INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

The Role of Beels in Flood Mitigation- A Case Study of Krishnanagar-II Block in Nadia District, West Bengal, India

Dr. Balai Chandra Das
Assistant Professor, Department of Geography, Krishnanagar Govt. College, Krishnanagar, West Bengal, India
Sanat Das
Assistant Teacher, Department of Geography, Bablari Ramsundar High School (H.S), Nabadwip, West Bengal, India

Abstract:
Selected Beels (wetlands) of C. D. Block Krishnagar-II cover an area of 385.99 acres or 1562046.11 m^2 or 1.56 km^2. With an average depth of 1.81 meter they can provide scope for 3776155.383 m^3 flood water. They provide space for spread of flood water over a vast area reducing the vertical level as well as the vulnerability of flood disaster. This spread of flood water over a vast area facilitates recharge of ground water, which again reduces the flood level. Spills acts as arteries and veins to transport silt laden flood water to Beels during flood and silt-free water during lean periods. These processes help in maintaining river depth of rivers and hasty pass of flood water again reducing the flood level. There are 11 wetlands (Recorded under B.L. & L.R.O, Krishnagar-II), having an average area more or equal to 5 acres or 20234.28 m^2 have been considered for the present study. Data for this study were collected from the office of the B.L. & L.R.O, Krishnagar-II, District Fishery Office, Nadia and simple arithmetic calculation is made to come into conclusion that healthy Beels are worthy means for flood mitigation.

Keywords: *Beels, flood, storage water, flood mitigation, Wetland Restoration, Floodgate construction*

1. Introduction

Wetlands are lands transitional between terrestrial and aquatic system where the water table is usually or near the water surface and land is covered by shallow water. They are life support systems for people living around and are effective in flood mitigation, waste water treatment, reducing sediment, recharging of aquifers and also a winter resort for variety of birds for shelter and breeding and provide a suitable habitat for fish and other flora and fauna (Sharma. P, 2011-2012). It is widely accepted that wetlands have a significant influence in flood mitigation. In the aftermath of the flooding, a dominant policy question has been the potential role of wetland restoration in reducing future flood damages. Wetlands have therefore become important elements in water management policy at international, national and regional level.

Wetlands prevent flooding temporarily by storing excessive rain water in its bed. Wetlands also reduce water flow, thus allowing sediments and associated pollutants settle out (Doyle & Doniger, 2000). Thus, the water bodies play an important role in flood mitigation in the study area. The floodplains of major rivers act as natural storage reservoirs, enabling excess water to spread out over a wide area, which reduce its depth and speed. Wetlands close to the headwaters of streams as rivers can slow down rain water run-off and spring snowmelt so that it doesn't run straight of the land into water courses. This can help prevent sudden, a damaging flood downstream (Potter, 1994).

The study area, Krishnanagar-II block of Nadia district, belongs to Bhagirathi-Jalangi interfluve floodplain of the state of West Bengal. Most of the blocks of Nadia district are flood prone area. Flood is the seasonal problem which occurs due to natural and man-made reasons in Nadia district. In this paper the nature and characteristics and the role of wetlands in flood mitigation of the study area has been discussed.

2. Materials and Methodology

Materials for this study are wetlands of C.D. Block Krishnanagar-II and data informs of area, depth of those wetlands; statistics of rainfall of the catchment area; guage height of River Jalangi and Bhagirathi, Govt. records, Journals, Statistical Hand Books of Nadia and Books are also used as materials for the study.

Simple arithmetic and statistical tools are applied to analyze assimilate the data. M.S. Word and Excel are used to represent outcomes graphically.

3. Study Area

Krishnanagar-II is a block in the Nadia district of West Bengal, India. Its Head Quarters is Dhubulia. Krishnanagar-II block lies between $23^{0}23^{/}$N to $23^{0}32^{/}$N latitudes and $88^{0}21^{/}$E to $88^{0}33^{/}$E longitudes. Its area is 124.37 Sq.Kms. Geographically, Krishnanagar- II block is bounded by Jalangi river, Krishnanagar-I and Nabadwip block towards South, Krishnanagar- I block towards South- East, Chapra block and river of Jalangi towards East and North-East, Nakashipara block towards North and Burdwan district towards West.

