridor
16	Scientific cultivation of makhana and other edible and medicinal aquatic plants; exporting for further processing; Setting up small-scale units for makhana processing and production of value-added food.	Raw materials found aplenty, experience of makhana collection	Lack of experience in scientific farming and processing	Awareness, exposure, training, incentive for setting up small-scale processing and production units.
17	Incense stick making	Experience for some, easy to learn the technology, no high education is required, market demand, low investment, readily available market	Inexperience for many	Training, access to market, financial incentive through SHGs
18	Electric servicing (Electrician)	Basic knowledge and skill available with many	No serious risk	Training/vocation education, financial support to set up small workshops and, manufacturing units
19	Soap and detergent making(small scale)	Experience of some communities	Lack of skill and know-how for many, occupational hazards, waste management	Exposure, technology, training, link to private sector, government schemes and finance
20	Preparation of traditional Assamese food (Ladoo, pitha etc. for the Bihu ad other festivals etc.)	Experience and expertise amply available, assured market	Community not conversant with marketing strategy	Financial support for large production, marketing, and

		demand, large-scale production possible through SHGs, can be started with small working capital	to capture the city market	maintenance of supply chains
21	Medicinal and aromatic plant based enterprise(producing medicines or raw materials for medicine; aromatic oil, perfume and accessories)	abundance of medicinal and aromatic plant resources in the adjoining Rani-Garbhanga forests	Know-how and technology are new to most people	Awareness, exposure, training, handholding for setting up pilot units with financial support from concerned government agency and private sector
22	Electronic Marketing (Internet Marketing) for skill development	Keen interest of the youth, skill training is available in the city, possibility of leading to private sector jobs	No perceivable risk	Formal training from government or non-government agencies; Training many be provided free of cost or at subsidized cost.
23	Beautician	Choice of young girls and boys, steady requirement in market	Lack of capital for independent establishment	Training, internship, exposure for skill building and seeking jobs; Monetary support for individual enterprise setting

The choice of alternative livelihoods of the people indicates a tendency to shift from on-farm activities to off-farm and non-farm activities, adopt resilient ways of income generation that beget more money than conventional occupations, and a willingness to embrace business-oriented professions that would be more long-serving considering the rapidly changing societal and commercial needs of the existing peri-urban territory.

Reasons for seeking alternative livelihoods:

- The traditional livelihoods such as agriculture and fishing no longer guarantee regular and adequate income at present and these are anticipated to become less secured in future. Therefore, they want to do other things for extra income.
- Lack of land is a major constraint for doing agriculture and related activities.
- Agriculture can still be a viable source of income provided with capacity building(training) so that they can opt for value-added agro-products and new methods of farming for subsistence and trade.
- Lack of education limits the possibility of higher jobs; therefore, they want to enhance their capacity and skill to get engaged in other activities that are not prevalent in the area.
- Some livelihood options such as weaving, animal husbandry, dairy etc. are more suitable for women and will help women to contribute to family resources. Therefore, they seek support from the government and NGOs to the women to participate in such activities.
- Daily wage earning is not an assured source of income, it depends on luck and chance. Therefore, they want other means for a regular cash flow and extra income in some cases.

- The preferred alternative livelihoods are better sources of income, they generate more money, and they are less vulnerable to socioeconomic and environmental uncertainty. and they can become self-sufficient by adopting them.
- Some of them have skills in the chosen alternatives; Others can perform well by receiving training and other required support.
- Many of them want new income streams because the existing ones are not generating enough money. Inflation resulting in rapid rise in essential commodities has made their present income insufficient to run their families.
- The new generation does not want to continue with traditional vocations like fishing and agriculture; They are aware of other income-generating options that are more rewarding and therefore are more interested in the alternatives.
- Some of the alternative livelihood activities can be done at home and therefore investment will be less and hence the preference.

Suggestions from the community for creating ads promoting alternative livelihoods:

- Develop adequate infrastructure and services to promote eco-tourism massively in and around the wetland. When eco-tourism is promoted, the youth can find multiple opportunities for income through employment and business and contribute to showcasing the unique socio-cultural aspects of the local societies.
- Engage the local people in all development activities so that they can earn money from the development projects and schemes.
- Help the local youth get investment and provide monetary support and subsidy in initiating the chosen enterprises. Help them with market linkages.
- Support the SHGs by providing subsidies in creating their core fund for micro-credit and other activities. Subsidies have been stopped over the last few years.

Ecosystem Services from the Deepor Beel

10. Ecosystem Services from the Deepor Beel

Introduction

According to the Millennium Ecosystem Assessment (MEA, 2005)[31], an ecosystem is a dynamic complex of plant, animal, and microorganism communities and the non-living environment, interacting as a functional unit. Humans are an integral part of ecosystems. Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions.

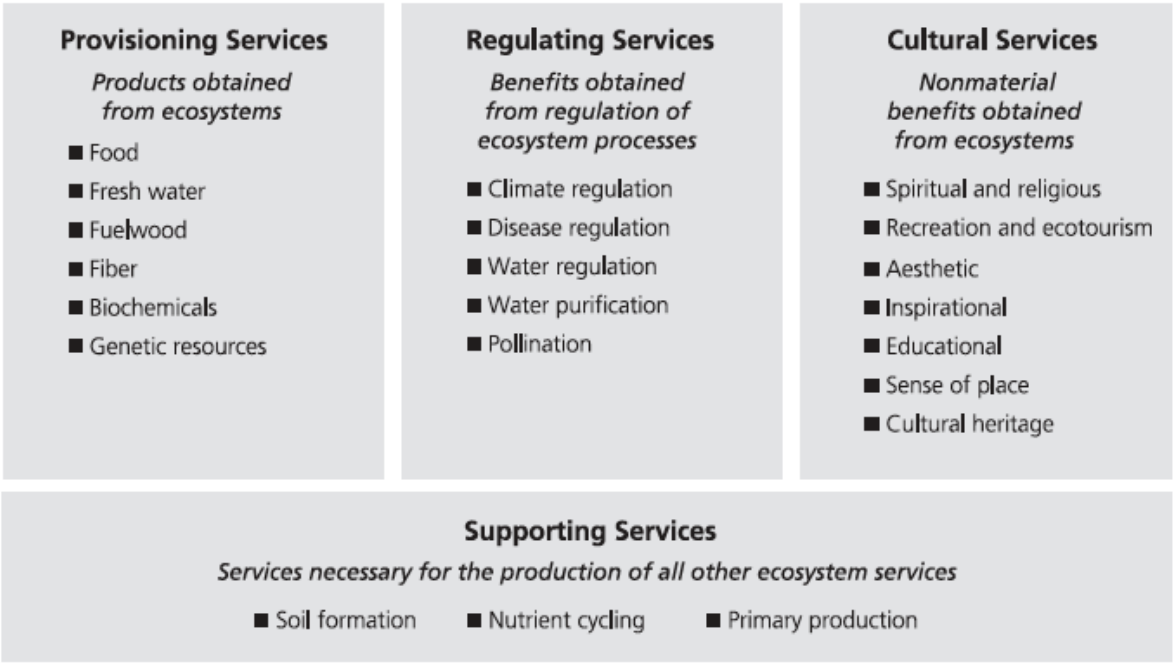


Figure 1: Categories of ecosystem services as defined by the MEA, 2005

We have found from this survey that about 887 households (22.3 % of the households of the study area) spread over thirteen HSUs mostly belonging to the fishing community depend directly on the beel for their living. Similarly, the majority of about 19.5% of the households that are earning from livestock rearing and animal husbandry are also directly or indirectly dependent on the Beel and its ecosystems for fodder such as grass on other plants in and around the beel.

Further, the sources of minor livelihoods like a collection of aquatic resources other than fish comprising about 6% of the HHs, agriculture with 4.9%, dairy (4.8%), and NTFP collection (1.4%) are also greatly reliant on the wetland and its ecological health.

[31]Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC

Thus 58.9%, about 59% of the households directly and indirectly derive benefits for the livelihoods in the area. If we talk about overall human well-being, the entire population gets the advantage of living in the vicinity of the wetland by way of getting fresh oxygen, a gentle and cool breeze, a moderate micro-thermal ambience shielding people and ecosystems from heat stress, and a visually scenic and aesthetically pleasing waterscape.

Community perception of the ESS

The community living around the Deepor Beel is fairly aware of the tangible as well as intangible benefits they receive from the wetland. accruing out from natural resources. In the following passages, we present the summary of the observations made by the community about how the wetland helps in their environmental well-being as well as their sustenance by supporting socioeconomic and livelihood pursuits.

- The wetland's large and varied fish resources provide a major source of livelihood and nutritional subsistence to a large number of people in the area. The Beel also produces many other aquatic plants, fruits, and organisms like the makhana or *nikori* that are also used for income generation for some households. Even the fishermen families who do not capture fish in the main wetland and use the Khanajan for the purpose, are dependent on the ecohydrological health of the beel.

- The area used to be agriculturally affluent once upon a time, till about the late 1990s mainly due to the productive soil made fertile by the wetland's water. The aquatic environment made the soil suitable for some varieties of deep-water rice (known as Bao Dhan in Assam). When the hydrological drainage between the inlets and the inlets through the wetland functioned efficiently, people were able to cultivate both summer rice (Ahu paddy) and winter rice (Sali paddy). The fact that agriculture has lost its position as an important livelihood is attributable to water pollution, sedimentation on the farmland, and prolonged inundation for months.

- The wetland and its periphery have become a tourist zone mainly because of its natural beauty and the presence of a large number of migratory and local birds. The avifaunal wealth of the wetland is the reason why the wetland got the recognition of a Ramsar Site in the year 2002. The increasing flow of tourists birdwatching, enjoying the natural beauty of the wetland, and various other recreational activities (e.g., picnicking in the winter season) has led to the development of many local business enterprises. Some people are also earning by acting as boatmen and nature guides. Locally made handloom and handicraft products also have become popular in a small niche market. Further development of eco-tourism with government support and through private entrepreneurism will bring more prosperity to the area and its people.

- Deepor Beel acts as a reservoir as it absorbs all the storm waters received through surface runoff through several inlet streams from a major part of the city of Guwahati around the year. The wetland's significance can be felt more during the monsoon months when the beel also receives and stores all the flood waters that inundate the city.

Therefore, if the beel shrinks and its water-carrying capacity reduces, the entire city as well as the beel's adjoining areas will suffer from worse flood situations.

