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The Dismal Picture of Lentic Water Bodies and Over Exploitation of Ground Water Storage in Raiganj Block, of North Dinajpur District, W.B., India

[1]Abhishek Sinha and [2]Amal Bhattacharya,
[1]Research Scholar, [2]Associate Professor,
[1,2]Department of Zoology, Raiganj University, West Bengal, India

Abstract: India is experiencing a gradual acute shortage of water resources due to global warming as well as by excessive extraction of groundwater and by much use of the other lentic water bodies due to excessive population growth. Raiganj block of North Dinajpur District of W.B., India is also facing the same problem. Almost 30% to 40% of water bodies have disappeared permanently from the map of Raiganj block during the last three decades. The dismal picture of water bodies shows that less than 2.25% area is covered under lentic water bodies in Raiganj block. The condition becomes severe in the hot dry months, when, altogether only 17% rainfall occurs, but, the average temperature rises up to 36.4^{o} C. As the land prices have been increased limitlessly the characteristics of small ponds, ditches and other waterlogged low lands have been changed in favour of house building lands. The highest decadal population growth rate of Raiganj block in respect to the whole West Bengal during the last three decades has led to excess groundwater extraction in the range of 7,74,19200 litres per day in 2020 which is partially being recharged. So, there may always be a cumulative deficit which may become a severe factor in the near future.

Key Words: *Lentic Water Bodies, Raiganj Block, Decadal Population Growth Rate, Water Consumption*

I. INTRODUCTION

It is known that the presence of a considerable amount of watery areas in a locality helps to avoid an extreme climate. During the last few decades, water bodies in India are fast disappearing leading to a drought-like situation and water shortage. To fight with this water crisis, rivers and underground water resources have attracted much attention in India, while the revival of other inland surface water bodies, such as ponds, lakes, small ditches, beels etc. have been largely overlooked (Mohanty, 2019). The same thing is happening in Raiganj block of North Dinajpur District, West Bengal, but here, the health of the only existing river, Kulik, is also in dying condition, particularly in the hot dry months. The only silver array in respect to India as well as in Raiganj block is monsoon precipitation which has been the lifeline for agriculture as well as recharging its water resources. It has been estimated that about 83% (941 mm out of 1130 mm) of precipitation occurs in the months from June to September in Raiganj block (Table 1 and Figure 4)(World weather,2018) which goes at per the records of the rest of India excepting in some western and northwestern dry states. As per record, India receives about 4000 billion cubic meters of average annual precipitation along with snowfall, of which 3000 billion cubic meters alone is received in the monsoon season from June to September. The spatial distribution of precipitation widely varies over the country, less than100 mm in Rajasthan to over 2500 mm in Assam (Central Ground Water Board, 2014). Less than 50% of total precipitation flows to the rivers and it is estimated to be 1869 billion cubic meters. However, only 690 billion cubic meter surface water resources can actually be utilised (Central Water Commission 2015).

A. Study site

The entire study area was confined within the jurisdiction of Raiganj (25.62^{o}N and 88.12^{o}E) block and this survey work was carried out from March, 2019 to the end of February 2020. Raiganj block is located in the North Dinajpur District of West Bengal, India (Fig.1a and 1b), the administrative headquarters of the district is Raiganj town (pink area, Fig.1c). It is a large block, covering an area of 472.13 km^2, out of which only 36.51 km^2 of the area is covered by Raiganj town which is also the administrative zone of Raiganj block, as well as, of whole North Dinajpur District. Raiganj Block is bounded by Haripur Upazila in Thakurgaon District of Bangladesh on the north, Hemtabad and Kaliaganj Blocks on the east, Itahar Block on the south and Barsoi Block in Katihar district of Bihar on the west (District Census Handbook, W.B.2011). In addition, the north-western side is bordered by Karandighi block.