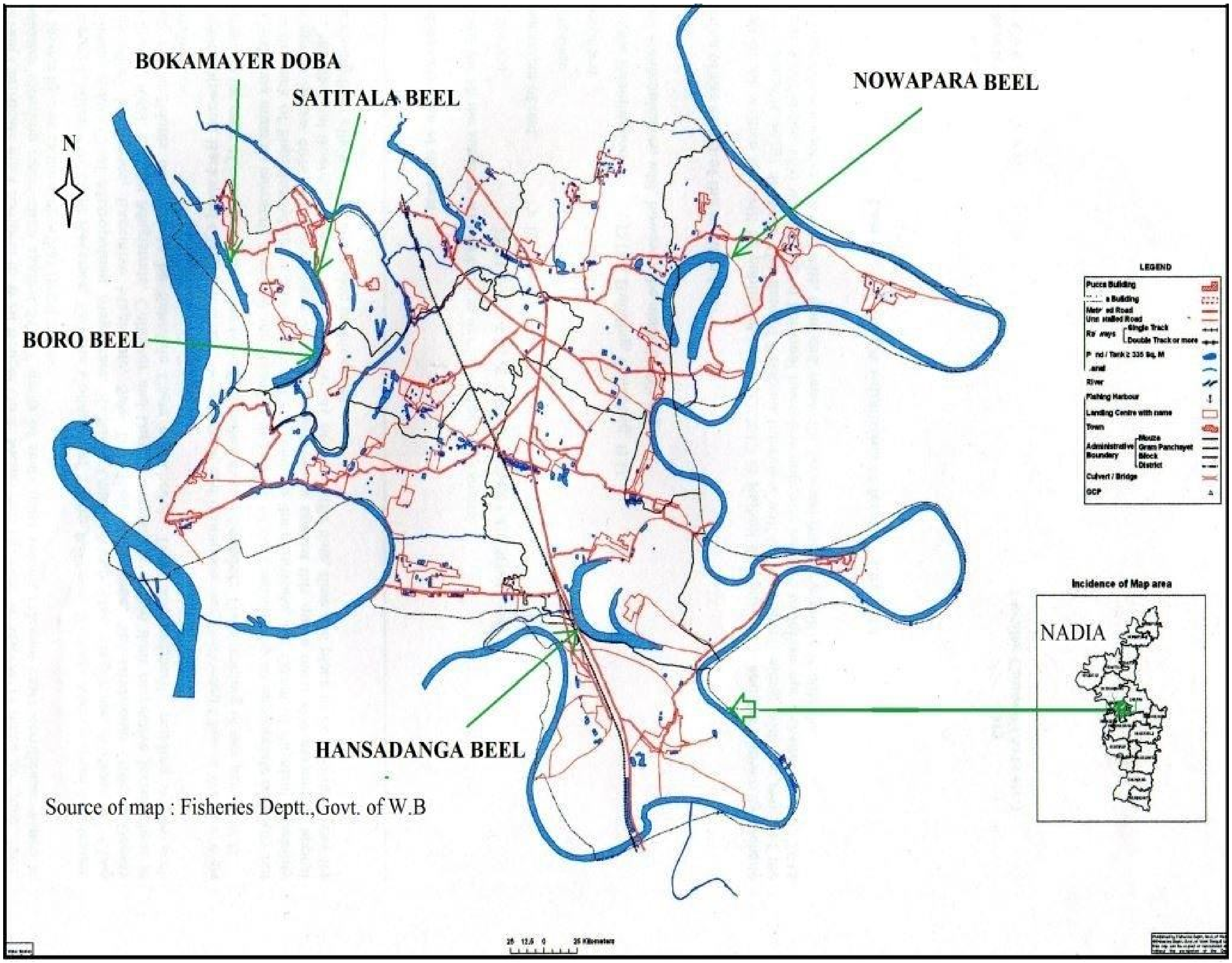

Figure 1: Location major beels of C.D. Block Krishnanagar-II

According to the records of the *District Land and Land Reforms officer, Nadia District, (collected on 20.05.2014),* there are 11 such water bodies (Five namable wetlands) in Krishnanagar- II block, which are with an area of more than 5 acres or 20234.28 m^2 each, and cover an area of 385.99 acre or 1562046.11 m^2 in total. The study area is a flood prone region in the Nadia district of West Bengal. Two rivers, mainly, Bhagirathi and Jalangi are found in the study areas. Bhagirathi is flowing on the West and Jalangi is flowing on the East and South in Krishnanagar- II block of Nadia district.

4. Result and Discussion

The study area, Krishnanagar- II block is a floodplain region in the Nadia district of West Bengal. Many types of water bodies are found in this block, such as, small and large ponds/tanks, depression of land and ox-bow lakes originated as rejected channel of river Bhaagirathi and Jalangi. The water bodies under B.L & L.R.O, Krishnanagar- ii block in Nadia district, namely Satitala Beel, Boro Beel, Bokamayer Doba, Nowapara Beel and Hansadanga Beel (Vested water bodies) play an important role in flood mitigation. Because these wetlands are able to store excessive water of river Bhagirathi and Jalangi during flood depends on the depth and size of those wetlands. Wetlands whose individual area is greater than or equals to 5 acre or 20234.28 m^2 and average depth of these wetlands are 1.81 metres except Nowapara Beel (3.353 m) and Boro Beel (2.743 m). The nature and characteristics of these water bodies are given bellow:

Sl. No.	Name of the Water bodies	Location	Area in m^2	Average depth in metre(m)	Capacity In m^3
1	Satitala Beel	Bargora	73855.129	1.372	101329.237
2	Boro Beel	Bargora-2	222779.446	2.743	611084.020
3	Bokamayer Doba	Rukunpur	56575.052	1.524	86220.379
4	Nowapara Beel	Nowapara	510106.251	3.353	1710386.260
5	No specific name given	Belpukur	22419.584	1.372	30759.669
6	No specific name given	Talta	74704.969	1.676	125205.528
7	No specific name given	Kamarhati	62119.246	1.524	94669.731