- Degradation or defilement of the wetland and its ecohydrological regime and ecosystems has resulted in the loss of livelihoods and sustenance of some households almost in every HSU.

- The varied benefits as implied by the ESS explained are available not only to the local people but also to a large city population who visit the wetland including and to the domestic, national, and international tourists who come to the water body and its adjoining landscape. Besides some of her provisioning services like fish, which people like to buy from the fishermen of the Beel, the beauty, serenity, and comfortable local clime are common benefits to all.

- If properly conserved, restored, and protected, the wetland can be maintained as a rich repository of aquatic biodiversity for posterity which will help research, education, and mass awareness about the value of wetlands in the state.

9.3. Major Ecosystem Services

The ecosystem services provided by the Deepor beel and its allied ecosystems are presented below using the classification scheme of the Millennium Ecosystem Assessment (MES). The information was obtained through community consultations and secondary literature.

Table 1: Provisioning Services

Provisioning Services	Component of the Service and Examples	Benefits to community and use for human wellbeing (Ecosystem values)
Fiber (timber, thatch, bamboo)	Derived from nearby forest areas and paddy fields	Used as roofing, walls, pillars, and posts in the construction of houses; agricultural tools; furniture and handicrafts for domestic use and sales
Wood (fuel wood)	Wood, pieces of tree branches collected from nearby forest area	Provides for basic resources for cooking and lighting houses
Food (Crops)	Agricultural, and horticultural crops e.g., paddy, fruits, vegetables, maize	Staple food, supporting food and nutrition
Food (Fish, fisheries)	Fish catching by traditional means, trade in fish	Livelihood, nutrition, and food security
Food (wild edible plants and organisms)	Wild plants and organisms such as fern leaves, snails, molluscs, and Giant water lilies (Euryale ferox, Makhana)	Alternative and supplementary food for consumption or selling
Fodder	Vegetation, trees, and grass as fodder for domesticated animals	Food to livestock(cattle), poultry, piggery
Natural medicine	Derived from medicinal plants	Free or cheap medical care from locally available resources
Germplasm	Diversity of fish, macrophytes and zooplankton	Preservation of genetic characteristics of important plants and living organisms; will be useful to fish genetic research

[32]Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Table 2: Regulating Services

Regulating Services	Component of the Service and Examples	Benefits to Community (Ecosystem values)
Climate control	Carbon sequestration, influence on heat flux and water flux, altering water redistribution/recycling, and regional rainfall patterns (through evapotranspiration).	Controls local climate significantly and provides stable and congenial environs for people to adapt to.
Nutrient cycling	Distribution of nutrients in cycles among land(soil), water, and plants through inflow and outflow of water and sediment	Sustenance of plant growth and dispersal; bank siltation bringing nutrients helps agriculture and growth of vegetation
Flood moderation	Attenuates flood peaks and moderate flood damage by storing flood waters from connected rivers including the Brahmaputra	Reduction in flood hazards like inundation and loss of crops and infrastructure
Flooding (including a seasonal rise in the volume of water and water level)	Entry of fish, spawning in beel waters, removal of macrophytes	Cleaning of riparian ecosystems, decontamination of land, and restocking of fish in the wetland and adjoining paddy fields, helps in the maintenance of ecological succession

Table 3: Cultural Services

Cultural Services	Component of the Service and Examples	Benefits to Community (Ecosystem values)
Tourism/Ecotourism	Community-based or institutional eco-tourism	Encouragement to local entrepreneurship, generation of income for local people
	Festivals/events organized to celebrate nature and promote environmental awareness (e.g., Wildlife Week, World Wetland Day)	Promotion of importance of the wetland, conservation awareness, income generation for ecotourism guides, bird watching guides, nature trail and tracking guides; by hiring and operating boats, etc.;
Educational tour and visit	Visits of students at schools, colleges, Universities, and other institutions to learn about environment, forest, wildlife, wetland, and ecosystem services including research	Awareness generation about the need for conservation, contribution to scientific knowledge about the wetland, promotion of the importance of the wetland, income generation of local people by providing guidance and information, food vendors, and provision of logistic facilities (resort, hut, homestay, etc.), nature trail and tracking guide, hiring, and operating boats, etc.

Recreational visit	Visit families, and local social groups to enjoy the scenic beauty of the landscape and resources	Promotion of the site, knowledge generation, income generation by providing guidance and information, food vendors, and provision of logistic facilities (resort, hut, homestay, etc.), nature trail and tracking guide, hiring, and operating boats, etc.
Bird Watching	Bird lovers, bird conservationists, and ornithologists visit and stay to watch, and study birds, their habitats, and their behaviour	Knowledge generation (bird inventory), promotion of the site, income generation by providing guidance and information, food vendors, and provision of logistic facilities (resort, hut, homestay, etc.)
Aesthetics	Natural beauty and serenity help enhance human creativity by providing mental peace and well-being	Mental satisfaction and health care

Table 4: Supporting Services

Supporting Services	Component of the Service and Examples	Benefits to Community (Ecosystem values)
Livelihood generation	Natural resources, products, goods, and services facilitate direct and indirect livelihoods e.g., collection and selling of fuel wood, fodder, medicinal plants, edible plants, organisms, fishing, etc.	Provides sources of income from collection, processing, and trade in natural resources and products
Communication(waterways)	Using the waters of the beel for navigation using boats for local transport of people and goods	Provides an easy way of transporting using the water body especially among villages and from villages to the city
Maintenance of habitat and ecosystems	Creation of suitable hydrologic regime and aquatic ecosystems and habitats for aquatic plants, residential and migratory birds, turtles, etc.	Biodiversity enriched, ecosystem services thrive, ecotourism flourishes, local livelihoods and economy supported
Re-stocking of fish	Seasonal inflow from the Brahmaputra to the beel and flooding help bring in a fresh stock of fish to the wetlands	Fish stock and diversity maintained and enriched; Helps in nutrition intake and source of income
Cleaning and fertilization of wetland	Flood pulses help flush out static water, and pollutants	Wetlands become more productive, producing

	and clean up the wetland thereby enhancing its productivity	more fish for general consumption, and boosting the income of fish traders; other flora and fauna also benefits
Increase in soil fertility by flood	Flood waters deposit nutrients in the form of fine silts on riparian land and enhance its fertility	Fertile soil produces more crops and less cost of applying inorganic manures

Photo 1: The wetland is providing grasses and other plants and fodder for the livestock of the local people.

Photo 2: Euryale ferox or Foxnut plant grows in plenty in the Deepor Beel, the fruit of this plant yields the makhana or *nikori*

Photo 3: Makhana or Nikori (Foxnut) fruit is an important aquatic edible fruit that is used in

Management & Governance Issues

11. Management and governance issues

The following issues pertaining to the management and governance of the wetland and its associated water bodies have emerged from the survey that have a direct and indirect bearing on the socio-economy and livelihood of the people.

The Ecological Sensitive Zone (ESZ) Notification

The Draft Notification on the Eco-sensitive Zone (ESZ) around the Deepor Beel was published(notified) by the Ministry of Environment, Forests and Climate Change (MoEFCC) on August 25, 2021. This preliminary notification declared an area to an extent varying from 294 metres to 16.32 kilometres around the boundary of Deepor Beel Wildlife Sanctuary, in Kamrup (Metropolitan) District in the State of Assam as the Eco-sensitive Zone. The area of the ESZ is set to be 148.9767 square kilometres.

The Eco-sensitive Zones are notified by the MoEFCC, and GoI around protected areas (National Parks and Wildlife Sanctuaries) under the Environmental (Protection) Act, 1986. The main purpose of the ESZ notification is to regulate certain anthropogenic activities and to minimise the negative impacts of such activities on the fragile ecosystem surrounding the protected areas.

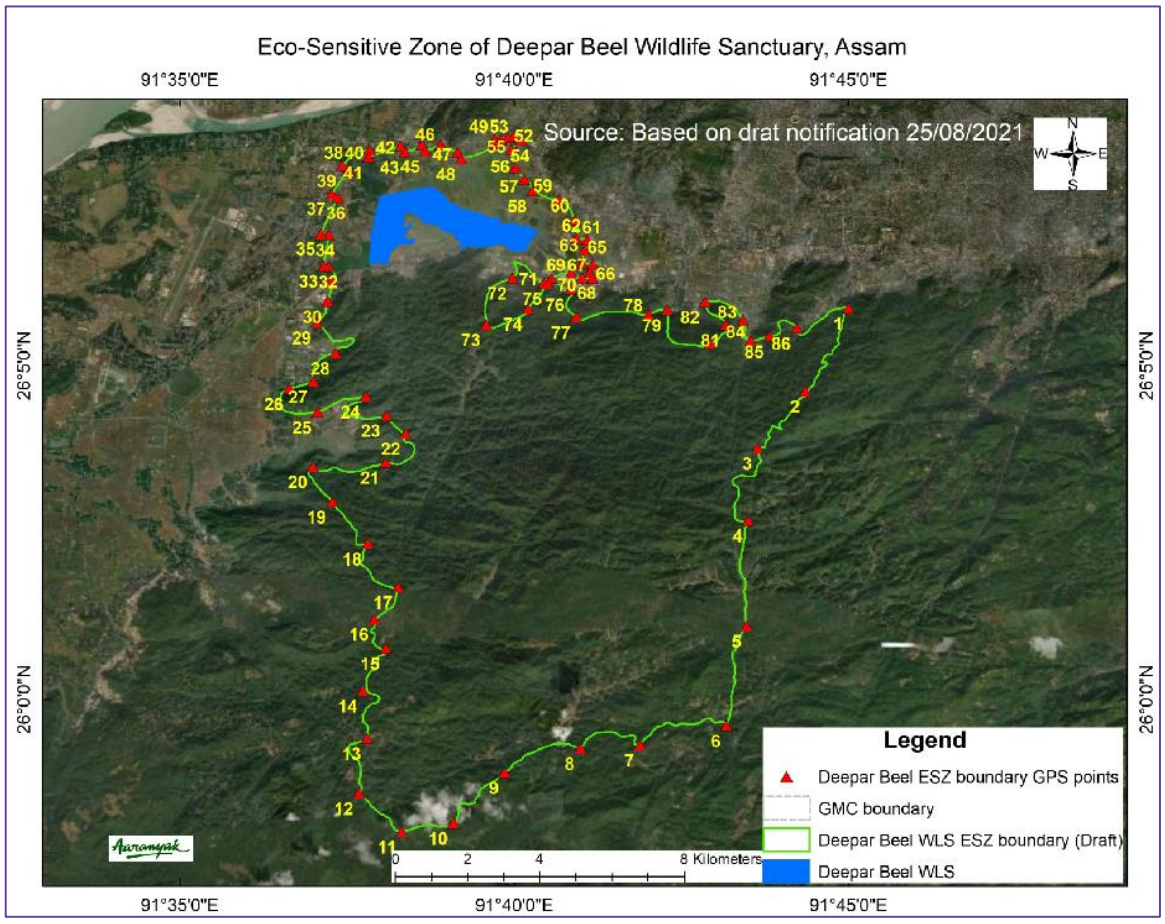


Figure 1: The map of the Eco-sensitive Zone of the Deepor Beel as defined by the draft ESZ notification, GoI.

