A Geoenvironmental Study of Anjana – an endangered wetland in Krishnanagar I Block, West-Bengal

Dr. Indira Samajdar Gangopadhyay,
Assistant Professor, P.G. Dept. of Geography, Barrackpore Rastraguru Surendranath College, Kolkata

Article Info

Abstract

Wetlands are one of the most productive ecosystems on earth with multiple utilities in terms of ecology, economy and sociology. Hence this calls for a comprehensive study on the ecology and conservation of wetland. They are defined as "Areas of marsh, pen, peat land or water, whether natural or artificial, permanent or temporary with water i.e. static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed 6 m.", according to Ramsar convention (1971). But irony lies in the fact that wetlands have not been given the importance that they deserve and they are under constant threat. The present paper is concerned with this contemporary environmental issue i.e. degradation of wetland ecology of Anjana, a fresh water wetland, situated in Krishnanagar 1 block of Nadia district in West Bengal.

Introduction

Wetlands in West Bengal deserve special attention in order to understand their environmental consequences as well as socio economic impacts. In Nadia district wetlands are landscape systems relating to fluvial processes under humid environment of the part of lower Ganga basin. Nadia is the land of rivers like the River Bhagirathi, the River Jalangi, the River Bhairab, the River Mathabhanga,the River Icchamati and the River Churni. River Bhagirathi along with its meandering course and its tributaries to a little extent is constantly shifting towards east having an impact on the nature of wetlands. The natural process of shifting of the River Bhagirathi and its tributaries has formed several fresh water wetlands. They are mainly floodplain wetlands i.e. cut off meanders, ox bow lakes, dead and old river channels and marshes lying scattered all over the district locally called bils and khals. The studied wetland i.e Anjana is similarly an abandoned river channel (Fig 2). Urban development, population pressure and developing agrarian economy have lead to conversion, encroachment and pollution of these wetlands leading to its loss. Similarly at present the studied wetland is also under threatened condition. It is affected by several serious problems of siltation and excessive pollution. This in turn leads to decrease of water area, deterioration of water quality, eutrophication and algal bloom. In view of these facts proper conservation and management of this wetland and planned harnessing of its resources is necessary.

Location of the Study Area

Anjana bil is situated in Krishnanagar1 block under Krishnanagar Sadar subdivision in Saktinagar area. Its latitudinal and longitudinal extension is from $23^0 22'$N to $88^0 30'$ E Some of its portion is vested and is under the control of Fishery Department of the State Government and is managed by New Saktinanagar Fishermen's Cooperative Society (Fig. 1)¨

Objectives

The primary objectives of the study are :
1) To analyse the impact of degradation of the ecology of Anjana leading to its degradation.

2) To assess the effects of such loss on its biodiversity and stakeholders.

3) Lastly to suggest measures regarding the conservation of this fragile ecosystem.

Methodology

The present research work has involved certain methodological procedures. They are as follows -

The first phase includes collection of secondary data and information like maps, literature and data from different libraries, NATMO, the district fishery office.

Second phase has been based on study of wetland ecology of Anjana bil which involved intensive field study and collection of primary data and

Finally, analysis and preparation of the final report.

Geomorphology

Anjana is an abandoned channel of River Jalangi, almost dying. The wetland is mainly rainfed and is connected with River Churni at present. The depth of water varies seasonally (Table - 1)

Pattern of Utilisation of the Wetland

The wetland is mainly utilized for fishing, domestic work, irrigation, immersion of deities and other activities. Anjana is owned by the fishery department of West Bengal Government and fishing right is given to the cooperative society. Around 160 Quintal of fishes are produced from this Wetland and the average annual income of the fishermen is around Rs.1.2 million (Fig. 4 and 52)

Species Diversity

There is great diversity in floral and faunal species of the surveyed wetland in this block. The common flora of the wetland are Water Hyacinth, rooted submerged Hydrophytes like Hydrilla, Ottelia,Vallisneria etc. which grow at various depth. There are also plant species rooted in the mud but their leaves reach water surface and float. They are Nelumbo, Nymphaea, Trapa etc. There are free floating plants that are not fixed in the mud like Lemna,Wolfia, Pistia, Salvinia, Azolla etc (Table 2 and 3). Other fauna are Zooplanktons like Daphnia lumhaltazi, Moina micrura, D.carinata etc. Insects like May fly, Dragon fly, Water stridergerris,Water boatman, Whirling bettle, Leaf insect, Spiders ,Crab are common. Annelids like Earth worm, Leach are common. Molluscs like Lymnaa, Pila globosa etc. are common (Fig. 6 and 7).

