

# Sustainable Agro-farming Intensification in Peri-urban Wetlands : A Pro-community Action Research in Deepor Beel Site

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## Introduction

**D**eepor Beel is one of the largest and most important riverine wetland of the Brahmaputra Valley in Assam. It lies within the area of Assam's Burma Monsoon Forest biographic region. Located at 26° 05' 26" North to 26° 09' 26" North latitude and 90° 35' 39" East to 91° 41' 25" East longitude, Deepor Beel covers an area of 40.14 sq km. The wetland not only is endowed with rich floral and faunal biodiversity but also provide many other vital Ecosystem Services including livelihood support to a large number of communities around it. Deepor Beel, located at the peri-urban zone of Guwahati city is not an exception which is highly affected by the unplanned city growth and rampant misuse of natural resource degrading the whole ecosystem and livelihood of the rural community.

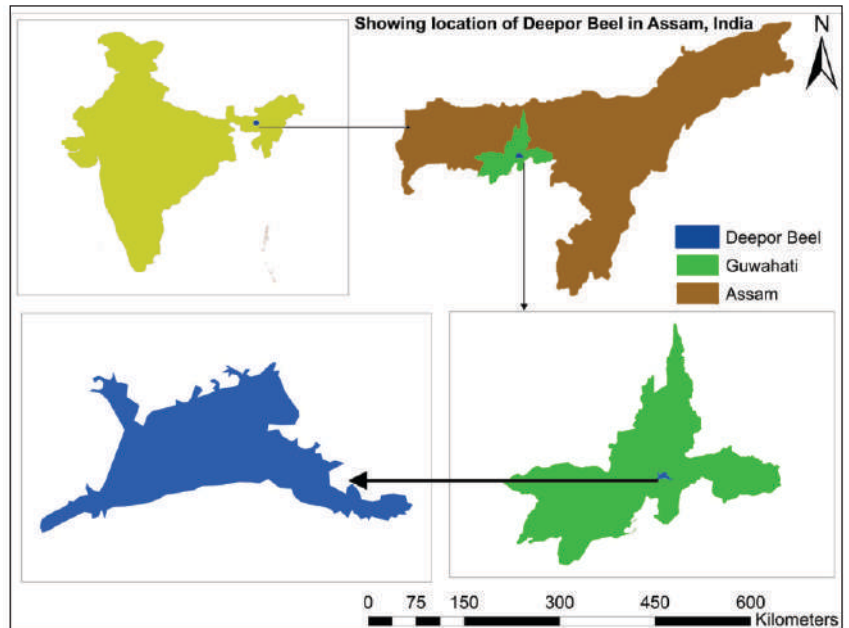
## Identifying the Existing Ecosystem Services

The present study aimed at finding out the major Ecosystem Services (ESs) of Deepor Beel. TEEB checklist of ESs has been followed to identify the Ecosystem Services of the wetland. Ecosystem services have been categorized into four main categories: provisioning services, habitat and supporting services, regulating services and cultural services. The ecosystem services have been identified through ecological field survey (Within January to April 2016) and primary household survey (in February and April 2016).

### Provisioning Services:

Provisioning ecosystem services are those which indicate material and energy output from the ecosystem such as food, water and other resources. Following are the important provisioning services of Deepor Beel:

- Deepor Beel provides habitat for as many as fifty species of indigenous edible fish varieties. Based on this ecosystem service traditional fishing is being practiced by the local communities for ages. Dipor Beel is reported to provide directly or indirectly livelihood to fourteen villages (1200 families), most of whom are fishermen.
- Agriculture is another important provisioning service. About thirty percent of the villagers practice agriculture around the wetland area. Paddy is grown in summer season (Boro paddy) which is main source of food grain for the farmers. Farmers also grow potato and other vegetables in the winter season. Paddy and vegetables are both consumed and sold at the market. Irrigation water for the agriculture is collected from the wetland.
- The villagers living near to the wetland collect various kinds of spinach, roots of giant water lily, and medicinal plants from the wetland area which supplement their daily diet and livelihood as well.
- About fifty percent of the villagers have livestock and the fodder is collected from the wetland areas. Surrounding areas of the wetland are also used for pasture.



Minor food products collection from deepor beel

### Habitat or Supporting Services

- Deepor Beel is one of the staging sites for migratory birds of North East India (about 70 migratory species). Some of the largest congregation of aquatic birds can be found here, especially in winter. Besides, it supports species of 20 amphibians, 12 lizards, 18 snakes and 6 turtles. It also supports wide range of mammals. 18 genera of phytoplankton are reported to have been found in the wetland. 448 species of flora are found in the wetland area. The vegetation is mainly comprised of aquatic submerged and emergent vegetation, shrubs, climbers and trees.

- The wetland supports a number of IUCN red listed species such as the birds,( Spot –billed Pelican, Bears Pochard, Lesse Adjutant Stork, Pallas's Sea Eagle, Slender-Billed Vulture, Ferruginous Duck, Greater Adjutant Stork), Asiatic Elephant, Irriwaddy Squirrel and Hoolock Gibbon.
- The wetland supports wide diversity of indigenous fresh water fishes (about 50 species of fishes). The wetland is a major breeding and nursery ground of fishes which supplies fish to the connecting wetlands and the rivers and rivulets.
- DeeporBeel is the source of food and water for large number of animals from surrounding Rani and Garbhanga Reserve Forests, especially Asiatic Elephants living in the surrounding forest.
- In addition to the wide range of faunal population, the DeeporBeel also produces large amount and variety of vegetables, fruits, medicinal plants which are directly and indirectly used by the community of surrounding areas.



*Deepor beel : Fishing*

### **Regulating Services**

- Due to the topography of the region, the wetland acts as a natural storm water reservoir during the monsoon season from the surrounding catchment area and from the whole Guwahati city.
- It also receives waste water from the Guwahati city and acts as natural purifier.
- The wetland plays pivotal role in ground water recharge, flood control etc.
- Like other wetlands it also regulates the local climate by storing and sequestering massive amount of carbon.