8	No specific name given	Ghateswar	26547.378	1.372	36423.003
9	No specific name given	Permedia	70212.958	1.676	117676.918
10	No specific name given	Rupdaha	23350.362	1.372	32036.695
11	Hansadanga Beel	Banagram	419375.731	1.980 (Das, 2014)	830363.947

Table: 1: Water Bodies Under B.L. & L.R.O., Krishnanagar-II, Nadia District.
Data Source: District Land & Land Reforms Officer, Nadia District, 20.05.2014

A catchment area of the river of Jalangi basin is 5344 km^2 (Irrigation and Waterways Directorate, March, 2014). Most of the rainfall in this district occurs in the Monsoon Season due to South-West Monsoon wind. Based on the analysis of 10 year's (2004-2013) monthly rainfall data (Table-2) in the district of Nadia (Meteorological Department, Govt. of India and Agricultural Meteorologist, Directorate of Agriculture, Govt. of W.B.) it can be said that from the month of June to September (Four Months) the amount of rainfall is 72.864%, whereas during the month of October to May (Eight Months) the average rainfall is only 27.136% (Table-3). So due to the intense rainfall during short Monsoon Season the rivers overflow, sub-marging the surrounding areas and beels provide a considerable scope (3776155.383 m^3) for that overflow water.
In Swarupganj which is situated in the Nabadwip block, the danger level of water of Jalangi river is 8.44 metres and the extreme danger level of water of is 9.05 metre (Dasgupta, 2002). The diagram (Fig. 2) represents the average water level in the Bhagirathi river at Swarupganj, from the year 1978 to 2010 (Table-4). In this diagram, the highest flood level of water in the years of 1981, 1983, 1986, 1988, 1989, 1991, 1994, 2001, 2003, 2008, 2009 (Table-4) has been seen above the danger level of water and the highest flood level of water in the years of 1978, 1980, 1984, 1987, 1990, 1993, 1995, 1996, 1997, 1998, 1999, 2000, 2002, 2004, 2006, 2007 (Table-4) have been seen above the extreme danger level of water. As Swarupganj is situated in the adjacent block of Krishnanagar-II if the water level crosses the danger level, most of the parts of Krishnanagar-II block also gets affected.