Discussion and Analysis
Problems

Anjana is affected by high or medium rate of siltation which has resulted in gradual rising up of the bottom of wetland, decrease of water holding capacity and reduction of water area during summer. The command area for the water body is around 4 to 6 ha. Moreover the water body is affected by intensive pollution. The main source of pollution is sewage pollution like hospital effluent and domestic sewage. The part of Anjana which flows through Krishnanagar town is highly affected by pollution from sewage of Saktinagar jilla hospital, hospital marg and domestic sewage which includes human and animal excreta of the surrounding settlements of Krishnagar sadar area. This abandoned river channel provides the space for dumping purpose of municipal wastes of the locality, which not only pollute the water but also encroached some portion of the wetland and has profound negative impact on its environment.

These in turn causes accelerated eutrophication and algal bloom leading to diverse ecological changes within the system. High nutrient inputs are characteristics of Eutrophic condition. Nutrients such as, Nitrate and Phosphates are present in domestic sewage which also greatly increase the nutrient load in water bodies. Sewage, other organic wastes, animal and human excreta are classified as oxygen demanding waste. These organic wastes provide good substrata for the luxuriant growth of aerobic bacteria which decompose the waste and deplete oxygen. When these sewage and organic wastes are broken down, inorganic nutrients enrich the water. In this way, the mineral and salt contents of water body increases. This nutrient load greatly increases the productivity of water as these are essential for plant growth.

It promotes algal bloom and other macrophytes.The growth of algae and other organic matter promotes that of a large decomposer population which breaks down dead algae and other organic matter using oxygen from the water. Living organisms and the algae also consume oxygen at night for respiration .In this way, oxygen is greatly depleted from the wetland which causes serious problems to fish and other organisms. On the other hand this problem of excessive nutrient load accelerates the process of Eutrophication. (Fig. 8 and 9). At the Eutrophic extreme of the scale water becomes turbid, support dense algal growth but has a very low oxygen content supporting few animals. This Eutrophic wetland shows proliferation of Green algae, Blue Green algae which form a continuous mat commonly known as Pond Scum over the water surface. Light penetration and oxygen diffusion to the water below are greatly reduced to near zero, creating conditions that prove deleterious for most forms of aquatic life.

Development of high concentration of NH_3 and H_2S at the pond bottom due to accumulation of sludge endangers fish life. Parasitic infection in fish stock causing various diseases like tail and fin rot, worm diseases, potential microbiological problems were well observed by the researcher during her survey work. Due to the flow of domestic sewage in the bil, transmission of human pathogens are also associated with the health of the fishes which is well documented in

the water sample tested by the researcher. These toxic substances are highly persistent and thereby contaminate the entire biogeochemical cycle of the bil ecosystem which is a static system. The capacity of the ecosystem to satisfy the Biological Oxygen Demand (BOD) is exceeded and the condition deteriorates rapidly. The polluting power of different sources of wastes is reflected in the BOD values of the water sample test. The fish and other biotic communities come under physiological stress. It kills aerobic organisms including some micro organisms and invertebrates. It affects the growth and reproduction cycles of the majority of aquatic animals. Such a situation not only results in low fish output or fish mortality but is also responsible for transport of toxic materials in the users. It affects fish growth and gill, scales and muscle of fish which in turn affect human beings when consumed owing to accumulation of non biodegradable pollutants at different trophic levels. Eggs of fish are also affected, decreasing fish production. Smell of medicine in water and fish is also reported by the users and is also observed by the surveyor. Some of the fish species like Mourala, Nadosh, Khaira, Sarpunti, Chital, Boyal and Shoal have now become endangered species as being reported by the fishermen. Such pollution problems are also liable to affect faunal density and the users of this wetland. These are evident from decrease in the number of migratory birds and skin diseases of the users. The researcher has amply documented the toxicity of municipal residue and hospital effluents in her study which is analysed below.