### **Cultural Services**

- Because of the richness of avian fauna, Deepor Beel has been selected as one of the Important Bird Area (IBA) by Birdlife International in 2004. It is one of the 26 Ramsar Sites of India. Due to the rich bird diversity the Government of Assam has declared 414 ha of the wetland area as bird sanctuary in 1989. Due to its ecological importance the wetland attracts researchers from various parts of the world.
- Due to its scenic beauty and large assemblage of biodiversity, it attracts large number of nature lovers and tourists throughout the year.



*Deepor beel : Pasture fodder*

## Understanding the Dependency of the Community on Ecosystem Services

The community around Deepor Beel is entertaining various direct and indirect benefits from the wetland. The survey tried to assess the direct benefits enjoyed by villagers. Here only provisioning services have been taken into consideration. Hundred households have been surveyed for this assessment. The survey shows that 86% of the total respondent households practice fishing and fishing is the primary livelihood for 26% of the households. 14% of the total households practice agriculture and irrigation water in the surrounding areas of the wetland and 6% of them earn their primary livelihood from farming. 49% of the households depend on the wetland for fodder for the livestock. 30% and 40% of the households collect various foodstuffs (fishes, vegetables, spinach etc.) and medicinal plants respectively from the wetland area which supplements their daily nutrition and health care.

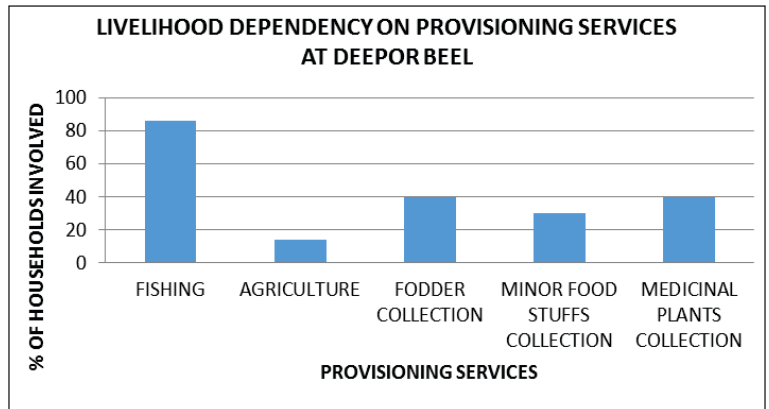


Figure : 1

## Finding out the major changes taken place in and around the wetland and the driving factors

Located at the peri-urban fringe of Guwahati city, Deepor Beel is highly affected by the ever increasing urban pressure on one hand and unchecked exploitation of the natural resources on the other. As a result there is rapid decline in both the range as well as intensity of Ecosystem Services once provided by it. There are many drivers actively or passively involved in this degradation process.

### Rapid and unplanned land-use change

One of the major characteristics of the major Indian cities is the rapid and unplanned growth affecting the ecosystems of their peri-urban areas. During past few decades the Deepor Beel has undergone rapid changes due to industrialization, agricultural activities, forest cover change in the adjoining reserve forests, and growth of human settlements within the wetland area and its buffer zone resulting in imbalance in the wetland ecosystem. The range of land-use changes taking place in and around the wetland is very wide as well as dynamic.

- The population density around Deepor Beel is increasing rapidly due to natural growth of the population of the villages as well as due to continuous migration from the surrounding regions. The wetland area is under tremendous pressure due to the nearness of the rapidly growing city. The spread effect of the city is well recognizable in the wetland area. As the



Deepor beel : Urban and rural encroachment

Guwahati city has become over-congested, the building constructors have focused their attention towards the peri-urban areas where the availability of land is comparatively high at relatively cheap price. For construction and development works people are continuously clearing the vegetation of the wetland areas damaging the habitat of wetland dependent species.

- Proliferation of human settlement, roads and industries around the periphery (in the eastern and north-eastern sides) are the leading causes of causing pollution in the wetland.
- Construction of broad gauge railway and high road in the southern periphery of the wetland has bisected two interdependent ecosystems i.e. Deepor Beel wetland ecosystem and Rani/Garbhanga reserve Forest. Moreover, the movement of vehicles and trains create constant disturbance to the wetland dependent species. According to the local people, many birds and animals have stopped or reduced visiting the wetland which has adversely affected the wetland ecosystem as well as the livelihood of the ecosystem dependent community.
- According to the local fisher community, the fish output has reduced and become unpredictable over the last few years after the elephants, which used to clean the wetland by feeding on the lake vegetation, stopped visiting it. Moreover, unable to enter the wetland, the elephants attack the surrounding paddy and vegetable fields. Man-animal conflict has increased in past few years.
- Industrial development within the periphery of the wetland has increased in past few years which not only encroaching the wetland area but also draining their untreated effluents to the wetland.
- Soil digging is going on constantly around the wetland area and heavy vehicles are constantly entering to carry the soil out of the area. This is leading toward greater imbalance in the wetland ecosystem.



Deepor beel : Railway track

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Deepor beel : Solid waste dumping

### **Pollution**

Pollution has become one of the leading degrading factor of the wetland ecosystem:

- The inflow of storm water and untreated waste water from Guwahati city are finding their way into the core area of the wetland degrading the water quality and causing hazardous environment for the aquatic flora and fauna of the wetland.
- Municipal garbage dumping in the wetland by the Guwahati Municipal Corporation has become one of the leading threats to the wetland. Garbage dumping is extremely detrimental to the water quality and scenic beauty of the wetland. Plastics from the dumping ground float even into the core area of the wetland.