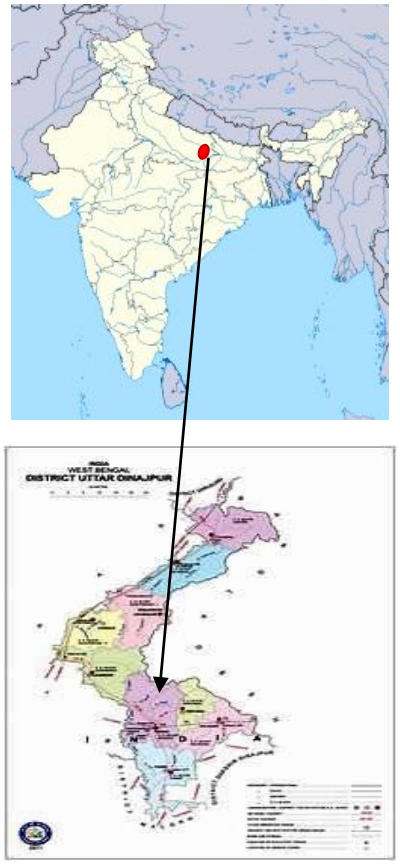

Fig.1(a) Map of India showing the Fig.1(b) Map of North Dinajpur Dist block Fig1(c) Detail map of Raiganj block the location of Raiganj Block

II. METHODOLOGY

The study was initiated following the observation of gradual degradation of watery areas through decades, so, a project was undertaken from March, 2019 in Raiganj block by the Department of Zoology, Raiganj University. Total one-year data were collected covering all the seasons for the fluctuating area covered by the water bodies. Most of the areas were covered by the first author; but, in spite of that, some major help was taken from the Block Development Office of Raiganj Block (2019-20) for the available total picture of the water bodies, and due to failure to reach to some inaccessible remote areas. Apart from this, some data on water bodies were collected from the local residents. The previous data of the then existing water bodies were collected from the senior residents of Raiganj block, especially, from the senior permanent residents of Raiganj town because of many developmental works had been taken there during the last three decades following the formation of District Head Quarter from 1st April 1992. Records of decadal population growth rate, population density, etc., were obtained from the population census records of India from 1991 to present to calculate the population pressure index on the surface lentic watery areas and on the groundwater resources. For this purpose, randomly 30 houses were selected in different wards under Raiganj Municipality area which is densely populated to calculate per head per day consumption of water. The obtained data were multiplied by the population strength of the block for getting an average result of the total consumption of water per day. Besides, records of climatological data were taken from World Weather Report (2018).

III. RESULTS AND DISCUSSIONS

Present Picture of water coverage: The present scenario of water bodies in Raiganj Block is not very encouraging. According to survey work on surface static water bodies done in Raiganj Block in 2019-2020, the estimated total water coverage area (excluding the Kulik river and its tributaries) of lentic water bodies is only 2624.45 acres which comprises of 1612.81 acres (61.45%) of big, medium and small ponds; 397.74 acres (15.15%) of ditches; only 59.42 acres (2.26%) of khals and 554.48 acres (21.12%) of beels (Office of the Land and Land Revenue, Raiganj,2020)(Fig.2). No man-made reservoirs were constructed during the last three decades (Department of Planning and Statistics, North Dinajpur District, 2010).