Figure 1 presents the map of the ESZ, prepared by Aaranyak based on the information provided with the draft notification presented below. Figure 2 shows the location of the study area within the extent of the ESZ. Figure 2 clearly demonstrates that all the HSUS surveyed in this study and several other villages lie well within the ESZ meaning these HSUs are all affected by the restrictions imposed by the notification on many of the ongoing activities carried out by the local people related to their socioeconomic and livelihood pursuits.

This is the reason why almost everybody in the area has resentment against the ESZ notification. Moreover, the information about the ESZ and its maps are not easily available to the people because of which the landowners have great difficulty in finding out whether their land property comes under the ESZ. They also think the notification goes against the rights of the indigenous people to their natural resources.
The unequivocal opinion of the people is that the notification should be immediately withdrawn, and it should be replaced with alternative policies that help in the conservation and protection of the beel and its ecosystems without seriously harming the interest of the stakeholders. Such decisions are to be taken and implemented in consultation with the local communities.

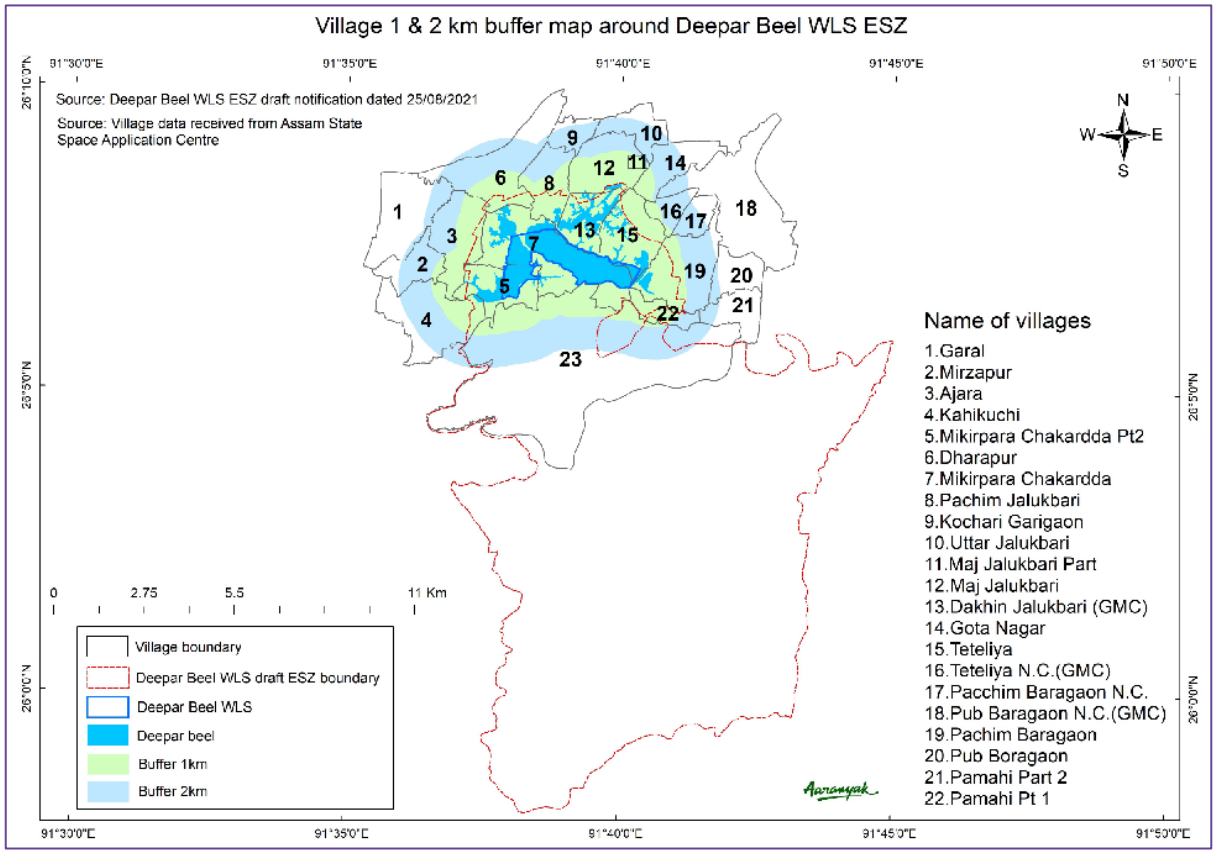


Figure 2: The Map of ESZ overlaid on the map of the study area.

The Case of Elephant Corridors:

There are two an elephant corridor on the south bank of the wetland that are known to have been used by elephants for a long- time (at least for the last 50 years) to travel from the nearby hills of the Rani-Garbhanga Reserve Forests (RF) to the Deepor Beel for basking in the waters of the wetland. The elephants make frequent visits to the wetland in the summer months to cool off in wallow in the waters. Moreover, there are certain aquatic fruits like the *Nikori* or *Makhana* found in the wetland which are the favourite edible of the elephants.

Recently, the Forest Department has erected several hoardings with the names of four more elephant corridors on the roadsides of the PWD road that passes through the south bank of the beel along the track of the railway track. These hoardings have specified the space on the road through which the newly recognized corridors are passing. According to the local people, although the newly defined corridors have obviously traversed through the privately owned land of many people. Yet, they have not been given information about the specific demarcation of the land marked as elephant corridors. Besides, the local villagers were not consulted or informed before the declaration of the new corridors. consulted or informed before the declaration of the new corridors.

Photo 1: Beltol (Matia) Elephant Corridor

Photo 2: Sabhaghar Elephant Corridor

Photo 3: Mikirpara Elephant Corridor

Photo 4: Segunbari Elephant Corridor

Photos 1 to 6 show the signages designating the elephant corridors. installed by the State Forest Department. While the first 4 are the new corridors, the 5th and the 6th ones are the old and original elephant passes.

This has led to confusion among the villages about the actual status of their land. On the other hand, some of the people have been debarred from construction activities on their land since that plot of land falls under the newly defined elephant corridor as per standard rules. This situation has led to widespread disgruntlement among the villages of the south bank since they consider it a denial of their right to use their legally owned land. Many people are of the opinion that such restrictions have affected their livelihood since they cannot sell or buy the land that is now occupied by the elephant corridor, or they are not allowed to dig a pond for developing a fishery or build a house for opening a shop.

Therefore, they consider the issue as a matter of grave concern for their land rights as well as livelihood.

Photo 5: Tower Camp Elephant Corridor

Photo 5: Bhangrasthan Elephant Corridor

According to the community, only two elephant corridors, the ones near the Tower camp and the Bhangrasthan temple are the original routes of the elephants. The new ones are used only occasionally by elephants and therefore there was no need to designate the other corridors. They want these corridors to be derecognised and removed.

Moreover, the two original and old corridors are blocked on the foothills by constructions on the land belonging to a few individuals. Because of this closure on their natural passages, the elephants stray away and take different other routes to make their way to the wetland. Therefore, the community wants the obstructions on the original two corridors to be removed so that the elephants can have a smooth passage to the wetland and then the other corridors will be irrelevant.

Landscape analysis of the elephant corridor zone

Figures 3 and 4 show the land use-landcover analysis of the narrow riparian strip of land extending along the PWD Road and the Railway track on the southern bank. This strip is located between the wetland and the foothills of the Rani-Garbhanga Reserve Forest and contains the elephant corridors mentioned above. The figures present the land use-landcover conditions in four different years viz. 2001, 2005, 2010 and 2015. The analysis has revealed the changes in the landscape every five years over the 15 years during 2001-2015.

For this analysis, we have considered a 0.5 km buffer on both sides of the main road and digitized the features in Google Earth Pro in detail. The maps for the year 2020 have been digitized but not yet finalized. In addition, the most recent map for the year 2023 will also be prepared for the final report.