### **Other Threats**

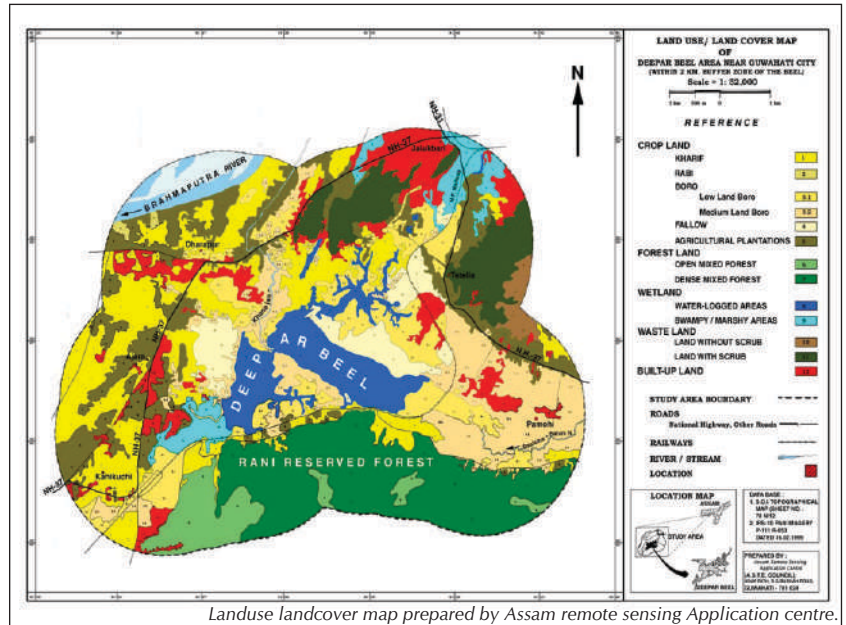
As the cumulative result of the factors discussed above, the wetland ecosystem has been affected to a large extent which has in turn directly affected the livelihood of the traditional fishing community. As the amount and diversity of fish catch has reduced,

the fishermen have introduced some intensive fish species to maintain the average catch. Introduction of invasive species always become detrimental to the natural ecosystem.

## Assess the current ecological stature and water quality parameters of the lake

### Background

Deepor Beel (in Assamese beel refers to a water body) which is located about 10 km southwest of Guwahati city is considered as one of the most significant riverine wetlands in the Brahmaputra valley of lower Assam, India. Deepor Beel is an open lake basin connected with a set of inflow and out flow channels. Originally, the beel had its natural linkages with the river Brahmaputra through the Sola Beel and the swampy areas of Pandu to the northeast. Due to construction of residential buildings, NH-37 and Railway line the main link has already been disrupted and it remains as a small secondary channel. A perennial stream originating from Basistha runs through the heart of the beel and joins the river Brahmaputra through Khanamukh towards north of the Beel. The stream is also fed by Bharalu River.



Landuse and Landcover map of Deepor Beel

### Climate

Deepor beel has a meso-thermal climate, characterized by high humidity and moderate temperature. The temperature ranges between 10.6°C to 30°C. The annual average precipitation is 3000 to 4000 mm. Most rainfall is occurring during monsoon period (May-September). The premonsoon season (March-May) has a maximum temperature of 27° C and minimum of 24° C, and relative humidity between 50.5-76.8%. Although the weather is dry for the greater part of the period, occasional hailstorms and heavy showers are not uncommon. The monsoon season (May -September) has a maximum temperature of 32°C and minimum of 27.3°C. The relative humidity is 82.5%. Warm humid and cloudy weather (it may continue for weeks) is characteristics for this season. The retreating monsoon covers the period from September to October with maximum and minimum temperatures of 27° and 25° C respectively. The relative humidity is 82% and the rainfall gradually decreases to average as the season advances, when the morning mist and fogs start appearing. The winter season begins in November and continues until January. The average field temperature during this period remains at 20 ± 2°C and the relative humidity measures about 77.5%. This season also experiences occasional rainfall due to the west monsoon. January is the coldest month, with a lowest temperature of 17.6°C.



Deepor beel : Ecological survey by SAFE

### Habitat

The water area of Deepor beel itself offers a variety of habitats through the years as the water regime changes. During the summer, large parts of the water-body are covered by aquatic vegetation like water hyacinth; aquatic grasses, water lilies and others submerged, emergent and floating vegetation. The highland areas, which are completely dry during winter, are also covered by aquatic and semi-aquatic vegetation. The water regime touches the surrounding boundaries such as edges of hilly terrain and National Highways etc. during peak of the monsoon season; hence it is a part of the Deepor beel ecosystem. During the winter a variety of habitat such as deep open water area (hydrophase), marshy lands, mud flat, emergent vegetation, water hyacinth patches, wet-grassland patches, paddy field area, dry grassland areas, and scattered forest areas etc. support manifold habitats for migratory waterfowl, residential waterfowl and terrestrial avifauna. The scattered forest present within the beel area supports a large variety of lizard species. These habitats support specific overlapping communities. Feeding relationships forms a very complex energy transformation system and food web links these communities.



Deepor beel : Ecological survey by SAFE

The Beel, is a habitat to a large number of migratory waterfowl each year in addition to a huge congregation of residential water birds. The lake supports globally threatened species of birds like Spotbilled Pelican (*Pelecanus philippensis*), Lesser Adjutant Stork (*Leptoptilos javanicus*), Baer's Pochard (*Aythya baeri*), Pallas' Sea Eagle (*Haliaeetus leucogaster*), Greater Adjutant Stork (*Leptoptilos dubius*), Blacknecked Stork, and large Whistling Teal. It also supports 50 fish species belonging to 19 families. Deepor Beel is a source of water for the number of wild animals from the adjoining Rani and Garbhanga Reserved Forests, including the noteworthy Asiatic elephants.



Deepor beel : Ecological survey by SAFE

### Vegetation

Phytoplankton is one of the major components of the lowest level of the producers in the Deepor beel ecosystem. Again, the fluctuations of water regime during summer and winter also influence the diversity and abundance of the lowest level of the food web. Phytoplankton community is present in higher range throughout the period,

mostly the dominant species are represented by *Oscillatoria spp.* and *Microcystis spp.* A total of 18 genera of phytoplankton are reported only from the core area of the Deepor beel ecosystem. During the retreating monsoon, a total of 18 genera of phytoplankton has been reported which was about 62% of the total planktonic population of the sample (499 individual/l) whereas, during winter season, 68.64% phytoplankton was estimated from a plankton density of 542 ind./l and constituted by 15 genera (Chetry, 1999). The 10 phytoplankton species were *Volvox sp.*, *Anacystis sp.*, *Oscillatoria sp.*, *Spirogyra sp.*, *Ulothrix sp.*, *Diatom sp.*, *Ceratium sp.*, *Selenastrum sp.*, *Microcystis sp.*, *Anabaena sp.*, *Zygnema sp.*, *Closterium sp.*, *Hydrodictyon sp.*, *Tribonema sp.*, *Chlorella sp.*, *Navicula sp.*, *Melosira sp.*, and *Synedra sp.* etc. (Sarma et al., 1993). There are

three peaks of Phytoplankton population: the major one is a winter and retreating monsoon bloom with a minor bloom during the pre-monsoon (Chetry, 1999). The population density of phytoplankton reaches fairly high levels during winter season and re-treating monsoon but remain low during summer season.

