ABSTRACT

TITLE: WETLANDS OF TUFANGANJ AND KOCH BIHAR SADAR SUB DIVISIONS IN THE KOCH BIHAR DISTRICT, WEST BENGAL: A GEO-ENVIRONMENTAL STUDY

Wetlands can be considered as one of the vital components that maintain the ecological harmony of Nature. Wetlands play a significant role in biological productivity, flood control, ground water recharge, regulation of water quality and other activities. However, information from different sources reveals that nearly half of global wetlands have been lost, and the condition of remaining wetlands is deplorable. A study by the Wildlife Institute of India reveals that around 70-80% of fresh water marshes and lakes in the Ganga & Brahmaputra floodplains have been lost in the last 50 years. Sometimes the damages to wetlands are unavoidable due to increasing population pressure. However, in other cases, it is the outcome of ignorance and indifference of individuals and institutions about the true value of wetlands.

The Koch Bihar district abounds in numerous wetlands, which include marshes, *beels,* and pools of stagnant water and tanks or ponds. These are mainly the remnants of the old beds of the river except tanks or ponds. They are named as *'Chhara', 'Dara', 'Doba', 'Jheel', 'Beel', 'Jampoi' and 'Kura'.* The wetlands of the district are presently facing a serious threat to their existence due to land & water pollution, disruption of wetland ecosystem and shrinkage of wetland area. Consequently, for regulation of these problems, there is a dire need for geo-environmental study and research.

The major objectives of the present study are to i) classify and study the distributional pattern of the wetlands ii) investigate the present use of wetlands of the study area iii) examine the present environmental status of the wetlands iv) assess the nature and dimension of degradation of the wetlands within the study area v) provide a conservation framework and management strategies for the wetlands.

Considering the all above objectives the present research has been made with the title "Wetlands of Tufanganj and Koch Bihar Sadar Sub-Divisions in the Koch Bihar District, West Bengal: A Geo-Environmental Study".

To fulfill the objectives, the researcher has adopted a rationalistic and scientific approach. Data on pisciculture, agriculture, use of wetland, flora and fauna endemic to the wetlands and land use in the fringe area of the wetlands were collected through questionnaires especially designed for the purpose. Water and soil samples were collected in pre-monsoon and post-monsoon from selected wetlands of the study area and were tested in the laboratory.

Different species of floras were collected in different seasons of the year with field note and then herbariums were prepared for the identification process. Faunal information was collected with the help of observation and photography method. For intensive field study researcher has selected 10 wetlands of various categories as the representatives of all the wetlands of the study area.

Besides primary data, the researcher used secondary data of different sources such as National Wetland Atlas (West Bengal & India), Hand Book on Government Water Bodies, West Bengal, Hand Book on Fisheries statistics, Koch Bihar, Statistical Hand Book, Koch Bihar etc. Collected data has been presented with different cartographic techniques and different statistical methods like Karl Pearson's Correlation Coefficient, Z-test, ANOVA, Standard Daviation, Standard Error of Estimation, Chi- square (χ^2) Test, Water Quality Index. The map of the wetland has been prepared from the SOI topographical map, Satellite imageries, Google Earth, Bhuban platform and ground survey data using GIS software.

The study investigates the geo-environmental status of wetlands of the study area. The whole research has been divided into seven chapters. The first chapter deals with the statement of the problem, location of the study area, objectives, hypothesis, database and methodology, significance of the study and review of the related literature. The second chapter incorporates the general background of the study area. Chapter three deals with the definition of wetland, classification of wetlands, distribution of wetlands in India, West Bengal, Koch Bihar and the

study area. Chapter four discusses about the common use of wetlands in the study area and specific use of selected wetlands with reference to land use and land cover of the surroundings of the wetland. Chapter five deals with the environmental status of wetlands of the study area by analyzing the water & soil quality of wetland and floral & faunal status. Chapter six discusses the main causes of degradation of wetland in the study area and consequences of wetland degradation in relation to the environment and economy of the people in the vicinity of the wetlands. Chapter seven reveals the existing conservation policies and legislation in India, major findings of the study and the corrective measures to be taken for the development of wetland followed by overall conclusion considering the essential points from the preceding chapters.

In the present study, a detailed investigation on the nature of the wetlands and their modifications are made and then Wetlands are categorized into three broad divisions namely Natural wetland, Quasi-natural wetland and man-made wetland. Of all the wetland, rivers are most abundant (63.08%) followed by oxbow lakes (18.55%), riverine wetland (6.12%), quasi-natural oxbow lake (5.47%), pond (3.39%), quasi-natural riverine wetland (2.09%) and lastly brick/clay/sand pits (1.30%). The researcher has identified 486 wetlands that cover a total area of 7898 ha, in the study area. On the other hand, the number of Government wetlands in the study area is only 85 covering an area of 904.51 ha.