Physico-Chemical Characteristics of Anjana

Anjana is situated in the urban areas and are affected by urban effluents. The water of this wetland is sampled for physical and chemical properties and bacteriological analysis. Analysis of these parameters has helped the researcher for highlighting the total picture of the physico - chemical characteristics of the bil. For this, samples have been collected on 23/1/2014 at 12.00 Noon. It shows that:

i) Temperature = 24 degree C: It is low and cooler water is not congenial for fish growth.

ii) Dissolved Oxygen (D.O.) = 5.6: The value is lower and sub optimal. It may be due to the fact that the sample is collected at noon and more organic load is in the bil leading to algae and macrophyte bloom.

iii) Biological Oxygen Demand (B.O.D) = 4.8: It is high due to presence of organic matter in heavy amount

Iv) pH= 7.81: It is optimal for fish production.

v) Free Carbon dioxide = 1 ppm: It is optimal.

vi) Phosphate = 0.29: It is higher due to presence of organic load in the form of domestic sewage leading to algal bloom.

vii) Nitrate Nitrogen = 0.007: It below the limit but

more or less good for fish production.

Bacteriological Analysis

Samplsehave been collected and analysed on 23/1/2014. It shows that faecal coliform bacteria = 20 CFU/100 ml water and faecal Streptococci bacteria = 30 CFU/100 ml water. Both the values are very high due to domestic sewage pollution and due to infiltration of sewage from Saktinagar Zilla hospital. It is of mixed origin due to the presence of human and animal excreta. Water is highly contaminated and not suitable for human use and aqua culture. Due to the presence of these bacteria, fishes are affected by bacterial diseases. Fishes are suffering from environmental stress due to depletion of oxygen and bacteriological diseases like tail and fin rotting, sores on body. Other aquatic organisms are also affected due to very low amount of D.O. and high B.O.D. Thus, the water of the wetland, Anjana is highly contaminated and is not suitable for aquatic ecosystem and for domestic use by human being.

Turbidity Status and Weed Infestation

This has been studied and analysed with the help of remote sensing software. It is observed that deeper the shade of green lower the turbidity i.e. more clear water, less sedimentation and less vegetative cover. This indicates higher absorption of light and more transparent water. On the other hand, higher turbidity and areas of macrophyte algae bloom are indicated by light and lighter green shades. It shows greater reflection of light and high rate of siltation. After classification, the fourth class indicates higher turbidity values and first class shows lowest values. i.e the pixel values ranging between 1 and 2 indicates low turbidity, between 2 and 3 indicates medium turbidity and between 3 and 4 indicates highly turbid water quality. It is observed from the diagram that most parts of the wetland are highly turbid and are infested with macrophytes. The main cause is high rate of suspended clay, silts and organic load due to sewage pollution leading to algal boom and weed infestation (Fig.8 and 9)

Conservation and Management

Wetland resource management implies sustainable use of its resources for maximization and long term benefit of society and minimization of waste products. In this context proper conservation and management of the wetland and planned harnessing of its resources is needed. In view of the fact, firstly the problems should be identified and accordingly management programmes should be taken up. Here the micro level planning is needed (Fig. 10 and 11):

1) Holistic approach for development of this flood plain wetland is a must with proper identification of activities to be implemented.

2) Timely arrangement of finance by the State Government for effective execution of project.· Is a

must.

3) Reducing the fish mortality by controlling water pollution, construction of sewage treatment ponds for the treatment of polluted water, restriction on numbers and types of gears, closed season and closed areas.

4) Proper monitoring of the activities by the Fisheries Department, GoWB in the frame work of environmental variables.·

5) Strengthening the extension services to make it more user friendly.

6) Development of eco-aquaculture is a suggestive measure in maintaining the good health of the aquatic ecosystem and also to sustain the farmers' interest in the long run. It implies enhancement of the productivity of aquaculture systems as well as widening the scope of enhancing the income of the farmers through maintenance of a sustainable ecosystem with a safe limit of biodiversity

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So far, several steps have been adopted for conservation, up gradation and improvement of the pattern of utilization of the resources from the existing water body. They are as follows:

1. Dredging is needed to remove siltation particularly in dry parts of the bil. For this, Govt. Has already spent about Rs 32 lakhs.

2. Several Government schemes are running since 2009, viz., Duck cum Fishery, Social forestry, Air breathing fish culture.

3. Pension schemes for old fishermen, improved extensive fish culture, improved fish feed and water quality management should be formulated and itroduced.