There is abundance of free floating, emergent and submerged aquatic macrophyte (Saikia & Bhattacharjee, 1987). The free floating plants *Eichhornia crassipes*, *Azolla pinnate*, *Pistia stratiotes*, *Lemna minor*, *Lemna major*, *Spirodela polkyrrhiza* exist throughout the year and they become plentiful during the summer.

### Water Quality

Water samples were collected and analysed from six different points at various locations of Deepor Beel in the month of May (pre- monsoon). On field instruments were used to determine the parameters of temperature, pH, Total Dissolved Solids (TDS), turbidity and Dissolved Oxygen (DO) as well as sensory interpretations of colour and odour were conducted.



Landsat Satellite imagery showcasing the sampling sites on Deepor Beel as well as the Boragaon Dumping ground and Keotpara in Azara.

**Table. 1 : Location of Sampling sites**

Sl. No.	Site Name	Location	Latitude	Longitude
1	SS1	Near Azara	26° 7'4.51"N	91° 37'55.42"E
2	SS2	Near Azara	26° 7'0.79"N	91° 38'3.95"E
3	SS3	Near Azara	26° 6'54.20"N	91° 38'10.11"E
4	SS4	Near Azara	26° 6'53.19"N	91° 38'21.54"E
5	SS5	Near Boragaon Dumping Ground	26° 6'47.25"N	91° 40'31.29"E
6	SS6	Near Boragaon Dumping Ground	26° 6'44.32"N	91° 39'57.29"E

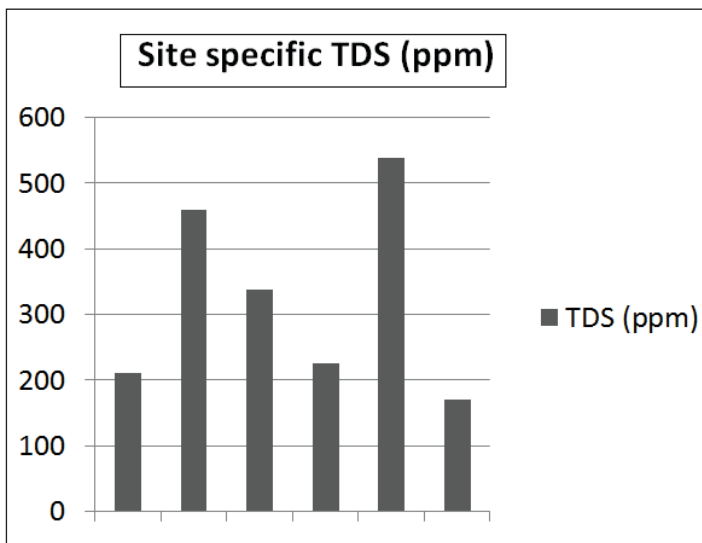
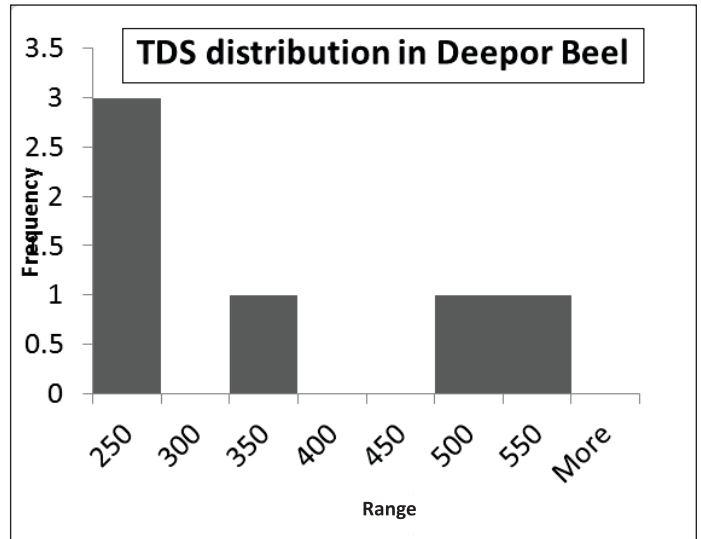
**Table 2 : Variation of ranges of water variables in different locations of Deepor beel.**

Water Parameters	SS 1	SS2	SS3	SS4	SS5	Ss6
Water Temperature (Celsius)	22	22.5	23	22.5	27	27
Colour	Blackish	Blackish	Blackish	Blackish	Black	Black
Odour	No Odor	No Odor	No Odor	No Odor	Foul Odor	Foul Odor
pH	7-8	7-8	7-8	7-8	8	8
TDS (ppm)	210	460	338	225	538	170
DO (ppm)	5.2	6.3	6.5	5.8	2.5	3.8
Turbidity (Secchi disk depth (cm))	15	16	15	15	20	21

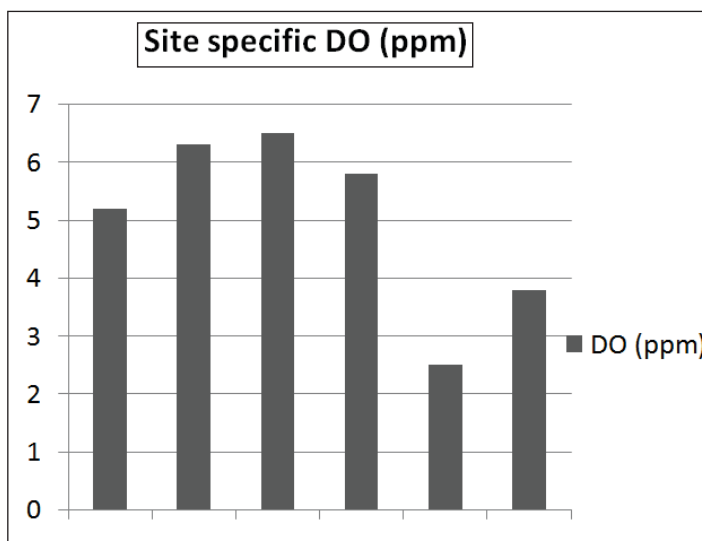
Impurities dissolved or suspended in water may give water different colored appearances since water in its pure form is colourless. The water samples near the dumping zone in Boragaon area exhibited tar black colouration whereas the colour of water in SS1, SS2, SS3 and SS4 were blackish with bad smell which usually indicates pollution and may be caused by chemical agents or decomposition of organic substances.



