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An Investigation on Assessment of Ecological and Socio-Economic Condition of Khamrenga Wetland, Assam,India

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Abstract: Wetlands, also called water bodies or aquatic ecosystems, are most aptly described as the waterlogged wealth of the nation. Wetlands provide many important services to human society but are at the same time ecologically sensitive systems. Floodplain wetlands, by virtue of their productivity potential as well as magnitude, constitute one of the frontline areas, capable of contributing substantially to aquatic production. This explains why much attention has been focused on sustainable management strategies for wetlands in recent years. Wetlands provide far more indirect benefits. Many wetlands have been modified and are managed by humans for specific purposes. The present paper considers the potential integration of insights and methods from natural and social sciences to better understand the interactions between ecology, economies and wetlands. Both natural and social sciences can contribute to an increased understanding of relevant processes and problems associated with such strategies.

KeyWords: Wetland, Ecosystem, socio economic

1. INTRODUCTION

Northeast India is blessed with a wide range of physiography and eco-climatic conditions. The State of Assam has extensive flood plains. Wetlands have spectacular wildlife viz. various species of fish, phytoplankton and zooplankton. Some of them are the main centres for rare and endemic avifauna (birds) both migratory and resident. Apart from this, conservation of biodiversity, recharging of groundwater and hydrological cycles are also very much dependent upon wetlands. They too represent our rich natural heritage. Despite so many uses and merits of the wetlands as stated above, our fresh water ecosystems are today very much threatened by pollution. Some of the water bodies, especially lakes and streams, are shrinking in size. It is all due to large scale biotic pressure viz. population explosion both of human beings and live stock, over exploitation of resources, siltation, encroachments, weeds infestation and reclamation for agriculture.

Study area

World Wetlands Day program was organised in Khamranga Beel. The Khamranga Beel is locate in Chandrapur which is very near to Guwahati City, Assam. Khamranga Beel is surrounded by the Amchang Wildlife Sanctuary. Khamranga Beel located at coordinates 26.224°N and 91.920°E. the communities residing along the wetland are mainly Bodo, Hajong, Rabha and Schedule caste people.

Objectives of the study

1. Identify the biotic and abiotic status of wetlands based on qualitative and quantitative study.
2. To study the pattern of the wetland utilization by the social groups living near the wetlands
3. To explore suitable restoration, prospects and conservation strategies

2. METHODOLOGY

Primary Data

The primary data was collected through field work on ornamental fish diversity, fish catch, fishing gears employed and the extent of human encroachment of the beel. Fishes collected were identified using standard manuals. Habits and habitats were studied in the field. Fishes were preserved in 5% formalin solution and brought to the laboratory.

Secondary Data

Data regarding the total area of the beel, water spread area, feeder channels, vegetation,etc were collected from Assam Remote Sensing and Application Centre, District fishery Office, Circle office, Internet, Draft Master Plan of Greater Guwahati prepared by GMDA etc. Information regarding govt. policy was collected from GMC and GMDA. Information regarding rainfall, humidity, air temperature was collected from Regional Meteorological Department etc.

Field Study

Extensive field work was done from the month of January 2018 to March 2018.Traverses were made along the fringe of the beel and also along the inlet and the outlet channel. Different points which are vulnerable to environmental hazards were closely studied. Traverses were also made across the beel by a boat.

Physico-Chemical Parameters

Physico-chemical parameters were studied after APHA, 1989.

Biological Parameters

Biological parameters were studied after Goswami, 1985; Lahon, 1984.
The present export value were studied after Reddy, (1987); Elambarithy, (1989); Dey, et.al, (2002) and INTERNET data.

Collection Of Sample For Study

The water samples are collected in pre cleaned polythene jar of 5L capacity. The sample is collected by lowering a closed bottle to the bottom and opening and closing it by hand and then bringing it to the surface. Records for every sample collected are made and identified by attaching a label. For estimation of DO separate bottles (300 ml capacity) are used. Water is collected beneath the water surface and opposite to the water flow. The macrophytes and macro invertebrates were collected using nets or hand picking. Some were fixed in 70% ethanol or 4% formalin solution at the time of collection, while others were identified at the field.