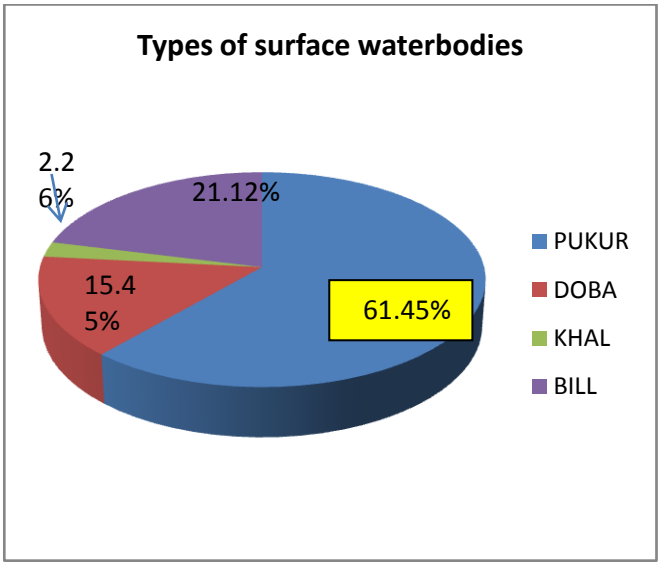

Fig.2: Graphical representation of different types of lentic water bodies in Raiganj block

The total area of Raiganj block is estimated to be 116,665.86 acres (472.13 km^2) with the inclusion of 227 moujas (5 new moujas have been included in recent times). So, if we calculate the percentage of lentic surface water coverage of Raiganj Block, it is less than only 2.25% (Fig3.), which is far below than the ideal average surface water coverage (12.34%) (Water Statistics of EU, 2020).

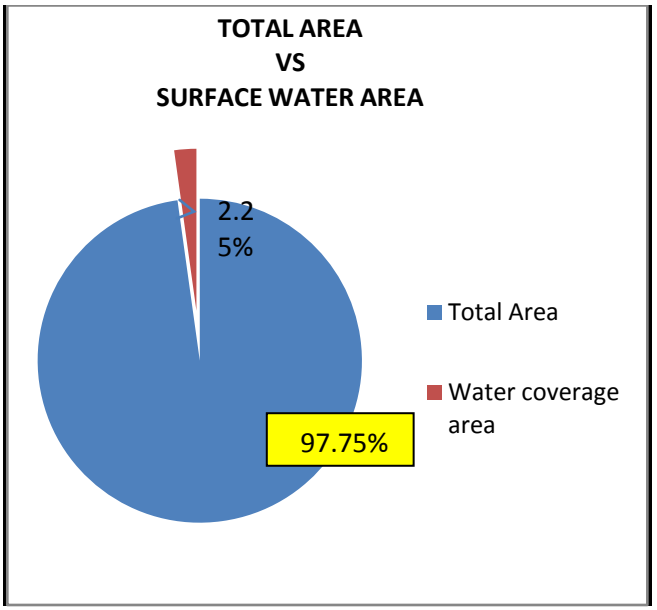

Fig.3: Total area vs surface water covered area, only 2.25% area is covered under water

The average high temperature of Raiganj block (Fig.5) reveals that the three hot and dry months, March, April and May shows the highest average temperature rising up to 36.4^o C when actually the lowest rainfall occurs averaging only 17 mm (approx.) (Table1 and Figure 4). That means, before monsoon, the water level of ponds, ditches, beels etc. reaches at its all-time lowest level in a year. The groundwater level also sinks down at its lowest level but, the per head consumption remains the same; rather demand becomes higher during these months. The difference between the high and low temperature in those three months also shows a higher differential average, i.e. 15.1^{o}C, which indicates that the relative humidity remains low and there is the least chance of rainfall.

JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT	OCT	NOV	DEC	TOT
19 0.7	11 0.4	11 0.4	08 0.3	33 1.3	134 5.3	306 12.0	274 10.8	227 8.9	94 3.7	09 0.4	04 0.2	1130 44.5

Table1:Showing 83% rainfall occur in June, July, August and September, while other eight months receives only17% of rainfall in Raiganj block (upper in mm and lower in inches) [after World Weather,2018]