Water Temperature (WT) showed a range of 22°C to 28°C during the study period. Certain taste and odour producing organism grow more readily at a temperature range of 16 to 20°C. Hence recommendation for any acceptable limit should be guided by the temperature requirement at a specific locality necessary to preserve normal species diversity and prevent undesirable growth of nuisance organism (WHO, 1971; Patra and Azadi, 1985; Umeham, 1989; Jonnalagadda and Mhere, 2001). Freshwaters with a pH range of 6.0 to 9.0 have been noted to be productive and thus recommended for fish culture (Adeniji, 1986). Turbidity can be measured using several methods. The easiest and least expensive method is through the employment of a Secchi disk. A Secchi disk is an 8-inch diameter disk with alternating black and white quadrants that is lowered into the water column until it can no longer be

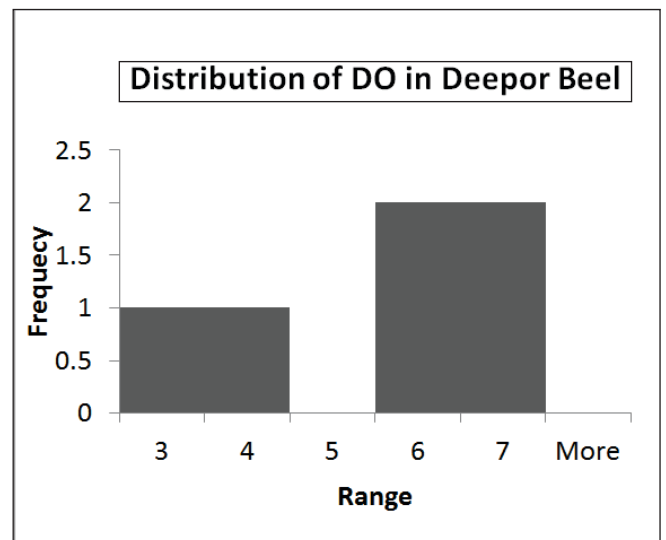


histogram demonstrates that the DO readings are most frequent in the range of 6 to 7. The DO increases the palatability of water because of its ability to remove undesirable taste. A dissolved oxygen concentration of not less than 5 ppm is required to sustain fish and other aquatic life in water bodies. TDS was found between 170 mg/l (SS 5) - 538 mg/l (SS6). At sites 1, 2, 3, 4 the TDS had been relatively less and one of the reasons could be rainfall.



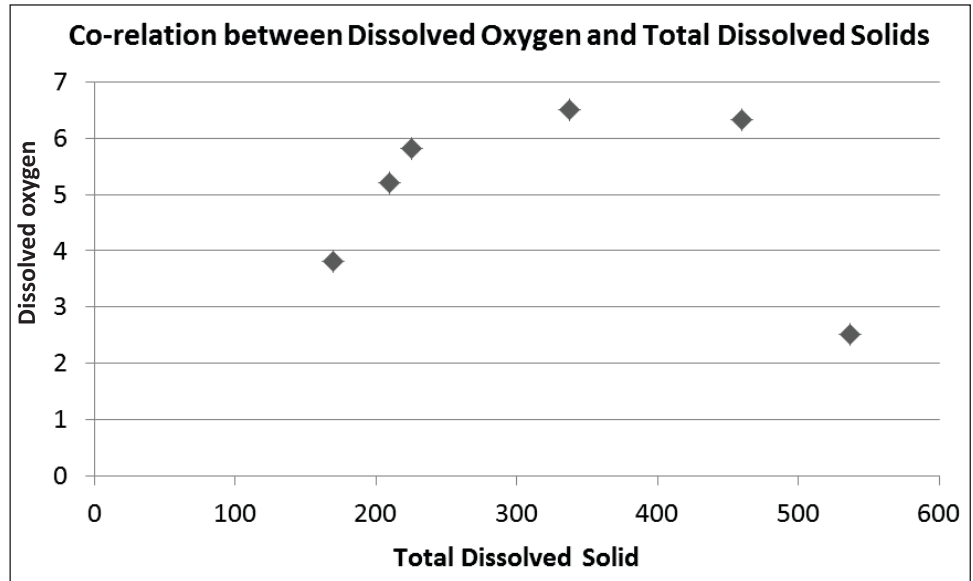
seen from the surface. The point at which the disk disappears is a function of the lake turbidity. The Secchi disk depth at Sample site 1, 2, 3, 4 was in the range of 15 to 16 cm and at Sample site 5 and 6 it was 20 and 21 cm respectively. The readings indicate highly turbid and eutrophic condition of the lake. Turbidity does not always harm fish; however, the reduction of sunlight intensity in the water decreases the productivity of water body. pH value of water found to range between 7 and 8 which falls within the desired range for fish production.

DO was found to be moderate in the sites 1, 2, 3, 4 and very low at site 5 and 6. Site 5 has the lowest DO of 2.5 ppm. The



The concentration and composition of TDS in natural waters is determined by the geology of the drainage, atmospheric precipitation and the water balance (evaporation-precipitation). Total dissolved solids cause toxicity through increases in salinity, changes in the ionic composition of the water and toxicity of individual ions. Increases in salinity have been shown to cause shifts in biotic communities, limit biodiversity, exclude less-tolerant species and cause acute or

chronic effects at specific life stages. TDS levels in lakes and streams are typically found in the range of 50 to 250 mg/L. In highly polluted water bodies it exceeds 500 mg/l. The correlation coefficient between Dissolved oxygen and TDS is a negative value of -0.21761 which demonstrates that the two variables are inversely related. A low DO value indicates a high TDS value and vice versa. However the negative correlation is not perfect since it is not a -1, and the few outliers suggest that the variability is dependent on other factors specifically heavy metal concentrates, organic contaminants and the abundance of macrophytes and phyto plantons . The abundance of phytoplanktons and free floating macrophytes in a water body can be an effective phytoremediation process which also lowers heavy metal concentrates and organic contaminants and thus there is a lower demand on dissolved oxygen levels (Rai, 2009 and Ali, Tripathi, Rai, Pal , Singh, 1999).