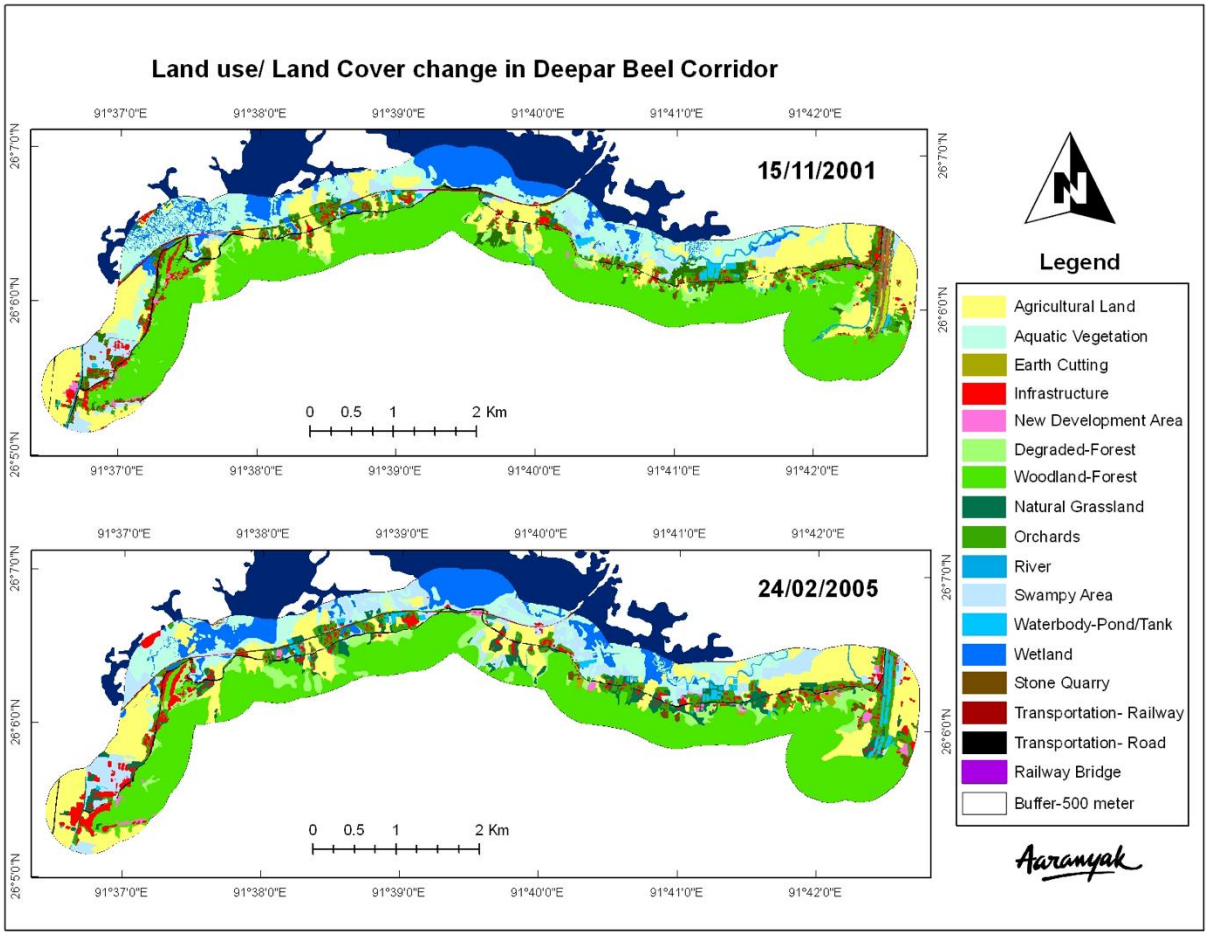


Figure 3: Landscape analysis on the southern plain strip of the Deepor beel containing the elephant corridors for the years 2001 and 2005.

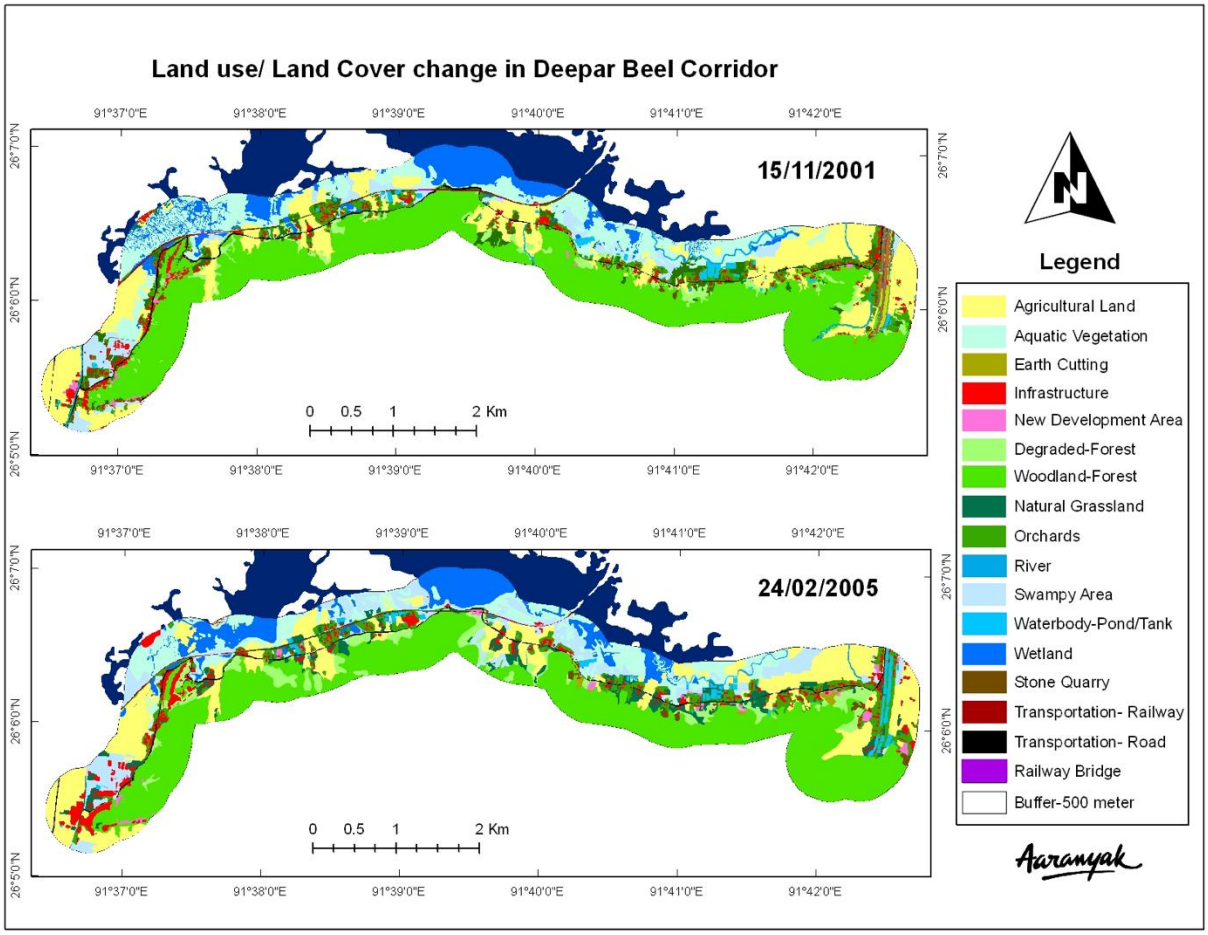


Table 1: The statistics of Landuse-landcover change of the elephant corridor area on the south bank of the Deepor Beel during 2001-2015

Sl. No.	Land Use Class	Area (Km2) 15/11/ 2001	Area (%) 15/11/ 2001	Area (Km2) 24/02/ 2005	Area (%) 24/02/ 2005	Area (Km2) 25/11/ 2010	Area (%) 25/11/ 2010	Area (Km2) 16/02/ 2015	Area (%) 16/02/ 2015
1	Agricultural Land-Cropland	2.432	18.612	2.358	18.042	1.771	13.555	1.019	7.794
2	Aquatic vegetation	1.733	13.259	1.206	9.232	1.424	10.898	1.982	15.168
3	Degraded-Forest	0.377	2.883	0.620	4.741	0.449	3.436	0.753	5.766
4	Earth Cutting	0.007	0.052	0.035	0.267	0.127	0.972	0.267	2.044
5	Infrastructure	0.398	3.049	0.531	4.066	0.710	5.436	1.294	9.903

6	Natural Grassland	0.556	4.255	0.549	4.204	1.019	7.796	0.953	7.293
7	New Development Area	0.031	0.238	0.097	0.742	0.198	1.517	0.499	3.819
8	Railway Bridge	0.003	0.019	0.003	0.019	0.003	0.019	0.003	0.019
9	Orchards	0.663	5.071	0.793	6.069	0.734	5.619	0.655	5.009
10	River	0.042	0.323	0.034	0.261	0.060	0.462	0.030	0.233
11	Stone quarry	0.008	0.058	0.037	0.281	0.108	0.830	0.133	1.018
12	Swampy Area	0.578	4.427	1.112	8.512	0.299	2.291	0.635	4.860
13	Transportation-Railway	0.054	0.412	0.054	0.412	0.054	0.412	0.054	0.412
14	Transportation-Road	0.112	0.856	0.122	0.933	0.148	1.135	0.185	1.412
15	Water Body-Pond/Tank	0.138	1.059	0.167	1.279	0.173	1.327	0.165	1.265
16	Wetland	1.020	7.802	0.977	7.475	1.405	10.753	0.732	5.605
17	Woodland-Forest	4.917	37.625	4.373	33.464	4.383	33.541	3.708	28.378
	Total	13.067	100.000	13.067	100.000	13.067	100.000	13.067	100.000

The analysis has indicated drastic changes occurring in this ecologically fragile land strip. The changes exhibit deterioration in the terrestrial and aquatic ecosystems of the area due mainly to the expansion of human settlement and development infrastructure. For example, woodland forest (or thick forest) cover has reduced from 37.6% to 28.4% during the period of 15 years, showing a decline of about 9.2%. The wetland in this part has shrunk by 2.2% leading to an increase in aquatic vegetation by 1.9%. Vast areas of the wetland infested with water hyacinth is a common sight in the western part of the beel. As a result, natural grasses are flourishing (3%) in the margins of the wetland where water has dried up.

As stone quarrying and earth cutting have expanded to more areas, by about 1% and 2% respectively, Forest degradation has engulfed 2.9%. more area. While infrastructure development has expanded to larger areas, by about 6.9%, and 3.6% more land was newly developed (for human settlement and commercial activities) agricultural land got squeezed by w whooping 10.8%. These results have vindicated some findings of the survey such as rapid decrease in agricultural areas, proliferation of industrial activity accompanied by expansion of basic infrastructure, products and services and conversion of rural landscape with agricultural

areas to commercial hubs thus facilitating urbanization of the area, shrinkage of the main water body, intense eutrophication resulting in large-sale growth of aquatic vegetation etc.

The above observations clearly indicate that the area in and around the elephant corridors have undergone remarkable changes in landuse and landcover due to intense pressure of human population growth and development infrastructure enlargement leading to deforestation, forest degradation, wetland shrinkage and degeneration of ecological health of the wetland. These changes have both directly and indirectly affected the movement of elephants and their habit and nature of using the corridors. Some of the recent incidents of straying elephants and consequent events of depredation could be ascribed to such factors.