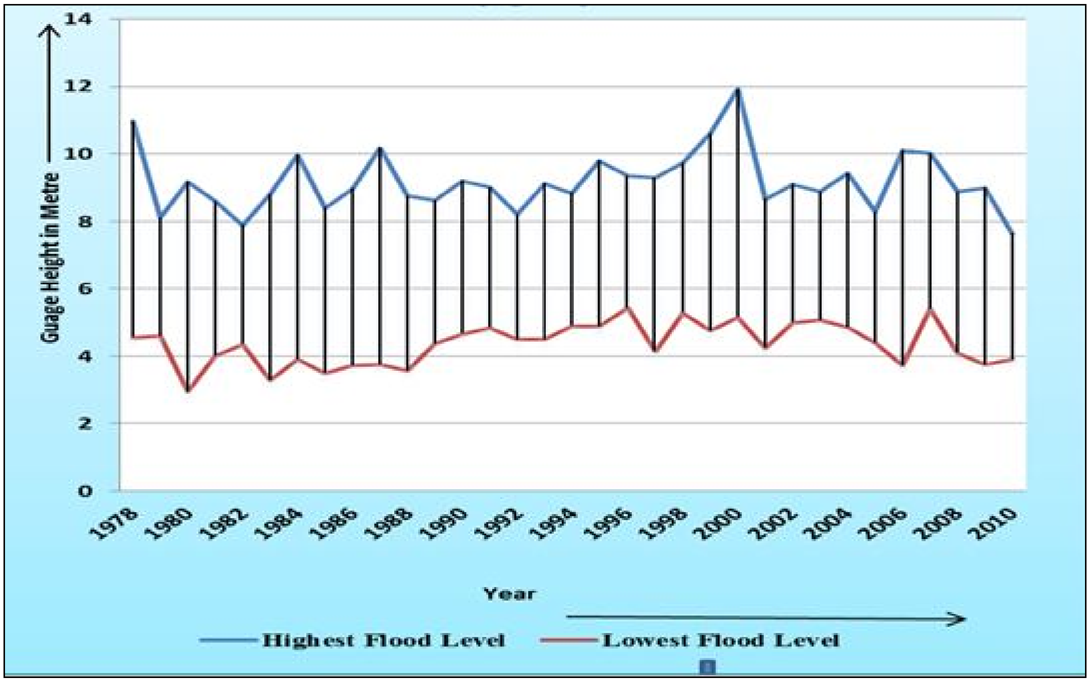

Figure 2: Average Water Level in Bhagirathi River at Swarupganj:1978-2010.

Foregoing water bodies in this district are capable of storing a considerable portion of the excess water of river Bhagirathi and Jalangi which enter in the study area during flood. Thus the wetlands play an important role in flood mitigation in this study area in Nadia District.
Wetlands of study area need some rescue and restoration measure for their very existence.

4.1. Restoration Wetlands

The restoration of wetland can affect downstream flood levels in several ways. Storage of water in wetland reduces and delays downstream flood peaks by storing the excess water in its bed. The water intake capacity of selected beels is 3776155.383m^3. The water intake capacity of different beels (Table-1) are as follows- i) Nowapara beel- 1710386.260 m^3, ii) Hansadanga beel- 830363.947 m^3, iii) Boro beel- 611084.020 m^3, iv) Satitala beel- 101329.237 m^3, v) Bokamayer Doba- 86220.379m^3 etc.