Graph showing co-relation between Dissolved Oxygen and Total Dissolved Solids.

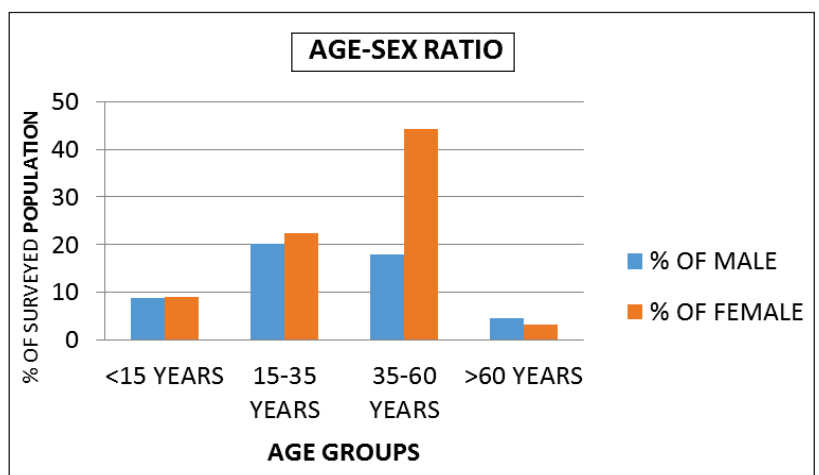
The analysis of water parameters suggests that the Deepor Beel water exhibits hyper-eutrophic conditions at certain zones. The unique layout of the water body with its remarkable shape of that of a neuron makes the ranges of its parameters extremely wide and the results heterogeneous. The major causes behind the infestation by *Echhornia crassipes* and algal scums are run offs of organic wastes from the dumping site that have accelerated eutrophication. The relation between TDS and Dissolved Oxygen suggests variability at certain sites the causes for which could be phytoremediation by aquatic macrophytes like *Eicchornia crassipes*, *Azolla pinnate*, *Pistia stratiotes*, *Lemna minor*, *Lemna major*, *Spirodela polkyrrhiza* of heavy metal and organic contaminant. The recent digging of the beel bed in number of locations in northern boundaries and heavy encroachments for settlements caused tremendous loss of wetland area and congestion of the natural outflow and inflow channels. Along with post monsoon data collection and analysis, further study on heavy metal concentration, population studies on aquatic macrophyte as well as microbial bio diversity is necessary to elucidate the extent of contamination and the span of ecological management practices to be implemented that are necessary for rehabilitation of this Ramsar site.

### Socio-Economic Survey for livelihood Indices , Vulnerability Assessment & Resource Mapping

Various aspects of social, economic and demographic aspects have been taken into consideration for social as well as economic resource mapping.

#### Social and Economic resources

The survey shows that of the total surveyed population 50.61% are male and 49.39% are female. The sex ratio of the surveyed area is 976, which is more than the national average. Average number of family members is five to six. Of the total surveyed households 64% households have male head of the family, where as 36% households have female head of the family. The age wise distribution of population shows that, 17.85% of the population has age below 15 years, 42.35% have age between 15-35 years and 32.14% have age between 35-60 years while 7.65% have age over 60 years. Average dependency ratio is 0.33. Of the total surveyed population 83.79% are literate and 16.21% are



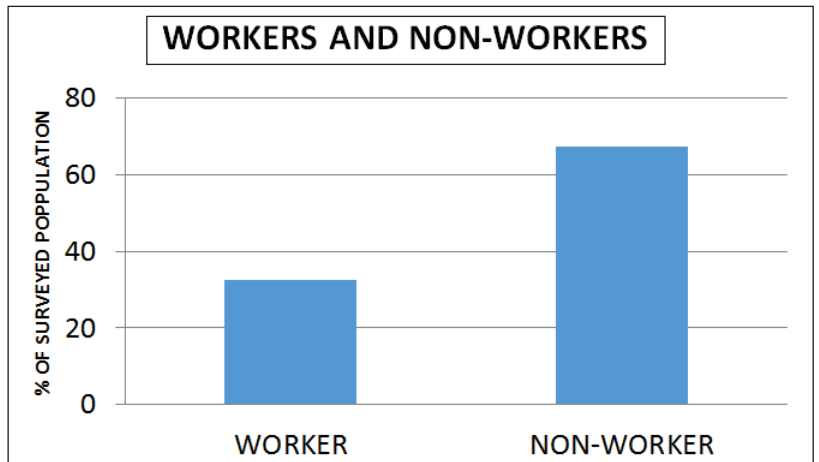
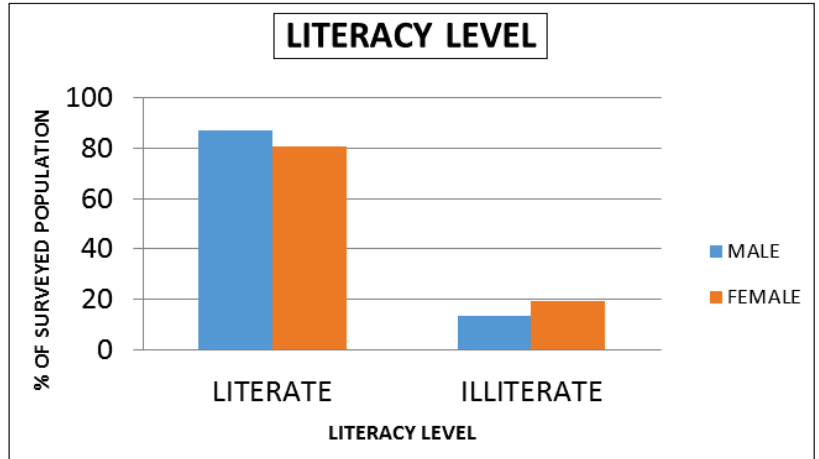
illiterate. 79% of the families have literate head of the family. It depicts that the basic literacy level of the area is above the national average.