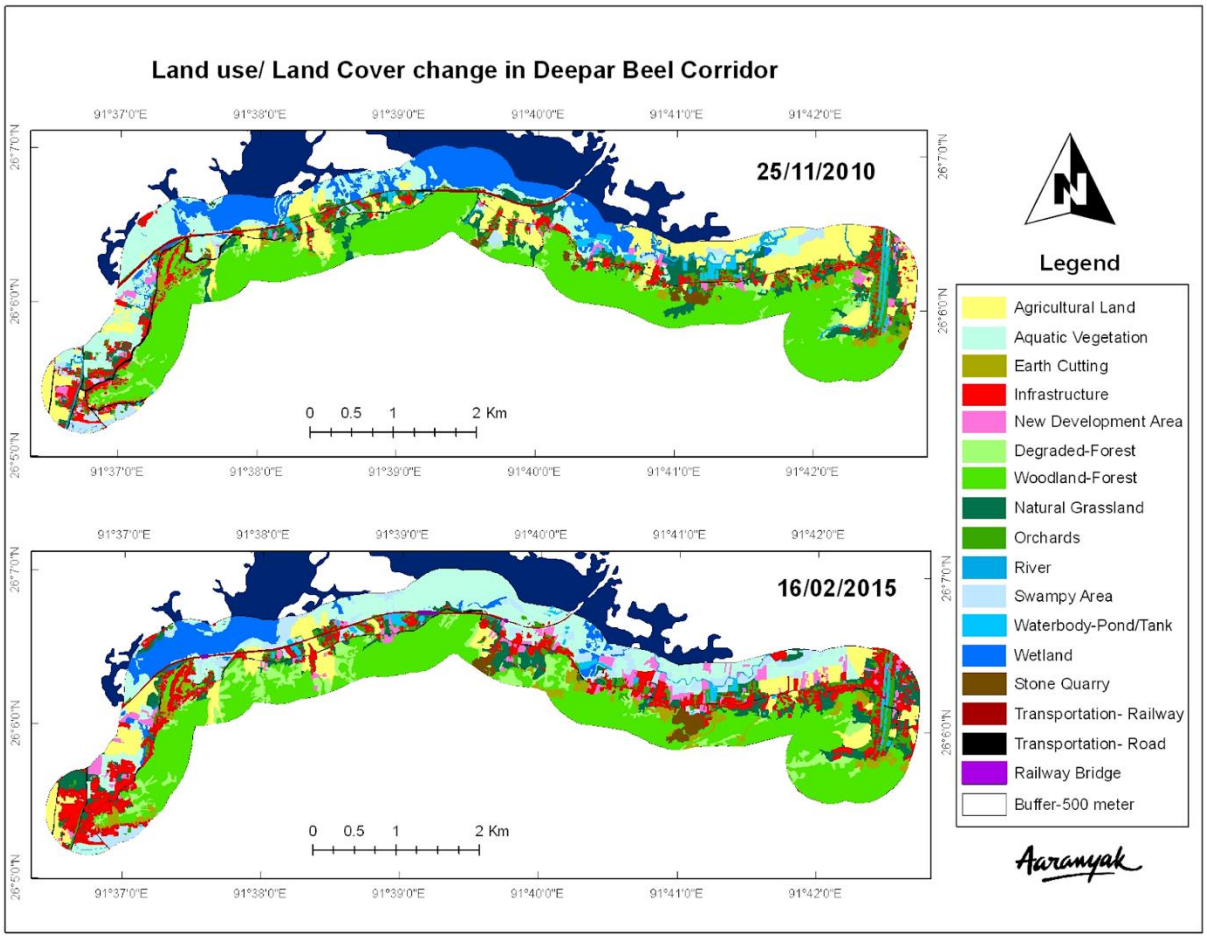


Figure 4: Landscape analysis on the southern plain strip of the Deepor beel containing the elephant corridors for the years 2010 and 2015.

Demarcation of the boundary of the Deepor Beel:

Although the boundaries of the WLS have been demarcated, the wetland as a whole is yet to see its precincts delineated on all sides. The communities believe that this is the main reason why some parts of the wetland have undergone encroachment by various sections of people. They complain about encroachment by politically powerful people who are intruding into the wetland's land by building houses, and apartments and setting up business infrastructure. People think this issue should be addressed as a top priority and the wetland should be protected forever by identifying and fortifying its boundaries with immediate effect.

Figure 4 features a map of the Deepor Beel with its landuse classes prepared by Aaranyak as part of this study, based on the Landsat 9 data dated 22.10.2022 and the data provided by the Assam Forest Department in the form of KML files of the boundary of the wetland during the peak flood stage. However, we do not have any information about whether these boundary layers were developed from field measurement or from satellite-based estimation. In case the estimation was made from satellite data, we are not aware of the time, date, month, and year of the data used. However, the map provides us with some authentic and most recent data that could be useful to the concerned authorities involved in administering and managing the Ramsar Site as well as the WLS.

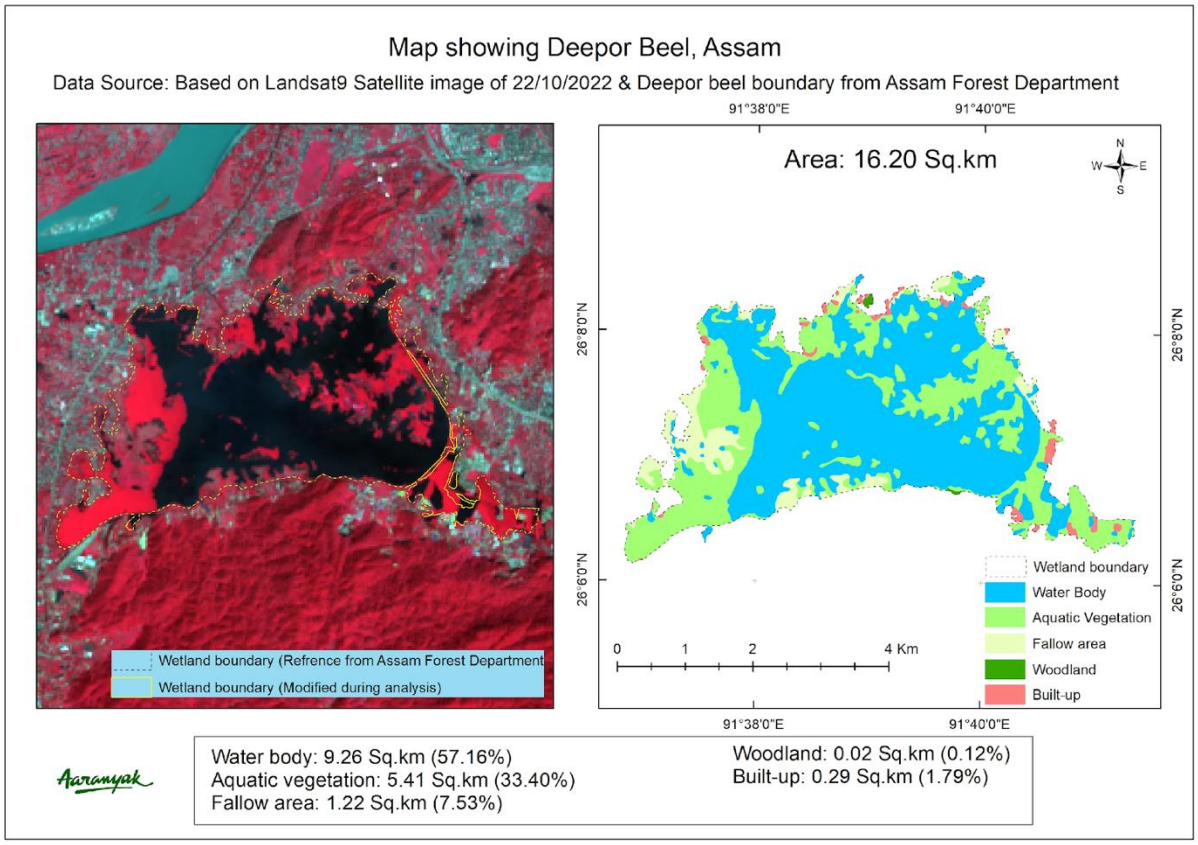


Figure 5: Map of the Deepor Beel as on November 22, 2022, showing the extent of the wetland and its land use in the post-monsoon season of 2022

It is found from the landuse analysis that the Deepor Beel has a total area of 16.20 km^2 out of which the water body extends over 9.26 km^2(57.16% of the total area of the wetland); Aquatic vegetation on 5.41 km^2(33.40%), and fallow area on 1.22 km^2(7.53%). A tiny portion of the wetland is seen to have human settlements (built-up area) expanding over 0.29 km^2(1.79%). The existence of woodland in the form of small patches of forests is almost negligible occupying only 0.02 km^2(0.12%).

Since the wetland occupies a maximum area of 16.20 km^2 during the peak flood stage, this extent may be considered as the optimal area over which the management activities of the Ramsar Site need to be carried out. In this sense, the 16.20 km^2 mask can serve as the natural boundary of the wetland.

A general sense of apathy and marginalization:
Communities, in general, hold the state government responsible for not developing the Deepor Beel area and for their social and economic backwardness and poverty. They especially mention the lack of ecotourism development, and the absence of any government initiative for socioeconomic empowerment and livelihood security as a glaring examples of such an attitude of negligence to the area although there is immense potential for all-round development of the area because of the presence of a Ramsar Site like the Deepor Beel.

People strongly feel that the government should provide them compensation for the losses incurred to existing livelihoods due to prohibitory policies in connection with setting up the WLS in the core fishing zone of the wetland and other related management measures. They are of the opinion that the state government should implement special development initiatives for the area that include the promotion of alternative livelihood packages for the native populations living in the area. Providing This is especially a dire need of the fishermen's community which has been in demand by all communities in the area.

Inadequate implementation of existing laws and policies:
There are several environmental acts/laws, rules, policies, and programs enacted by the Government of India as well as by the State Government of Assam providing for the protection, conservation, and management of wetlands. Examples are Wildlife (Protection Act), 1972; Environmental (Protection) Act, 1986; Guwahati Water Bodies (Preservation & Conservation) Act, 2008; Wetland (Conservation & Management) Rules, 2017 and Municipal Solid Waste (Management and Handling) Rules, 2016 etc. However, the enforcement of the laws and policies is poor, which is the main reason why many of the wetlands in Assam in particular are degrading and dying owing to pollution, fragmentation, desiccation, impaired hydrological connectivity, encroachment leading to reduction of area, excessive fishing etc. In the case of the Deepor Beel also strict implementation of these legal provisions is a must for its overall protection and preservation. A large section of the community wants the rules should be applied stringently where applicable, but at the same time care must be taken not to jeopardise basic life-sustaining activities and live hoods of the people. Enforcement of laws in a people-friendly manner through a consultative process is a way to keep a balance between the conservation of the wetland and the development of the people.