Here all wetlands are shallow. The average depth of these wetlands is 1.81 meters. If the depth of wetlands can be increased by cutting the soil of shallow wetlands through the local proprietors of Brick fields or through the Mahatma Gandhi National Rural Employment Guaranty Scheme (MNREGS), the capacity of water intake will be increased, which can help in mitigation of flood in the study areas.

4.2. Constructing Floodgates

Floodgates normally allow a one-way flow out of flood basins, opening when a hydraulic head exists on the upstream side and closing in the reverse situation (Middleton, Pressey, 2000). They vary in design from single flap gates on drains or culverts to large assemblies of adjustable drop gates controlling flow through wide river entrances. Floodgate should be constructed on the channel at Mahatpur connecting Nowapara Beel with river of Jalangi, so that the excessive flood water may enter easily into the wetlands during flood and it will be reopened when water level reach the highest level on the upstream side and closed just after the flood is over to store water to be used during lean season.

4.3. Plantation around the Beels

Plantation around the beels can decrease soil erosion. This can be done with the help of Social Afforestation project (Banamahatsab) undertaken by the local Govt. or Panchayet. The roots of the plants will hold back the soil in its place. As a result the alluvium deposition on the wetland beds will be reduced. If the soil erosion decreases the depth of the wetlands will remain intact.

5. Conclusion

This paper confirms that wetlands exert a strong influence on the flood mitigation. It strengthens the view that management of wetlands must be an important part of integrated water resources and flood management of all river basins. Wetlands reduce floods, recharge groundwater and increase dry season flows. Necessary steps should be taken at the micro level, such as wetland restoration, floodgate construction, and plantation around the beels in order to preserve the wetlands, so that it can be helpful in local flood mitigation. For these indiscriminate anthropocentric activities which are leading to increasing rates of siltation and rapid decrease in area and volume of wetlands in and around wetlands to be stopped.

6. References

- i. Irrigation and Waterways Directorate (March,2014):Annual Flood Report for the Year 2013;Jalasampad Bhavan, Saltlake, Kolkata-7000091, p-8.
- ii. Das, B. (2014). Alternative tourism: Potency of Beels of C.D Block Krishnanagar-II. IOSR Journal of Business and Management,16,12,p- 31-37.
- iii. Dasgupta, A. (2002). Paschimbanga Rajya Banya Janita Samsya, Pratikar Ebang Satarkikaran; Sechpatra. Irrigation and Waterways Division, Govt. of W.B,.
- iv. Doyle, J. Doniger,A.S. (2000). Wetlands for Citizens & Land Use Decision Makers. Heath Department . Monroe: The Environmental Protection Agency.p-46-60.
- v. Gutteridge, H. a. (n.d.). Stream clearing on the Colo River-environmental impact statement.
- vi. Meteorological Department, Govt. of India and Agricultural Meteorologist,Directorate of Agriculture, Govt. of W.B., District Statistical Handbook, Nadia District. (2008 and 2013).
- vii. Middleton.M.J, Pressey.R.L. (2000). Impacts of Flood Mitigation Works on Coastal Wetlands in New South Wales. Prepared for NSW State Fisheries, Sidney,p- 34.
- viii. Sharma, P. (2011-2012). Ecology and Environment (Eleventh Revised Edition ed.). Meerut: Rastogy Publications, p-317.
- ix. Potter. W. kenneth (1994) ;Estimating Potential Reduction Flood Benefits of Restored Wetlands, Journal of Contemporary Water Research and Education, vol.97, Issue-1,p-34
- x. Fisheries Mapping Project, Fishery Department, Govt. of West Bengal, Sector-IV, Saltlake, Kolkata-700098.
- xi. DL and LRO(2014);District Land & Land Reforms Officer, Nadia District
- xii. Irrigation Department, Jalagi Bhaban, Krishnanagar, Nadia, 2013.