Of the total surveyed population, only 32.65% population belongs to working group. About 30% of the households are directly dependent on the agricultural livelihoods. 87% of the surveyed households have own land while 40% of the households have fertile land. Monthly income for most of the families ranges between Rs. 3000 to 10000. About 49% of the households have livestock at their houses

**Livelihood Strategy**

Communities around Deepor Beel are dependent on the wetland for their livelihood directly and indirectly from time immemorial. The main livelihood of the community in the surrounding villages is fishing. Many villagers practice agriculture and livestock farming in the surrounding lands of the wetland. Other than these, large number of poor people also depends on collecting natural resources, such as vegetables, medicinal plants etc. from the wetland area which supplement their livelihood. The study tried to quantify the dependency of the community on the wetland.

**Fishing :** The survey reveals that as high as 86% of the total surveyed households practice in fishing to various extents in the wetland for livelihood. The fishermen belong to scheduled cast and scheduled tribe, who have fishing right in the wetland and are member of 'Panchpara Fishing Cooperative'. In spite of the continuous diminishing return from the wetland, still a good number of households (26% of the total surveyed households) primarily depend on fishing for their livelihood. One to three persons per households practice fishing. 65% of the total fishermen catch fish every day. There is both high level of temporal and spatial variation in daily fish catch. On an average, 1-1.5 kg fish are caught per person per day. Depending on the highly fluctuating market rate, on an average each fisherman earns Rs. 100 to 150 per day by saling fish at the local market. Fishes are caught twice a day following traditional techniques. There is wide seasonal variation in fish catch. Fishing is prohibited in the core area from March to May (as it is the breeding season for the fishes). This time fishes are caught mainly from buffer area. As a result the amount of fish catch becomes meager (average 500 gm fish/person/day). As a result daily income also decreases. Fish catch also becomes low during the winter season (November to January) due to increase in concentration of pollutants in the wetland water. This time on an average 2kg fishes are caught per person per day. The main



Deepor beel : SWOT FGD, Keotpara, conducted by SAFE team

fishing season is the rainy season (i.e. from June to October and February). In the pick fishing season, on an average 5-7 kg fishes are caught per person per day. The daily income also rises to Rs. 500 to 1000 per day.

**Agriculture :** Agriculture which was once very important livelihood for the wetland community is rapidly losing its significance as a result of various complex factors. The present survey reveals that though 40% of the surveyed households have share in the agricultural land in the surrounding parts of the wetland, only 17% of them practice agriculture at present and only 4% of the households are primarily depend on agriculture for their livelihood. Mainly 'Boro' paddy is grown in the surrounding areas of the wetland. The productivity varies from 60 to 80 kg paddy is grown per bigha. Vegetables, mainly potato, spinach and winter vegetables are grown in small pockets of the surrounding lands. On an average 50 to 60 kg vegetables are grown per bigha of vegetable fields. Both paddy and vegetables are grown mainly for personal consumption. Few farmers sale the surplus crop in the market.



Deepor beel : SWOT FGD, Matia, conducted by SAFE team

**Livestock farming :** Besides fishing and agriculture a wide number of villagers (49% of the total surveyed households) also have livestock and poultry in their houses such as cows, goats, pigs, hens, ducks etc. Livestock grazing and poultry farming is primary occupation for 6% of the total surveyed households. All the households having livestock depend on the wetland for fodder.

**Collection of natural resources :** Many people (about 30-40%) from the surrounding villages also collect natural resources such as spinach, roots of large water lily, medicinal plants and sale them at the local market which supplement their primary livelihood.



Deepor beel : SWOT FGD, Nowapara, conducted by SAFE team

**Livelihood Vulnerability**

In spite of these wide ranges of livelihood support offered by the wetland, the wetland and its dependent community are under severe stress. In response to the various complex drivers such as pollution, encroachment of the wetland area, crop damage by elephants, illegal soil digging etc. (discussed under section 3 in detail), the innate relation between the wetland and the community has changed in significantly. Fish production has reduced severely and has become highly fluctuating in the last decade mainly due to severe pollution and growth of weeds. Land for agriculture has been reduced considerably due to continuous urban encroachment as a response to peri-urbanization. Many of the villagers have also stopped agriculture due to regular crop loss by elephant attack.

Due to these factors, agricultural activities (fishing, agriculture, and livestock farming) have become economically

unprofitable. As a result many of the villagers have shifted from the traditional agricultural livelihood and got absorbed in various unorganized sectors of economy. It has resulted in severe economic insecurity among the community.

### Participatory SWOT Analysis to Find out Alternative Climate Adaptive Livelihood

The community based action research in the Deepor Beel area clearly shows that livelihood of the wetland community are under serious stress caused mainly by the rapid degradation of the wetland. The project aimed at finding out the community based remedial strategies that will lead towards intensification of ESs, innovations in agro-technology, conservation strategy that will ultimately lead towards efficient management of resources and overall sustainable development of the wetland community.

Participatory SWOT analysis method was adopted as a decision support tool to define the roadmap towards finding out climate adaptive sustainable alternative livelihood/s. In this regard two community meeting and participatory SWOT analysis were arranged at two villages adjacent to Deepor Beel, namely Keot Para and Chokor Doh.

### Results and Discussions

- The outcome of the participatory SWOT analysis can be summarized as below :

#### Participatory SWOT Analysis to Find out Alternative Climate Adaptive Livelihood at Keot Para and Chokor Doh, Deepor Beel, Guwahati, Assam

Most Suitable Alternative Livelihoods	Handloom Textile Cottage Industry for Women Community	Polyhouse Horticulture of High Priced Vegetables for the Men Community
<b>A. Strength</b>	1. 90% of the women in the area have skill in weaving textile products.	85% of the men have basic knowledge on agriculture.
	2. 80.62% of the female are literate.	86.87% of the male are literate.
	3. 80% of the families have weaving machines at home	60% of the families have basic agricultural tools.
	4. Almost all the families have own land and house.	
	5. 75% of the women have bank account.	90% of the men have bank account.
	6. 95% of the women are willing to have handloom textile goods production as alternative livelihood.	70% of the men are willing to adopt Polyhouse Horticulture as alternative source of income.
<b>B. Weakness</b>	1. 80% families belong to low income group and thus lack of financial resource.	
	2. 70% of the women have rudimentary knowledge in weaving but needs better training.	People have very low technological skill.
	3. 90% of the women have no idea about the market of the textile products.	80% of the men have no idea about market linkage.
<b>C. Opportunity</b>	1. Can create livelihood opportunity to the vast number of non-working women group.	Can create livelihood opportunity to the wide number of unemployed rural male.
	2. Financial security will increase women empowerment and social recognition of the women.	Sustainable livelihood will reduce financial insecurity of the families.
	3. Decrease the overall dependency ratio and will lead to better standard of living.	
	4. Livelihood security will lead towards reduction of dependency on natural resources.	
<b>D. Threat</b>	No immediate threat can be recognized at present condition.	People can shift from their traditional livelihood.