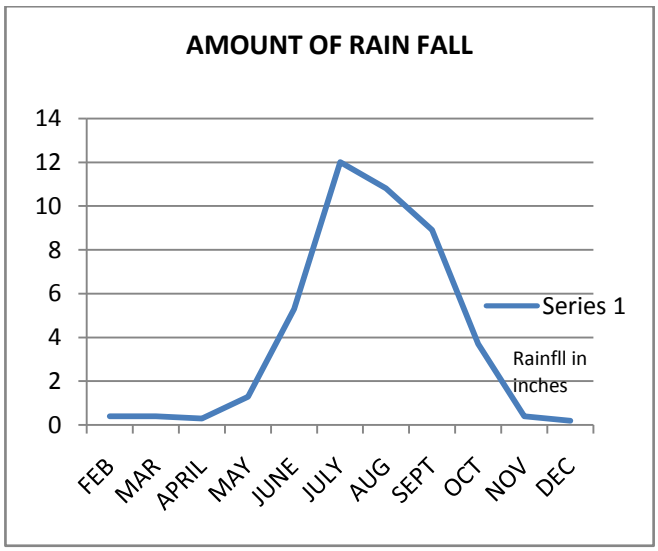

Fig.4: Graphical representation of precipitation in inches in Raiganj block (After World Weather,Dec.2018)

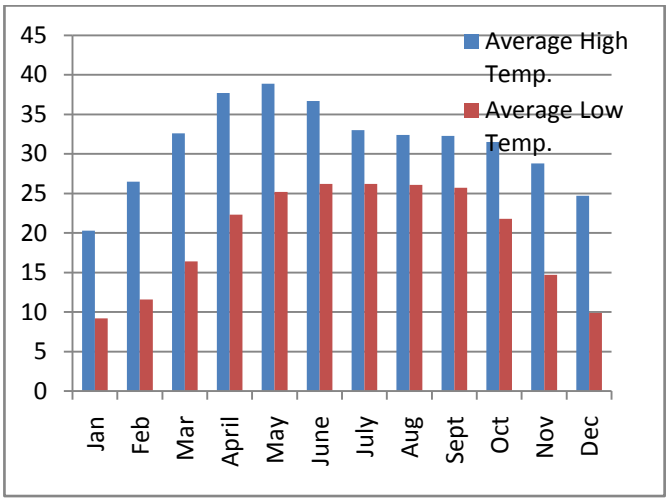

Fig.5. Average High and Low temperature of Raiganj block in ^{o}C (World Weather,2018)

Is the Raiganj Block drying up? If we look through the situation of lentic surface water bodies chronologically during the last 30 years, it will be very clear that the water bodies' coverage of the area has been drastically diminished in Raiganj block up to 30% to 40%. In many areas, either the ponds and low land water locked areas have been completely dried up, or the mud layer is exposed; the bottomland of the water bodies have risen up or have been filled up with manmade garbage along with aquatic weeds due to eutrophication (Photo 1). In some areas the character of the land has been changed from land to building erection land ('bastu') and the ponds or low lands have been filled up overnight for building purposes done by the influential persons, particularly in the urban localities. This punishable act in the eye of law had been ignored by the Municipal and Panchayet authorities in the respective zones in different periods whoever had been in power.

Photo1. A pond in the Ward no.9 in Raiganj Municipality area is full of aquatic weeds

The sheer casual attitude from the part of the authority, as well as, from the responsible citizens has paid back by the environment itself. The drastic change of weather during the last 30 years has been noticed. The summer has been too much dry with a hot wave and the monsoonal season has been extended up to September or, in some cases, up to the second week of October causing a severe flood. One of the main reasons is unplanned urbanization and its outward extensions haphazardly. Due to unplanned urbanization, the drainage system is disrupted and there are hardly any passages for flowing out of the floodwater to the Kulik River. Kulik River and its tributaries have also lost their water holding capacity and, thereby, causing devastating flood once in three or four years in a regular manner.