Lack of awareness about the management regime:
It was found in the survey that the people of the area have no awareness or information about the governance system that is associated with the management of the wetland. About 90% of the people do not know about the existing laws and policies mentioned above that are directly applicable to the Deepor Beel. They also know little about institutions like the Deepor Beel Management and Development Authority and the State Wetland Authority or the role of the district administration and the government agencies, apart from the Forest Department, that are stakeholders in the management of the wetland and how the management system works.

The impact of the sluice gate at the Khanajan:
The status of hydrological connectivity of the wetland is constrained by physical obstruction caused by a sluice gate on the Khanajan that connects the wetland to the Brahmaputra River while crossing the Highway on the northern bank of the beel. The Khanajan channel acts as both inlet and outlet to the Beel and the Brahmaputra River. The rules of operation of the sluice gate on the Khanajan and the size of the gates limit the natural flow of fish from the

Brahmaputra to the Deepor Beel in the breeding season, mainly May-July since this is the time when the sluice gates remain mostly closed to stop flooding in nearby areas by the backflows from the Brahmaputra. Laying of porcupines (a trapezoidal structure made of concrete) over the years to induce siltation and reclamation of land from the Brahmaputra near the Khanamukh (the confluence of Khanajan with the Brahmaputra) has resulted in silting up of the mouth of the Khanajan which blocks connectivity between the wetland and the river.

Photo 7: The sluice gate on the Khanajan rivulet which was constructed to reduce flooding in the area has become an impediment to the fish passage and movement between the Deepor Beel and the Brahmaputra River. (Photo in 2021)

The fishermen of the area consider the sluice gate and the way it is operated as the main reason for the reduction of fish stock in the Deepor Beel in the last decade. It is because of this obstruction in the form of the closed gates of the sluice system that the brood fishes cannot come down to the wetland to lay eggs. This is the reason why the fish productivity and stock of the beel have declined significantly in recent years. This is why nowadays the fishermen on their own initiative release large quantities of fish seedlings in the beel during the rainy season to make up for the loss in the quantity of natural fish stock because of the sluice gate.

Dumping of Municipal Solid Waste:

The most serious and immediate threat has come from the dumping of municipal solid waste (MSW) in Boragaon at a place almost touching the northeastern side of the wetland starting

[33] Gohain, S.B. and Bordoloi, S. (2013). A study on surface water and groundwater near a garbage disposal site in Guwahati, Assam, India. International Journal of Advanced Biological Research, VOL. 3(2) 2013: 212-216 ISSN 2250 – 3579

from the month of July 2006. The site is about 2 km from NH 37 and almost touches the boundary of the wetland. It contains all sorts of unsorted, unsegregated, non-biodegradable and toxic wastes of the city that generates 300 metric tons of solid waste per day. The dump has remained uncovered, and no scientific method was adopted for the disposal of the waste. There was no liner membrane underneath the waste dump or a leachate collection system to collect the leachate emanating from the base of the dump (Gohain and Bordoloi, 2013).

Photo 8: The Khanajan sluice gate in 2023. The gate of the sluice system remains closed during the rainy season which is also the breeding season of fish this blocks the movement of the fish from the Brahmaputra to the wetland (2023).

This has posed a severe threat causing pollution to the water of the beel, especially in the rainy season when the contaminants leach out with rains to the beel from the waste dumps. This activity, being carried out by the Guwahati Municipal Council (GMC) is a violation of the Municipal Solid Waste (Management and Handling) Rules, 2016 and the Wetland (Conservation & Management) Rules, 2017. There has been severe criticism and protests by environmentalists, civil society, and local people against this undesirable practice.

The groundwater in the area surrounding the waste dump and the nearby surface area of the beel has been found to contain toxic trace metals viz. Cadmium and Manganese in concentrations that are higher than the maximum permissible limit as per WHO and BIS IS: 10500 standards which has been considered as an impact of the MSW dumping. It is a major health risk to the 1200 families of 11 neighbouring villages as well as a source of toxicity to the water of the Deepor Beel (Gohain and Bordoloi, 2013). Toxic leachate flowing from the base of the dump continuously mixes with the nearby surface water of the wetland as well as

the aquifers being used by neighbouring villages as sources of drinking water through tube wells and bore wells. Contamination of soil and water can lead to bioaccumulation through the food chain.

Photo 9. Dumping of MSW near Boragaon since 2006 (situation in 2021). The dump site directly polluted water in Deepor Beel

However, with the intervention of the National Green Tribunal dumping of solid waste was stopped at the Boragaon site in 2022 but till then, locals believe that some irreversible injury was inflicted on the wetland's water and aquatic ecosystem. But the GMC started discharging the MSW at another place called Belor Ali, in the west Boragaon area, very near the old dumping site and close to the Pamohi channel which is an important inlet to the Deepor Beel.

Waste disposal at the new site, which started in August 2021, has also created pollution of land, air and water in the area thus inviting protests of the local people against this act. Besides, although the GMC assured of adopting scientific processes of solid waste management at this site, it is yet to do so. Moreover, the GMC has not gone for decentralized solid waste dumping using several locations spread around the city instead of dumping all the garbage in one place, a measure that the NGT wanted it to take. Therefore, the locals consider this act of the GMC as a violation of the order of the NGT. The communities consider the new site as harmful to the wetland as the old site, as the waters of the Pamohi as well as the Deepor beel are getting contaminated from the leachate produced by the wastes. One hears a unanimous voice of the communities on the eastern and southeastern sides of the beel demanding the removal of this site also from the vicinity of the bezel.

Photo 10: The MSW dump on the bank of the Deepor Beel near Boragaon (condition 2023).

Photo 11: MSW deposits on the new site on the Belor Ali in Pub Boragaon that started in August 2021

Effect of the Guwahati-Goalpara Railway Track:

The construction of railway lines connecting Guwahati to Goalpara along the southern and eastern boundaries of the wetland has affected the wetland in more than one way. The noise and the vibrations generated by speeding trains disturb the serene ambience of the wetland and its environs and, scare away the birds. This can be one of the reasons for the rapidly dwindling number of migratory as well as local birds. The train line has proved to be a deathbed for elephants that come from the nearby Rani-Garbhanga forests to drink water and beat the summer heat by basking in the wetland by crossing the rail line. Death of elephants especially juvenile ones due to collision with running trains is a common incident. More than 15 elephants have died due to accidents with speeding trains in this stretch near the Deepor Beel between 2004 and 2019.

Photo 12: The Railway track passing through the southern part of the Deepor Beel

There have been many protests and severe criticism against the laying of the rail track since it was constructed during 1991-1992 because of its possible and observed negative impact on the beel and its biodiversity, especially on the birds. As a result of consistent public and expert opinion built over the last three decades about the historical blunder committed by the concerned government agencies, mainly the Indian Railways, some respite has come of late (February 2023). The Northeast Frontier Railway has decided to construct an elevated.

[34]https://www.guwahatiplus.com/exclusive-news/deepor-beel-to-get-rs700-crore-elevated-corridor-underpass-to-end-elephant casualties#:~:text=The%20Northeast%20Frontier%20Railway%20(NFR,connecting%20Kamakhya%20with%20New%20Bongaigaon

corridor and underpasses along the 5.9 km long stretch of the railway between the Kamakhya and the Azara stations that cover the stretch where the elephant corridors are situated. The state government has also approved the DPR of the elevated corridor and the underpasses. The purpose of the elevated corridor is to reduce accidental death and injury to elephants by speeding trains while passing through the existing elephant corridors. The elephants will be able to cross the mainline without any collision with the trains.

Although some people in the area have welcomed the idea of the elevated corridor and the underpasses, the larger sections have expressed doubt about the effectiveness of the underpasses in guiding elephant movement through the designated corridors. Therefore, they demanded realignment of the railway line through the northern bank of the wetland so that the corridors could be freed forever.

Photo 13: About 15 elephants died during 2004-2019 due to collision with trains while crossing the railway track near the Deepor Beel (From the archive of Aaranyak).

Recommendations

The following are the salient recommendations that we make based on the suggestions and views of the communities as obtained during the survey, for the protection and conservation of the wetland as well as socioeconomic empowerment and livelihood security of the stakeholder communities. • It is evident that a comprehensive strategy, informed by the perspectives and needs of these communities, is essential for the harmonious coexistence of people, livestock, and the fragile ecosystem of this unique wetland habitat.

Research and Documentation:

- Document the unique traditional knowledge and practices of the fishermen's communities and preserve the aquaculture traditions.

- Establish an 'Aquaculture Heritage Museum' in one of the fishing community villages to preserve the rich and endemic bequest of the community related to the culture of fishing.

- Carry out a comprehensive socio-economic, livelihood and development survey in a census mode to get more accurate and all-inclusive information about the present status of the and to project future scenarios. Such an exercise will supplement the present rapid survey and will help conservation and development planning on a long-term scale.

- Scientific assessment of the impact of anthropogenic environmental change (local landuse and landcover), climate change and infrastructure development (e.g., road, railway, real estate, urbanisation) should be done on existing livelihood sources, mainly the farm-based vocations such as livestock rearing, agriculture, fishing etc. Governments should also be careful in decision and policy-making so that livelihoods like animal husbandry are not adversely affected.

- Carry out a comprehensive scientific assessment of the values of the ecosystem services of the wetland for a holistic ecosystem-based management and for understanding of both people and policymakers which will strengthen the argument in favour of investment for conservation of the wetland in a rapidly urbanizing and highly challenging circumstances.

- Take steps to monitor the water body to examine WQ and assess the water volume and the overall ecosystem health regularly (monthly and seasonal) followed by year-round ecosystem management measures should be implemented around the year.

Environmental and Conservation Intervention:

- Remove obstructions to the original two elephant corridors to allow the smooth passage of the elephants to the wetland. Subsequently, reconsider the alignment of the newly designated elephant corridors based on their necessity and in consultation with the affected villagers on the north bank.

- Close the old garbage disposal site at Surabhi Nagar in West Boragaon completely and shift the ongoing new dumping site at the Belor Ali area in East Boragaon to another place way away from the wetland. it to other places as directed by the National Green Tribunal

of India. At the same time, a robust integrated solid waste management policy with a proper scientific system for Guwahati City must be adopted without further delay to make sure such unpragmatic practices are not repeated in future.

- Redesign the sluice gate on the Khanamukh with suitable rules of operation to facilitate the timely movement of water and fish with other aquatic organisms between the Deepor Beel and the Brahmaputra River.