Through the survey conducted, it is revealed that with the exception of few, the wetlands have 27 types of services or uses in the study area. Most of the wetlands in the study area provide moderate to low wetland services. In Rasik beel wetland complex, out of 27 services, very common wetland service is 2 in number, fairly common 4, rare (on the verge of extinction) 17 and not found 4 in number. In Dangdhar Chhhara, fairly common services are 5 in number, rare (on the verge of extinction) is 10, not found is 12. In Rasomoti Jheel very common services are 2 in number, fairly common is 3, rare (on the verge of extinction) is 4 and not found is 18. In Baiganbari Chhara, very common wetland services are 3 in number, fairly common is 6, rare (on the verge of extinction) is 12, not found is 6 in number. In Sagardighi, very common wetland services are 3 in number, fairly common is 4, rare (on the verge of extinction) is 5 and not found is15. Based on the above study, it is observed that on an average

46.8% of services are not found, 32.10% are rarely observed, 15.43% services are occasional and only 6.17% services are commonly observed. A sharp decline in the number of services is observed in Chandan Dighi (20) and Rasomati Jheel (18) on accord of being the most degraded wetland in the study area and a protected wetland respectively.

The pH values of all selected wetlands except Sagar Dighi (9.2) are below the standard limit for aquatic life. The TDS, EC and Iron parameters of water were remaining at the permissible limit for aquatic life. The dissolved oxygen (DO) level, required for a healthy aquatic life is very low in Dangdhar Chhara (3.8 mg/L) and Chandan Dighi (1.8 mg/L & 1.9 mg/L) since Dangdhar Chhara is located in the vicinity of brick kiln industry and Chandan Dighi is the most neglected and is a dumping site of waste materials. The BOD level was also so high in Dangdhar Chhara (81mg/L) and Chandan Dighi (86.9 mg/L) and only Satwabhanga Nadi had BOD at the permissible limit in all season. The value TA and TH of water was at the permissible limit in all the selected wetlands except Rasomati Jheel. The free CO_2 of water is much higher than the standard value in all the selected wetlands except Sagardighi.

The pH of the soil in the wetlands bottom was at permissible limit except Sagardighi. The Organic Carbon levels are much higher than the standard levels in Bochamari Beel (4.95 percent), Rasomati Jheel (4.57 percent), Satwabhanga Nadi (3.61 percent), indicating eutrophication. The lowest nitrogen concentration is found in Baiganbari Chhara (37.63 mg/kg) which is unsuitable.

From the survey, a continuous decline in the aquatic life and extinction of many endemic species is observed. In the wetlands of the study are 66.67% flora and 55.56 % fauna may on the verge of Extinction. For example, indigenous reptiles like *Gharials* and turtles, amphibians like Bull Frog (Rana Tigerina) etc cease to exist now.

The major causes of wetland degradation are i) sedimentation in wetland bed ii) blockage of feeder channel iii) construction of engineering structures and fishing obstacles in the wetlands. iv) encroachment of wetland v) over-exploitation of wetland resources like

excessive fishing, irrigation, agriculture, Jute retting v) fragmentation of the wetlands vi) garbage dumping & pollutants inflow in wetlands.

Consequences of the degradation of wetlands and their effect on the environment and economy of the individuals in the vicinity of wetlands are identified by water quality index (WQI), soil quality standard, floral and faunal status, areal shrinkage and effect on the local and regional economy. In the study area, all selected wetlands are unsuitable for aquatic life except Sagar Dighi (WQI=30.66) and Rasomati Jheel (WQI=43.92). The water area of the wetlands in the study area is steadily declining as observed between the years 1971 to 2017. Baiganbari Chhara has witnessed the maximum negative change (-84.03) followed by Dhangdhar Chhara (-34.74). The wetland degradation affects the occupation and economy of the surrounding inhabitants as 13% fisherman and 20.83% edible plant collectors were change their occupation.

Joint wetland management committees should be initiated by including the fishermen, farmers in and around the wetlands, selected government and NGOs officials for conservation & management of wetland and the betterment of the beneficiaries. Community fishing, poaching and hunting of residential and migratory birds in the wetlands should be stopped at any cost. Wetlands should be rented to the fishermen co-operative society or government involving local people and NGOs. Unwise construction of engineering structures like- roads, bridges, railway lines, and road cum embankments across the wetland constructed by various departments should be stopped.

Appropriate measures have to be taken to improve the economic and educational condition of the dependent community of wetlands that reduce the pressure on wetlands. The government may initiate many developmental activities like weeds clearance, afforestation programme by implementing National Rural Employment Guarantee Scheme (NREGS) and Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

The government should make arrangements for alternative occupation for the fishermen during the breeding period. Paddy cultivation should be replaced by the cultivation of different

wetland compatible edible plants like *Kalmi, Hincha* in the dry season and *Saluk* in the monsoon season.

The present investigation deals with the present status of wetland with some recommendations for the betterment of wetlands. It is clear from the study that health of wetlands of the study area is very poor. If the wetlands are properly managed, it may bring a change in the environmental and economic aspect of the study area.

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