3. RESULTS AND DISCUSSIONS

Physcio-Chemical Parameters

1. Colour and odour: The colour was found to be pale straw colour in some parts of the wetland. Most parts of the wetland had clear water.
2. Atmospheric Temperature: The maximum temperature during the day was found to be 21.5°C and minimum temperature recorded was 12.0°C. During the monsoon and post-monsoon period the maximum and minimum temperature would vary. The degree and annual variation in temperature of a water body have a great effect on the water temperature.
4. Water Temperature: It is the most important ecological factor plays a major role in the life cycle of living organisms. It may kill aquatic organisms if it exceeds the upper or lower lethal level for no more than an hour or two. In an aquatic ecosystem the influence of temperature is due to the fact that the body temperature of aquatic organisms varies with and is almost the same as that of their own. The water temperature was recorded to be 11°C on that day.
5. Turbidity: Turbidity is the resultant effect of several factors like suspended soil particles, planktonic organisms, humic substances produced through decomposition of organic matter, etc. Turbidity was measured by Secchi disc visibility. Turbidity resulting from plankton is generally desirable. But heavy blooms limits heat and light penetration thus reducing the effective volume of the productive zone. The turbidity was found to be optimal.
6. pH: pH is the measure of the intensity of alkalinity or acidity and measures the concentration of Hydrogen ion in water. Water pH affects metabolism and physiological process of fishes. pH also exerts considerable influence on toxicity of ammonia and Hydrogen sulphide as well as nutrients and thereby water fertility. During the study the pH was found to be 7. During monsoon and post-monsoon the pH may vary.

Macro Invertebrates

Freshwater benthic macro invertebrates, or more simply "benthos", are animals without backbones that are larger than ½ millimeter (the size of a pencil dot). These animals live on rocks, logs, sediment, debris and aquatic plants during some period in their life.

Benthos is an important part of the food chain, especially for fish. Many invertebrates feed on algae and bacteria, which are on the lower end of the food chain. Some shred and eat leaves and other organic matter that enters the water. Because of their abundance and position as “middlemen” in the aquatic food chain, benthos plays a critical role in the natural flow of energy and nutrients. As benthic invertebrates die, they decay, leaving behind nutrients that are reused by aquatic plants and other animals in the food chain.

Macro invertebrates that were identified during the study include:

1. Crustaceans such as larvae , pupa, nymphs and some adults of caddish flies, beetles, diptera, Lepidoptera,damselflies,mayflies,beetles, bugs, mosquito, Cyclops, Daphnia, freshwater shrimps, crabs etc.
2. Molluscs such as pondsnails, pila.
3. Annelids such as leech, earthworm
4. Nemotodes

Macro Phytes

Aquatic macrophytes are aquatic plants that are large enough to be apparent to the naked eye; in other words, they are larger than most algae. Aquatic macrophytes characteristically grow in water or in wet areas and are quite a diverse group. For example, some are rooted in the sediments while others float on the water's surface and are not rooted to the bottom. Freshwater macrophytes play a very important role in aquatic ecosystem. They provide, either directly or

indirectly, food, shelter, and a variety of habitat for a large number of organisms , both aquatic and avian fauna. Aquatic plants absorb dissolved minerals and enrich water with oxygen produced during photosynthesis. From an ecological point of view, the diversity of species present in the wetlands is an indication of the relative importance of the aquatic biodiversity issue as a whole In disturbed bodies of water rampant growth of aquatic plants may interfere the ecology of the water body. They obstruct water flow, navigation or water intakes. Weeds are unwanted or undesirable plants or vegetation that interfere the biology of the water body.
The aquatic macrophytes observed during the study are:

1. Free floating: The plants with their whole shoots float freely above the water surface and generally remain non rooted in soil. Eg. Eichhornia sp. , Pistia sp.
2. Rooted floating: The plants are firmly rooted in the bottom but leave rise above from rhizome and float into the water and above the surface. Eg. Hydrilla, Vallisneria etc.
3. Submerged: The plants have most of their vegetative growth beneath the water surface. In case of few species only inflorescences rise just above the water surface. Eg. Members of Hydrocharitaceae, Nymphaeaceae (*Euryale ferox*),
4. Emergent: The plants grow in the shallow or in marshy places. Most of the shoots remain erect above the water surface. Eg. Reed, grasses etc
5. Marginal: The plants growing initially from the edge of beel, ditches etc Eg. *Ipomoea* sp., *Castor* sp, *Ziziphus* sp, etc.

Avian Species observed on the day.