- Consult and engage the local communities in all efforts for the protection of the Beel and conservation of its ecosystem since they are the people having the best ground knowledge of the wetland.

- Eutrophication and the overgrowth of water hyacinth must be controlled and maintained at a tolerable level to benefit fishermen as well as the beel's ecohydrological health.

- Establish Sewage Treatment Plants at appropriate locations so that all the water that flows to the beel through various inlets gets treated and cleaned by properly removing the pollutants to the best possible extent before getting released to the wetland.

Socioeconomic, Livelihood and Development Intervention

- Build up the capacity of the people, focusing especially on youth and women participation to make their existing livelihoods climate resilient, secure, and sustainable as far as possible.

- Provide a special package of eco-development activities combining conservation of the beel and its ecosystems with local development and livelihood improvement needs and implement the same with community participation.

- Provide alternative livelihoods to the local people based on the findings and recommendations of the present survey. The youth should get special attention in such initiatives according to their views, aspirations, qualifications, and skills.

- Allow fishing to the local fishermen communities outside the WLS area as per existing rules and ensure that the ecohydrology of the core area having the WLS is not affected.

- Promote community-based cultivation of makhana (nikori, fox nut) in the wetland and set up small industries for manufacturing value-added products from Makhana.

- Ensure prompt implementation of welfare and development schemes of the Central and the State Governments in the stakeholder villages to provide them with benefits of the projects in the true sense.

- Promote infrastructure and services for eco-tourism development with beautification of the beel and its banks keeping natural ecosystems unaffected.

Policy Intervention

- Demarcate the actual boundaries of the wetland on all sides and secure the beel by developing the waterfront taking proper care of the ecological needs of the wetland as well as the riparian communities.

- Initiate efforts to resolve conflicts between the state government authorities (especially the Forest Department) and the fishermen's communities with pragmatic strategies upholding the principles of community-based management of the common property resources.

- Execute all measures that are required as per the norms and guidelines of the Ramsar Convention(RRC, 2017)[35] and the Wetland (Conservation and Management) Rules, 2017 notified by the Government of India.

- Establish an institution especially for the conservation and management of the Deepor Beel by equipping it with adequate mandate, authority(power) and finance for preparing integrated action plans through research, community consultations and implementation of the same in a participatory mode.

- Prepare a 'Deepor Beel Conservation and Management Policy' for guiding this dedicated institution followed by drafting a comprehensive 'Action Plan for Conservation and Management of Deepor Beel' based on the findings of the present survey as well as other information available from credible sources through a consultative process with experts and communities.

- Ensure coordination and synergy among the stakeholder government line departments with a community interface in planning and implementation of the said action plan and the policy.

- We would like to suggest emphatically that the wetland with a part of its surroundings is declared as a 'Unique Urban Bio-cultural Zone' and work with the local people and institutions to promote the value of the biological diversity and the cultural richness of the indigenous people in the area.

[35] Ramsar Regional Centre – East Asia. (2017). The Designation and Management of Ramsar Sites – A practitioner's guide. Available at, www.ramsar.org and www.rrcea.org, https://www.ramsar.org/sites/default/files/documents/library/designation_management_ramsar_sites_e.pdf

Annexure-I Questionnaire used in the PRA exercises

Socio-Economic and Livelihood Assessment in the fringe villages of Deepor Beel. Conducted by Aaranyak, Guwahati. In collaboration with the Assam Forest Department and GIZ-India

1. Basic information about the village

i. Name of Neighbourhood/Village:
ii. Name of Revenue Villages, if applicable:
iii. Development Block:
iv. Revenue Circle:
v. Gaon Panchayat:
vi. Ward Number:
vii. Name(s) of Surveyor(s):
viii. Date of survey:
ix. Name of the Key Informant:
x. Names of the respondents in the Focus Group:
xi. Geo-coordinates of the village

2. Demographic profile of the village

(i) Population: (ii) Male: (iii) Female:
(iv) Number of households
(v) Caste: ST: SC: OBC: General: Others
(vi) Community: Assamese: Bengali: Karbi: Boro: Garo: Others (Name):
(vii) Religion: Hindu: Muslim: Others: Mention
(viii) Average size of family: </=5: </=8: </=10: >10:
(ix) Area of the villages: (In Bigha-Katha-Lecha):

3. Social profile of the village

3.1. Educational qualification:

(i) Literate: (ii) Illiterate: (iii) Up to LP school: (iv) Up to ME school:
(v) Up to High School (Matriculate): (vi) Up to Higher Secondary:
(vii) Up to College (Graduate): (viii) up to University (Postgraduate):
(ix) Technical/Vocational qualification/skill training:

3.2. Health, hygiene, sanitation
3.2.1. Sanitation facility/habits: Number of HH
(i) Sanitary latrine: (ii) Kuccha latrine: (iii) Open defecation:
(iv) Latrine under Swach Bharat Abhiyan (SBA) (v) Common latrine:

3.2.2. Source of drinking water
(i) Piped water supply at home: (ii) Piped water supply at a public place (Tap water)
(iii) Hand pump/Tube well: (iv) Water well (Kuwan) (v) Boring with water pump

(vi) Water from the wetland (vii) Water from any other natural source (river etc.)
(viii) Water from a household or public pond

3.2.3. Water treatment for drinking (NOHH)
(i) Home-made filter: (ii) Filter bought from market :
(iii) High-end filtering system (Aqua guard/RO etc.):

3.2.4. Source of water used for other purposes:
Bathing: Washing of clothes and utensils:

3.2.5. Water-induced health hazard
(i) Do people suffer from any water-related disease? Yes/No
(ii) If yes, please tick: Jaundice: Dysentery: Gastro-enteritis: Malaria:
Dengue: Others(mention):

3.2.6. Healthcare Facility
(i) Do you have any health care facility in or near the village? Yes/No
(ii) If yes, mention the name:
(iii) Distance from Het village:

4. Livelihood scenario: General

4.1. Major livelihood: NOP/NOHH
(i) Agriculture: (ii) Fishing: (iii) Daily wage-earning:
(iv) Job-Government: (v) Job-Semi-Government: (vi) Job-Private:
(vii) Own business: (viii) Livestock rearing:

4.2. Minor livelihood: Number of persons
(i) Dairy: (ii) Collection of NTFP from the beel's banks and nearby forests
(iii) Collection of aquatic resources other than fish (iv) Weaving:

4.3. Single source of livelihood: NOP/NOHH
(i) Only agriculture: (ii) Only fishing: (iii) Only daily wage earning:
(iv) Only service (any kind of job):

5. Livelihood scenario: Agriculture

5.1: Agricultural landholding (Area):
(i) Maximum: (ii) Minimum: (iii) Landless families:
(iv) Number of HH/Person engaged in agriculture in own land:
(v) Number of HH/Person engaged in agriculture on land owned by others:

5.2. Crops cultivated
(i) Paddy for subsistence (NOHH):
(ii) Paddy for commercial purposes (NOHH):
(iii) Major paddy type cultivated:
(iv) Winter vegetables for subsistence (NOHH):
(v) Types of vegetables:

(vi) Jute (NOHH):
(vii) Oil seeds (e.g., Mustard) (NOHH):

(viii) Other crops cultivated for income: Name of crop:
(ix) DO people practice integrated farming? Yes/No
(x) If yes, mention the components

5.3. Irrigation facility
(i) Whether irrigation facility exists: Yes/No;
(ii) If yes, what type: Lift irrigation: Canal irrigation; Using water pump: Others:
(iii) Source of irrigation: Surface water: Groundwater: Drip/sprinkle irrigation:
(iv) If, not, do you need irrigation? Yes/No
(v) If yes, for what purpose?

5.4. Homestead/Horticulture/Agroforestry:
(i) No. of HH having homestead gardens:
(ii) Land under homestead garden (Average Area):
(iii) Resources, products and assets generally found in homestead garden:

5.5. Use of chemicals
(i) Use of chemical manure: Yes/No, if yes, please mention the names
(ii) Use of organic manure, Yes/No, if yes, please mention names
(iii) Use of chemical pesticide, Yes/No, if yes, please mention the names

5.6. What are the main problems and constraints faced by people in doing agriculture and related trade and business?

5.7. How can these problems be solved? What are your suggestions?

6. Livelihood scenario: Livestock & Poultry

6.1. Name of livestock reared (NOHH)
(i) Cow: (ii) Goat: (iii) Buffalo: (iv) Pigs (v) Poultry: (vi) Others:

6.2. Livestock rearing for subsistence:

6.3. Livestock rearing for income:

6.4. Source of drinking water for the livestock:
(i) Wetland (ii) Other sources (Mention):

6.5. What are the main problems and constraints faced by people in doing livestock rearing and related trade and business?
6.6. How can these problems be solved? What are your suggestions?

7. Livelihood scenario: Fishing

7.1. Major source of fishing: Deepor Beel or Other water body (Mention name):
7.2. Fishing for subsistence (NOHH):
7.3. Fishing for income generation (NOHH):
7.4. Main fishing season: Months as per English or Assamese calendar
7.5. Fishing gear used:
7.6. Fishing method used:
7.7. Average fish catch per day during the fishing season (per fisherman):
7.8. Average fish catch during non-season (per fishermen):
7.9. Number of days of fishing in a week: in a month:
7.10. Family income from fishing per month in fishing season:
7.11. Family income from fishing per month in non-fishing season:
7.12. Have you observed any change in the amount and variety of fish in the Deepor Beel in the last 30 years? Yes/No,
7.13. If yes, please tick, increasing decreasing
Describe (if needed):
7.14. Have you observed any change in daily fish catch in the last 30 years? Yes/No
7.15. If yes, please tick, increasing: decreasing:
Describe (If needed):

7.16. Role of women in fishing
(i) Do women take part in subsistence fishing? Yes/No
(ii) Do women take part in commercial fishing? Yes/No
7.17. What are the other villages near the Deepor beel where people fish for a livelihood source?
7.18. Do fishermen observe the fishing ban period rules? Yes/No
7.19. If not, why?
7.20. What are the main problems and constraints faced by people in fishing and fish-related trade and business?
7.21. How can these problems be solved? What are your suggestions?