4. Pollution can be checked by bleaching and clearing the wetlands with lime, potassium permanganate and organic material like cowdung. It also includes construction of sewage treatment ponds for treating polluted water. Social forestry and plantation of useful trees around the bil is needed for conservation purpose.(Plate no.7,8)

5. Quality of water of the wetland should be monitored continuously.

6. As far as the biodiversity is concerned this wetland has immense economic potential. So a list of threatened species must be urgently prepared. Efforts should be made to restore the habitat of the flora and fauna for conservation of the biodiversity.

7. Moreover, this wetland's resources are being used by the local people as a means of their sustenance. Hence, sustainable use and management of its resources is immediately needed.

Findings and Concluding Remarks

The major findings are as follows:

1. The wetland is mainly used for pisciculture, domestic work and immersion of deities etc.

2. The wetland is owned by the Fishery Dept. of Govt. of West Bengal and fishing right is given to the cooperative societies.

3. The bil is affected by siltation and pollution mainly

due to draining of hospital and municipal sewage and dumping of town garbage leading to profound negative impact on biodiversity and its users.

4. So the wetland at present is losing its effective water area and is under constant threat.

5. State Govt. has adopted some steps regarding its pattern of utilization, up gradation and management but these are not enough to resuscitate this ecosystem.

Wetlands play certain vital roles in maintaining the environmental sustainability of its neighbourhood. Therefore, its implication must be properly assessed with regard to attempt for its conservation and development by Government and Non Governmental Organizations. This research work may be viewed as a step forward towards sustainable utilization and conservation of this fragile ecosystem in Nadia district.

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Table – 1: Area and Depth covered by the water body

Bil	Area (ha)	Depth (ft)
ANJANA	16.50	4 – 6

Table – 2: Fauna- The common fish species

Scientific Name	Local Name
Major Carps	
Catla Catla	Catla
Labio Rohita	Rohu
CirrhinusMrigale	Mrigal
Silver Carp	Silver Carp
Minor Carps	
Puntius Ticto	Tit Punti
Puntius Stigma	Punti
Chaniformes	
Ophicephalus punctattus	Lata
Ophicephalus' striatus	Shole
Siluriformes	
Wallago attu	Boyal
Mystas mystas	Tangra
Osteoglossiformes	
Natopterus Chitala	Chital

Table – 3: The common bird species

Scientific Name	Local Name	Status
Phalacrcorox carbo	Boro Pankauri	Resident
P.furcicollis	Majhari Pankauri	Resident
P.niger	Choto Pankauri	Resident
E.garzetta	Choto Bak	Resident
E.intermediae	Majhari Bak	Resident
Nettapus	Bali Hansh	Migratory
Anasacuta	Dighi Hansh	Migratory
Alcedohercules	Choto Machranga	Resident

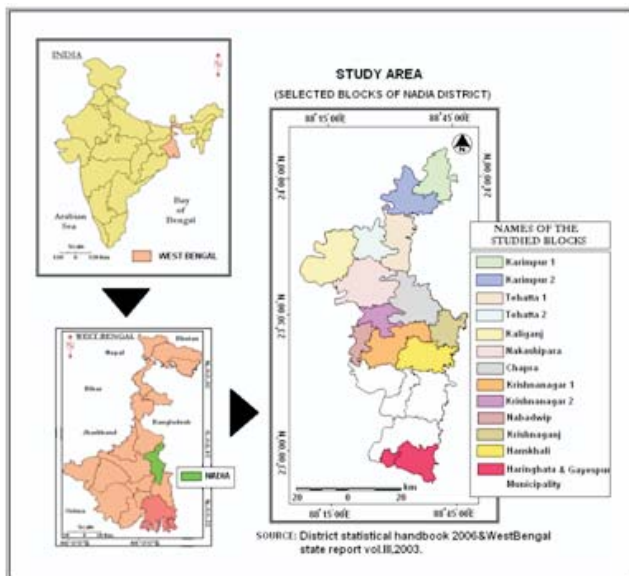*Note: All Tables compiled and prepared by the author*