1. Little Cormorant: The little cormorant (*Microcarbo niger*) is a member of the cormorant family of seabirds.
2. Little Egret: The little egret (*Egretta garzetta*) is a species of small heron in the family Ardeidae.
3. Cattle Egret: The cattle egret (*Bubulcus ibis*) is a cosmopolitan species of heron found in the tropics, subtropics, and warm-temperate zones.
4. Black Crowned neck Heron: Black-crowned Night-Herons (*Nycticorax nycticorax*) are small herons with rather squat, thick proportions. They have thick necks, large, flat heads, and heavy, pointed bills.
5. Asian Open Billed Stork: The Asian openbill or Asian openbill stork (*Anastomus oscitans*) is a large wading bird in the stork family Ciconiidae.
6. Lesser Whistling-Duck: The lesser whistling duck (*Dendrocygna javanica*), also known as Indian whistling duck or lesser whistling teal, is a species of whistling duck that breeds in the Indian subcontinent and Southeast Asia. They are nocturnal feeders that during the day may be found in flocks around lakes and wet paddy fields.
7. White-Breasted Waterhen: The white-breasted waterhen (*Amaurornis phoenicurus*) is a waterbird of the rail and crake family, Rallidae. They are dark slaty birds with a clean white face, breast, and belly.
8. White Breasted Kingfisher: The white-throated kingfisher (*Halcyon smyrnensis*) also known as the white-breasted kingfisher is a tree kingfisher.
9. Indian Treepie: The rufous treepie (*Dendrocitta vagabunda*) is a treepie, native to the Indian Subcontinent and adjoining parts of Southeast Asia. It is a member of the crow family, Corvidae.
10. Bronze-winged jacana: The Bronze-winged jacana *(Metopidius indicus*) is a wader in the family Jacanidae. It is an inhabitant of well-vegetated wetlands, especially ponds and lakes with floating vegetation.
11. Red wattled lapwing: The red-wattled lapwing (*Vanellus indicus*) is an Asian lapwing or large plover, a wader in the family Charadriidae.

12. Spotted Dove: The spotted dove (*Spilopelia chinensis*) is a small and somewhat long-tailed pigeon that is a common resident breeding bird across its native range
13. Coppersmith Barbet: The coppersmith barbet (*Psilopogon haemacephalus*), also called crimson-breasted barbet and coppersmith, is an Asian barbet with crimson forehead and throat.
14. White wagtail: The white wagtail (*Motacilla alba*) is a small passerine bird in the family Motacillidae, which also includes pipits and longclaws.
15. Oriental Magpie Robin: The Oriental Magpie-Robin (*Copsychus saularis*) is a medium-sized robin (19-20 cm) with a broad white wing-bar running from the shoulder to the tip of the wing.

Socio-Economic Characteristics of the Respondents and Households

Among the respondents, 58% were females and 42% males. Age distribution of the respondents ranged from 21 to 90 years with an average of 50 years. The marital status of the respondents comprised of 71, 28, and 1% for married, widowed and single, respectively. Most of the respondents had attained primary school education (57%), while those with no formal, secondary, and college education levels were 27, 14, and 2%, respectively. Each household had an average of 5 people with a minimum of 1 person and maximum of 12 people. Among the households, 86% (194 households) were deriving such as crops, water for irrigation, aquaculture and livestock, water hyacinth and fiber, mustard and pasture from the wetland. The remaining households (32 households) had never derived any provisioning from the wetland. Average annual household income for the year 2017 from non-wetland activities was about INR 1000.00 and ranged between INR 0 and INR 9000.00. Comparing socio-economic characteristics between wetland cultivating and non-cultivating households, the results show that most households cultivating in the wetland areas were male-headed (80%), did not have alternative sources of income (59%) and were not harvesting fishes from the wetland.

Problems and Prospects of Khamrenga Beel:

Natural resources are the basic source of survival for humankind. The need for the conservation of fish is the bounden duty of the populace of the country for prosperity. The approach of planning, development and management rests on established interdependence of water, land and people. The success of aquatic ecosystem protection venture ultimately depends on the creation of mass awareness and participation of local people. This concern has increased with the loss of aquatic biodiversity population sizes of many species of fish countrywide and extinction of a number of species. Undoubtedly, the loss of aquatic biodiversity and genetic variability will severely affect sustainable fisheries development. Wetlands provide many services and commodities to humanity. Regional wetlands are integral parts of larger landscapes, their functions and values to the people in these landscapes; depend on both their extent and their location. Each wetland thus is ecologically unique. Wetlands perform numerous valuable functions such as recycle nutrients, purify water, attenuate floods, maintain stream flow, recharge ground water, and also serve in providing drinking water, fish, fodder, fuel, wildlife habitat, control rate of runoff in urban area, buffer shorelines against erosion and recreation to the society. The interaction of man with wetlands during the last few decades has been of concern largely due to the rapid population growth- accompanied by intensified industrial, commercial and residential development further leading to pollution of wetlands by domestic, industrial sewage, and agricultural run-offs as fertilizers, insecticides and feedlot wastes. The fact that wetland values are overlooked has resulted in threat to the source of these benefits. Wetlands are often described as “kidneys of the landscape” (Mitsch & Gosselink 1986).