8. Economic condition:

8.1. Land ownership:
8.1.1. Land under private ownership:
(i) Maximum: (ii) Minimum: (iii) Average:
8.1.1.2. Land under community ownership:

8.2. Range of monthly income of a family's (NOHH)
(i) < 1 lakh: (ii) 1-2 lakh: (iii) 2-3 lakh; (iv) 3- 5 lakh:
(v) >5 lakh:

8.3. Poverty status:
(i) Number of BPL families: (ii) Number of APL families:

8.4. House ownership:
(i) Number of families having own house: (ii) Number of families living in rented house:

8.5. Housing types:
(i) Pucca: (ii) Semi pucca: (iii) Kucha:
(iv) RCC Multi-storied: (v) RCC one story: (vi) Assam Type: (vii) Mudhouse:
(viii) Other types (Mention type and number):

8.6. Household assets: (i) 2-wheeler: (ii) 3-wheeler: (iii) Car:
(iv) Bus: (v) Tractor: (vi) Power tiller: (vii) Water pump: (viii) Boat:
(ix) TV: (x): Refrigerator: (xi) AC: (xii) Washing machine:

8.7. Source of energy for lighting:
(i) Electricity (ii) Solar power (iii) Kerosene
(iv) Other battery-driven devices:

8.8. Source of energy for cooking:
(i) Cooking gas (LPG) (ii) Fuel wood (iii) Electricity (iv) Solar power

8.9. Cooking device:
(i) Conventional chullah (ii) Improved Chullah (Smokeless):

8.10. Labour migration:
(i) Is there labour migration from the villages: Yes/No,
(ii) If yes, mention common destinations of labour migrants:
(iii) Mention a number of migrant households:

9. Alternative Livelihood (AL) potential and options

(i) Type of alternative livelihood preferred:
(ii) Reason for choosing the AL:
(iii) Expertise/Skill available in the village: Yes/No
(iv) Whether knowledge of finance or relevant government scheme available in the village: Yes/No
(v) What AL will be suitable for the women?
(vi) What type of support is sought from the government?
(vii) What type of support is sought from non-government agencies?

10. Environmental condition of the beel, the village and the adjoining area

10.1. General land use:
(i) Forest(area): (ii) Water area (pond/fishery/rivulet/river etc.):
(iii) Wasteland (degraded soil) (iv) Public area: Under collective ownership
(v) CPR: Common property resources: Yes/No
(vi) If yes, please mention the resources type and area:

10.2. Pollution and other threats
(i) Source of pollution to land/water/soil: Yes/No
(ii) If yes, mention and describe:

(iii) Is the water of the river clean and clear? Yes/no
(iv) If no, why?
(v) What are the sources of pollution of the beel?
(vi) What are the major threats to the beel at present?
(vii) Do you think deforestation stone quarrying and earth cutting in the hills are affecting the environment of the beel? Yes/No
(viii) If, yes how?

10.3. Effect of the Garbage Dumping Ground
(i) Do you know about the dumping of municipal garbage near Boragaon on the northern side of the beel? Yes/No
(ii) If yes, how has the garbage affected the beel, its water and aquatic resources?
(iii) Has it affected people's economy and livelihoods? Yes/No
(iv) If yes, how?
(v) What was the condition of the beel before the dumping ground came compared to het its present status?
(vi) Are there examples of minimal conflict in the area? Yes/No
(vii) If yes, please describe the conflict and its cause
(viii) Do such conflicts affect your socioeconomic condition and livelihoods? Yes/No
(ix) If yes, how?

11. Ecosystem services from the beel: Community' relationship with the wetland

(i) Do you think the wetland is important for your life and sustenance? Yes/No
(ii) If yes, why and how?
(iii) What are the benefits in various aspects of your lives and livelihoods that you get from the beel?
(iv) If the water the beel degrades in quality, how would your lives be affected?
(v) Do you depend on the beel for your livelihood/family income? Yes/No
(vi) If yes, how?
(vii) Is there any folklore/legend regarding the wetland and its history?
(viii) Do you have any cultural rituals where the beel and its water are used?
(ix) Do people use the water of the beel? yes/no, If yes: Mention purpose

12. Climatic risk assessment

12.1. Have you observed any significant change in the local weather and climate in recent times? Yes/No.
12.2. If yes, please mention:
(i) Rainfall: Please tick: Increasing: Decreasing: No change:
(ii) Temperature: Please tick: Increasing: Decreasing: No change:
(iii) Describe other aspects:
12.3. In your observation is the beel shrinking or drying of late? Yes/No
12.4. If yes, why?
12.5. Does the beel cause flooding in your village? Yes/No
12.6. Does the beel cause flooding in any other area? Yes/No, If yes, mention the name
12.7. Have you observed any change in the pattern of siltation on the banks of the beel?
Increasing: Decreasing: Has not changed:

12.8. Have you observed erosion on the banks of the beel happening of late? Yes/No
If yes, how much area has been eroded?
12.9. Ae your livelihood affected by changes in weather and climate? Yes/No
12.10. If yes, give examples.

13. Management/Governance

13.1. Do you know who manages or controls the wetland? Yes/No?
13.2. If yes, please name:
13.3. Are you aware of the different government departments that have a hand in managing the wetland? Yes/No?
13.4. If yes, name a few:
13.5. What are the measures taken by the government for the protection and conservation of the beel?
13.6. Are you aware of the rules framed by the Government that apply to the management of the beel? Yes/No
13.7. If yes, please name a few:
13.8. Who would you approach if you want this knowledge?
13.9. What are the problems of this management system?
13.10. What are your suggestions to improve the wetland management of the Deepor Beel?

14. Development status

14.1. What are the development projects and welfare schemes implemented or being implemented by the government in your village in the last 10 years?
14.2. Are the villagers benefitting from any government welfare scheme: Yes/No
14.3. If yes, name a few schemes and how these have benefitted you:
14.4. In other areas in the fringe area of Deepor Beel:
14.5. What are the suggestions for the development of your village and the adjoining area?

Additional Questions

The surveyors will ask additional questions if and when necessary, depending on the field situation.

Annexure-II Important fish species found in Deepor Beel and its connecting channels in the vicinity

(Sourced from Das et al., 2014)[36]

Sl. No.	Local name	Scientific Name
1	Bahu	*Catla catla*
2	Mirika	*Cirrhinus mrigala*
3	Bhangon	*C. reba*
4	Malimash	*Lebeo calbasu*
5	Kurhi	*L. gonious*
6	Rohu	*L. rohita*
7	Hafu mash	*Osteobrama cotio cotio*
8	Puthi	*Puntius conchonius*
9	Puthi	*P. chola*
10	China Puthi	*P.sarana*
11	Silver carp	*Hypophthalmichthys molitrix*
12	Dighol Daricona	*Parluciosoma daniconius*
13	Phul Doricona	*Brachidenio rario*
14	Common carp	*Cyprinus carpio*
15	Grass carp	*Ctenopherongodon idella*
16	Moa mash	*Amphllypharyngodon mola*
17	Laopotia	*Danio deverio*
18	Batia	*Nemacheilus botia*
19	Kukur Batia	*Botia derio*
20	Ari	*Aorichthys seenghala*
21	Shingora	*Mystus bleekeri*
22	Singora	*Mustus cavasius*
23	Katia Singora	*Mystus tengara*
24	Lalua Singora	*Mystus vittatus*
25	Bordua mash	*Psudotrophis aetheronoides*
26	Pabha	*Ompok bimaculatus*
28	Pabha	*Ompok pabda*
29	Barali	*Wallago attu*
30	Bosa	*Eutropiichthys vacha*
31	Magur	*Clarias batrachus*
32	Singi	*Heteropneustes fossilis*
33	Kokila	*Xenentodon cancila*
34	Kuchia	*Monopterus cuchia*
35	Chanda (elongated)	*Chanda nama*
36	Chanda	*Chanda ranga*

[36]Das, P.J., Hazarika, M.A. and Das, A. (2014). Status and trends in wetlands with reference to hydrological connectivity, climate change impacts and implications for biodiversity and community livelihood: a case study in Deepar Beel, India-Phase II (2012-2014). Unpublished Technical Report submitted to IUCN-New Delhi. Study carried out under the 'Ecosystem for Life: A Bangladesh –India Initiative' of IUCN.

37	Chanda (Red)	*Pseudombasis ranga*
38	Gedgedi	*Nandus nandus*
39	Japani Kawoi	*Oreochromis mossambica*
40	Pati mutura	*Glossogobius giuris*
41	Kawoi	*Anabas testudineus*
42	Khalihana	*Colisa fasciatus*
43	Khalihana	*C lalia*
44	Randhoni	*Badis badis*
45	Sal	*Channa striatus*
46	Goroi	*C.punctutas*
47	Sol	*C. marulius*
48	Senga	*C.gachua*
49	Sengeli	*Channa spp*
50	Rukumoi Senga	*C.barca*
51	Bami	*Mastacembelus armatus*
52	Tura	*Macrognathus pancalus*
53	Kai-bai	*Macrognathus spp*
54	Ganga toop	*Tetraodon cutcutia*
55	Chital	*Notopterus chitala*
56	Kanduli	*Notopterus notopterus*
57	Koroti	*Gudusia chapra*
58	Aleng	*Rasbora alenga*
59	Illish	*Tenualosa Illisha*
60	Mrigal	*Cirrhinus Mrigala*
61	Rashim/ Lachim	*Cirrhinus reba*
62	Mali, Kalsasu	*Labeo Kalbasu*
63	Puthi	*Puntius phutunio*
64	Puthi	*Puntius puntio*
65	Puthi	*Puntius sophore*
66	Puthi	*Puntius ticto*
67	Laupatia, Herbaggi	*Laubuca Laubuca*
68	Selcona	*Salmophasia bacaila*
69	Selcona	*Salmophasia phulo*
70	Boreala	*Aspideparia morar*
71	Lauputhi	*Devario Devario*
72	Dorikona	*Danio rerio*
73	Dorikona	*Esomus darica*
74	Dorikona	*Rasbora daniconius*
75	Dorikona	*Rasbora rasbora*
76	Botia	*Acanthocobitis botia*
77	Botia	*Lapidocephalichthys guntea*
78	Aari	*Sperata Singhala*
79	Tengra	*Mystus Bleekeri*
80	Tengra	*Mystus Cavasius*
81	Lal Tengra	*Mystus Vittayus*
82	Ritha	*Rita rita*
83	Pabho	*Ompok pabo*
84	Neria	*Clupisoma garua*
85	Chanda	*Parambassis ranga*

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Sitz der Gesellschaft
Bonn und Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Deutschland
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Deutschland
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de