## Sustainable Agro-farming Intensification in Peri-urban Wetlands : Identifying Present and Alternative Livelihoods at Bondajaan Beel and Silsako Beel



*Bondajaan Beel*



*Silsako Beel*

Community meetings and primary household surveys have also been conducted around peri-urban wetlands around Guwahati city. The main aim of the survey was to find out the present livelihood status of the community as well as to find out alternative livelihoods for the community. In this respect surveys have been conducted at two wetlands namely Bondajaan Beel and Silsako Beel.

### Major Findings

#### *Bondajaan Beel*

Bondajaan Beel which is located at about 20 Km away from Guwahati city provide livelihood to approximately 200 to 250 families from surrounding five villages namely Rajabari, Bondacolony, Panikhaiti, Azobori, Uzanbazar and Monikornishwar.

According to the local people the physical condition of the wetland has been degraded significantly in past few years. The wetland which is fed by Brahmaputra has shrunk in size to 100 bigha approximately.

The main livelihood of the villager, living around Bondajaan Beel is fishing. Besides many of them are cultivators and wage labours mainly at industries and brick fields. Fishing is male dominant. Women belong to mainly non-worker category resulting in high dependency ratio. Fishing becomes banned during 3 to 4 months every year that which create utter livelihood crisis.



*Fishing : Bondajaan Beel*

**Silsako Beel**

Though fishing once was one of the main livelihoods of the community around the wetland, due to rapid urbanization community has shifted from their traditional livelihood to other livelihoods. During the survey, only a few fishermen have been found who catch fish only in rainy season.

**Scope of Alternative livelihoods**

The study reveals that there is utter need of alternative climate adaptive sustainable livelihoods for the community around the surveyed wetlands. Introduction of handloom cottage industry, composite pen culture and cultivation of high priced vegetables in poly-houses can be suitable alternative livelihood for the community.



Survey : Silsako Beel



Survey : Bondajaan Beel



Survey : Silsako Beel



## Meeting minutes of closing PMRC

Event	: Community Review Meeting : In Continuation to last PMRC meeting.
Agenda	: Review of the project and community feedback on project intervention and challenges.
Meeting conducted by	: SAFE project members.
Attended by	: NABARD official, Guwahati, Assam SAFE official Beneficiary Participants 55
Date & Time	: 14.12.2017 at 12.00pm-2.00pm
Meeting Place	: Project site: Dora Beel, Guwahati

### Meeting Resolutions

1. The fishermen community of Dora Beel, confirmed that they all attended the training programs and learnt about cage and pen culture methods and how to make the best out of the technology, which is simple, low cost and can be replicated in the ponds available, or individually owned by them. SAFE organized series of trainings for the community of Dora bill on Pen and cage culture in collaboration with CIFRI, (Central Inland Fisheries Research Institute), Guwahati.
2. What are the challenges at fishermen/beneficiaries level in carrying out the work for which they received training? The members from beneficiaries attending the meeting held on 14th Dec 2017, at Dora Beel said that, they do not have capacity to do the project themselves, as they are very poor and they sustain on daily earning basis, for whatever they earn through traditional fishing. The other challenge the retention of water in ponds after monsoon is over. The pond dries up and fish cultivation becomes impossible at their individual/group level.
3. What about the Joint Liability Group? Why it is not yet done? The members from beneficiaries/fishermen said, "We have total 37 members/fishermen's names registered in the group, almost six members in each group, but most of us have voter card, even Aadhar card, but we have no Pan card, and Pan card of group members is mandatory to open the bank account of JLG. This is one reason despite group is formed; we could not formalize the JLG by opening a bank account".
4. According to NABARD official: Pan card can be made, and we request you to take the initiative yourself, it is not so difficult to get a Pan card done. Also how it would be if loan facility is given? For felicitating loan JLG is required, as it works as a guarantee to the bank. This makes processes easier for bank. According to fishermen/beneficiaries, due to lack of documents they are unable to formalize the bank account of JLG, also they are apprehensive and confused on loan and credit facility, and it is better if they can get interest free loans.
5. As retaining water is a challenge at Dora Beel ponds, and pond can be created using geo-membranes, but the project of that scale needs to be taken up by the government agencies/depts..
6. After series of extensive trainings, even beyond the project frame, SAFE had committed to the community to provide {2} Pen and cage culture infrastructure to each JLG, with initial fish fingerlings and fish feed, but the condition was the formalization of the JLG, however due to lack of documents of JLG members as required by bank, this could not be done till date.
7. Three immediate need or solution as highlighted by community for betterment of their livelihood proposed by community are:
  - Digging of the pond-To retain the water for longer period of time, this will secure the fish cultivation.
  - Dairy farming
  - Loans free of interest or with very low interest.
8. SAFE project team, and NABARD official expressed concern, that during winter, as water is low, and traditional fishing is almost impossible to carry out, which means that fishermen community is suffering seasonal unemployment, and they are also not prepared for this crisis. It is important, that they risk preparedness and Pen and Cage culture can work as a savior for them in this lean period.



## Closing PMRC at a glance on camera



Meeting attended by:

From NABARD : Abhjit Deuri, Manager

From SAFE : Amrita Chatterjee, Director, Communications  
Ananda Ghosh, Chief Program Coordinator  
Wazim Ahmed, Program Coordinator

Community Representative : 55 heads



*Deepor beel : Scientific intervention*



*Deepor beel : Enchroachment*



*Deepor beel : Enchroachment*



*Deepor beel : SWOT, FGD*



*Deepor beel : Community conservation with SAFE*

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