Problems relating to the degradation of the wetland

1. **Reduction of Size of the Water Body:**

During the study, it was found that an increase in the pressure of livelihood has resulted in encroachment onto the beel. As there is no marked demarcation of the beel area and the residential area, plots of land from the beel are being sold at a very high price. Besides private construction, a few government establishments have been set. Moreover, land has been allotted to a few nongovernmental undertakings. As a result of encroachment either due to roads or human settlements, the drainage channels carrying water into the beel is blocked affecting water inflow into the beel.

2. **Soil Erosion:**

The main cause of the deterioration beel water is the continuous in flows of inorganic sediments and nutrients deposited into the beel from their catchments. These include sand, silt and clay, in high concentration. This unwanted growth of weeds creates deficiency of oxygen supply and ultimately influences the other aquatic life.

4. **Over-Exploitation of Natural Resources:**

Due to ignorance among the local people, there has been an over exploitation of natural resources. Illegal felling of trees, over fishing using un- scientific methods, dumping of garbage are some of the causes. Fishing is also carried out during the breeding season resulting in the depletion of stock and also hampering regeneration.

5**. Agricultural Conversion:**

Most of the fringe areas of the beel are used by the local people for agriculture. To sustain their livelihood, they either encroach upon the area of the beel or use the beel during the dry months to earn a livelihood.

6. **Use of Pesticides in Cultivation on the Fringes of the Beel**:

The beel dries up during the summers and the community residing on the periphery of the beel starts cultivation within the wetland area. As the cropping cycle is short (approximately three months) vegetables are mostly grown here. This cultivation of vegetables triggers the usage of pesticides within beel.

7**. Eutrophication**:

Ammonia from animal waste and agricultural fertilizers contributes to eutrophication, which kills aquatic and plant life. Eutrophication is the enrichment of waters with plant nutrients especially phosphorus and nitrogen. This leads to an increase in growth of algae and macrophytes and can result in visible plankton bloom and algal mats, which are not desirable. Decomposition of these plants depletes the Dissolved oxygen (DO2) and release undesirable substances including toxins and hydrogen sulfide.

8. **Use of Unscientific Devices for Fishing:**

Use of small mesh size nets for fishing, it was reported that small mesh size nets are used for fishing in beel, as a result, the spawn and fingerling are netted out resulting in depletion of stocks in the beel.

Prospects of the Beel

If the potentialities of the beel are properly utilized, it can be a source of income generation for the Government. The beel can be developed into a site for eco-tourism. The beel can also be developed into a bird sanctuary as many resident and migratory birds use the beel as breeding and nesting ground. Fishing activity can also be allowed in some parts of the beel for the tourists. But the sustained fisheries development of the beel will require both micro and macro planning approach. As the micro planning approach is essentially project-oriented and involves investments in a carefully planned manner, all important aspects concerned with the project cycle such as identification, appraisal, financing and subsequent implementation will be

required. While this needs to be continued, greater attention is needed to be devoted for macro planning, requiring sectoral development approach. Thus, it is imperative that some form of co-management with local communities be established for the beel.

4. CONCLUSION AND RECOMMENDATIONS

For the above causes following measures can be taken:

1**. Protection of the Vegetation of the Catchment:**

Since all the fringe areas/watersheds are highly deforested, so after reforestations, these must be protected. These may be fenced as they are small areas. Fencing will exclude all biotic interference. Moreover, the wetland should be included under Amching Wildlife Sanctuary.

2. **Development of the Catchment:**

Instead of allowing the catchments to degrade & deteriorate further, plans must be drawn to develop them aesthetically. This can be done by intensive tree planting measures, introducing ornamental trees and flowering shrubs/ herbs. This will promote tourism as aquatic ecosystems-based tourism has been a bright historic and traditional development.

3. **Encroachment Control:**

The need of the hour is, therefore, to have strict measures to protect it from encroachments.

4. **Restoration of the Waterbody**:

Restoring the beel to its original and natural size as has to be done if possible. De-weeding and excavation should be done. Closing of the catchments to grazing and other human interferences is the basic measure as also the protection of vegetation against cutting.

5. **Pollution Control:**

Biotic interference in the catchments of wetland like cattle trespass which spreads cow dung in the areas and causes pollution be stopped. Carcasses of dead animals in the catchments are positive source of water pollution hence also require their proper disposal. Discharge of human and cattle wastes (solids & liquids) into the beel should be banned by law.

7. **Active Cooperation & Participation of the Local People:**

The local people should be motivated to understand that development of the water bodies is for their benefits & they must contribute emotionally in this development. Although during the survey it was found that the local communities are getting aware about the prospects and the importance of the wetland and are taking measures.

8. **Master Plan of Sanitation:**

To save the Khamrenga beel from further degradation, a master plan for the beel area needs to be drawn up and executed meticulously.

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