Fig. 1: Location of the Study Area

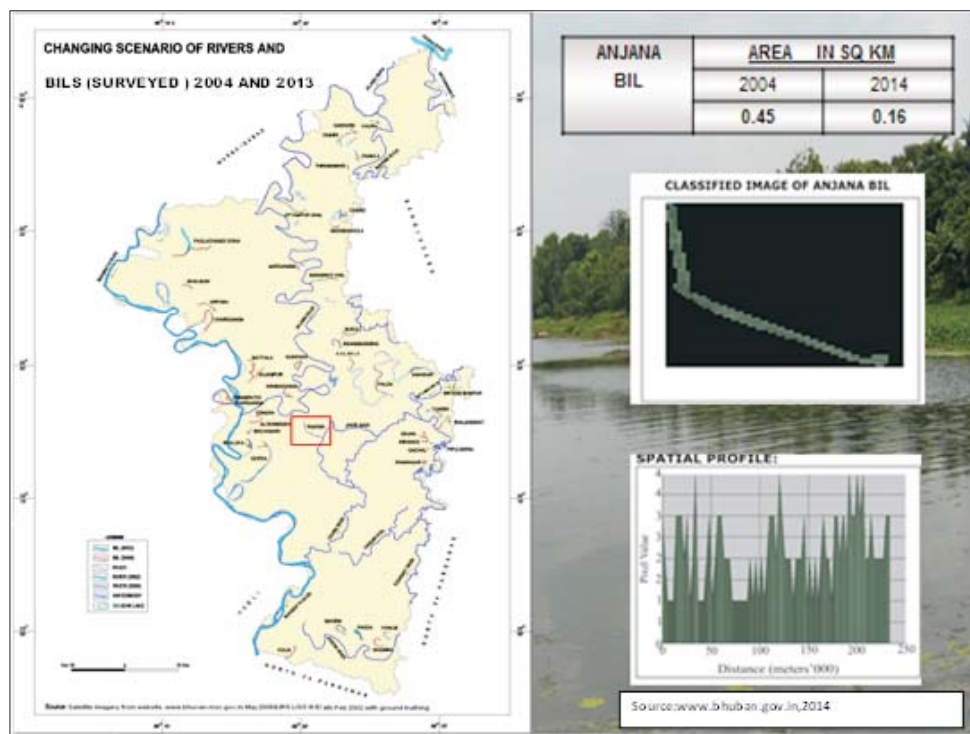Fig. 2: Satellite Imagery of the Anjana Wetland and its Catchment Area

Fig. 3: Changing Scenario of the Rivers and Bils and Classified Image with Spatial Profile

Fig. 4

Fig. 5

Fig. 6: Location of Tangri Watershed and its Geomorphological Features

Fig. 7: Location of Tangri Watershed and its Geomorphological Features
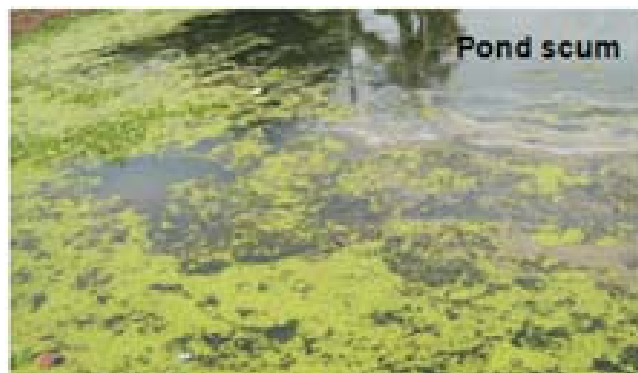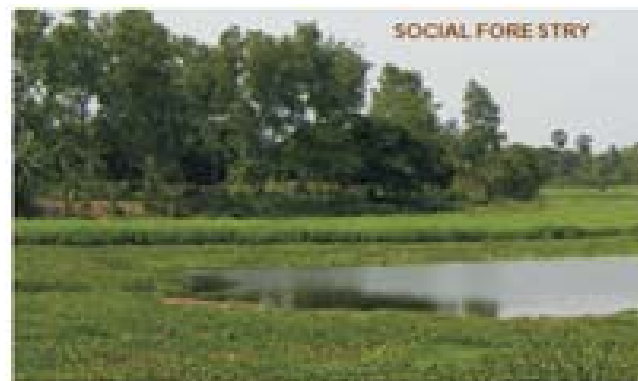

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Dr. Indira Samajdar Gangopadhyay
Assistant Professor, P.G. Department of Geography
Barrackpore Rastraguru Surendranath College, Kolkata 700120
Email:samajdar.indira@rediffmail.com