Appendixes

Year	Month												Total
	Jan.	Feb.	March	April	May	Jun	July	Aug.	Sept.	Oct.	Nov	Dec.	
2004	12.0	0.0	2.0	87.0	69.0	169.0	130.0	183.0	439.0	127.0	0.0	6.0	1224.0
2005	23.0	6.0	77.0	23.0	44.0	170.0	234.0	126.0	128.0	359.0	0.0	5.0	1195.0
2006	0.0	0.0	1.0	16.0	82.0	139.0	308.0	201.0	362.0	28.0	6.0	0.0	1143.0
2007	0.0	64.0	28.0	20.0	48.0	242.0	468.0	204.0	376.0	112.0	50.0	0.0	1612.0
2008	42.0	39.0	29.0	50.0	194.0	222.0	395.0	114.0	399.0	114.0	0.0	0.0	1598.0
2009	0.0	0.0	33.3	0.4	249.5	87.7	234.2	506.8	303.9	59.9	20.6	0.2	1496.5
2010	0.0	14.5	0.0	29.4	94.2	173.4	106.9	87.9	180.6	110.1	6.8	42.4	846.2
2011	0.0	0.4	35.8	99.2	122.1	324.8	238.2	362.6	197.3	29.6	3.4	0.0	1413.4
2012	19.7	0.4	0.4	27.2	74.3	95.6	206.8	162.7	161.8	71.6	37.8	3.7	862.0
2013	6.3	9.1	1.5	39.3	149.7	188.1	181.1	327.0	160.7	224.8	0.0	0.2	1287.8
Rainfall in mm													

Table 2: Monthly Rainfall in the District of Nadia (2004- 2013).
Source of Data: 1). Agricultural Meteorologist, Directorate of Agriculture, Govt. of West Bengal
2. Meteorological Department, Govt. of India and District Statistical Handbook, Nadia District. (2008 and 2013).

Month	Year										Total
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Jan-May	13.89	14.48	8.66	9.93	22.15	18.93	16.32	18.22	14.15	15.99	15.272
Jun-Sep (Monsoon Season)	75.24	55.06	88.36	80.02	70.71	75.68	64.85	79.45	72.73	66.54	72.864
Oct-Dec	10.87	30.46	2.98	10.05	7.14	5.39	18.83	2.33	13.12	17.47	11.864

Table 3: Average Monthly Rainfall (%) in the District of Nadia (2004-2013).
Source of Data: Computed by The Author Based on Monthly Rainfall (2004-2013).

Year	Highest Flood Level	Lowest Flood Level	Year	Highest Flood Level	Lowest Flood Level
1978	10.97	4.56	1995	9.8	4.88
1979	8.1	4.6	1996	9.35	5.43
1980	9.18	2.95	1997	9.3	4.15
1981	8.59	4	1998	9.74	5.28
1982	7.89	4.35	1999	10.61	4.76
1983	8.8	3.29	2000	11.92	5.15
1984	9.98	3.9	2001	8.66	4.25
1985	8.4	3.5	2002	9.1	5
1986	8.97	3.72	2003	8.88	5.07
1987	10.18	3.74	2004	9.42	4.85
1988	8.76	3.56	2005	8.28	4.4
1989	8.63	4.36	2006	10.11	3.72
1990	9.2	4.66	2007	10.01	5.4
1991	9.01	4.84	2008	8.88	4.1
1992	8.21	4.49	2009	9	3.75
1993	9.13	4.49	2010	7.63	3.9
1994	8.84	4.9			
Guage height in Metre					

Table 4: Average Water Level in Bhagirathi River at Swarupganj from 1978 to 2010.
Source of Data: Irrigation Department,Jalagi Bhaban, Krishnanagar, Nadia, 2013.