Overall tremendous growth of human population: Population growth is positively correlated with the consumption of water. If one looks back to the population growth rate during 1981-1991 decade the highest growth rate can be observed. Almost 57% growth rate occurred in Raiganj block during that period in comparison to the whole district (35%) and West Bengal (25%)(Fig.6). Before that, from 1947 to 1971 a constant fluctuating flow of immigration was a regular phenomenon and after 1971 a higher rate of immigrants started entering into the border districts of northern West Bengal, particularly in the then West Dinajpur District. The other decades show the population growth rate of Raiganj Block ranging from 30% to 20% (Fig.6), whereas, the population growth rate in West Bengal was managed to confine within 15% to 20%. This extra load of human population in Raiganj Block has broken all the systematic developmental procedures. The underground water level has lowered down considerably and per capita expenditure of water increased without any limit during this period.

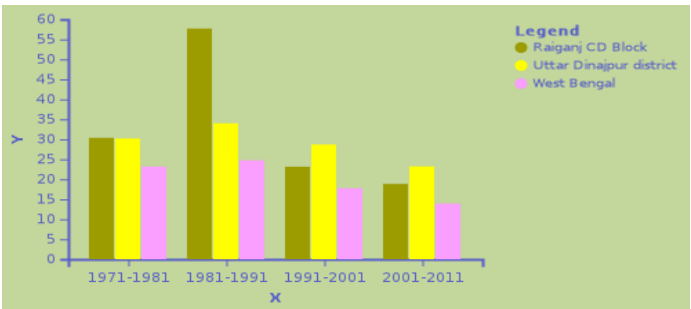

Fig.6: Decadal population growth rate in Raiganj Block from 1971 to 2011(After CD Block wise Primary Census Data, 2018)

A study by North Bengal University reveals that *"Immigrants from East Pakistan/Bangladesh have arrived in the then West Dinajpur District (Latter Uttar Dinajpur from 1st April,1992) in almost equal numbers before and after 1971."* The Human Development Report opines that, *"The overall post-Partition impact on the rates of demographic growth have been particularly strong in all North Bengal districts. Despite its smaller relative size, the region has received more migration in pro-rata terms than the West Bengal districts lying south of the Ganga."*

The decadal growth of population in Raiganj Block in 2001-2011 was 18.83%. The decadal growth of population in Raiganj PS in 1991-2001 was 23.14%, in 1981-91 was 57.70% and in 1971-81 was 30.37%. The decadal growth rate of population in North Dinajpur district was as follows: 30.2% in 1971-81, 34.0% in 1981-91, 28.7% in 1991-2001 and 23.2% in 2001-11. At the same time, the decadal growth rate for West Bengal was 13.93% in 2001-2011, 17.77% in 1991-2001, 24.73% in 1981-1991 and 23.17% in 1971-1981.

Fig.6 shows that North Dinajpur district has the highest decadal population growth rate in West Bengal with a figure of 23.2% for the decade 2001-2011 which is much higher than the state average of 13.8% (Census of India, *recd 26 Dec.2018*).

As per the 2011 and 2001 Census of India, Raiganj Block had a total population of 430,221 and 362,285 respectively (CD Block wise Primary Census data, *recd.22 Dec.2018*). Considering the registered population growth of 30.71 per cent during the 1991-2001 decade the 1991 census recorded a total population of 253,600. By this time the decadal growth for the district was 28.72 per cent.

This huge pressure of population growth had a direct effect on its land-use pattern. Many of the ponds, shallow lowlands, open marshlands, bills, small waterlogged tributaries of Kulik river disappeared permanently from the map of Raiganj Block. Gradual shrinkage of water bodies like ponds had been occurring by filling earth and rubbish. The worst damage had been done in the wards 9,11,12,23,24,25 of Raiganj Municipality area where the developmental programmes were taken extensively. Due to the high price of land in these areas, the ditches, small ponds etc. have been vanished in quick successions.

Apart from diminishing the surface water coverage the underground water source also had been fallen under tremendous pressure. Underground water was being pumped out by using shallow pumps so heavily and in so unlimited way for the irrigation purpose that the water level sank down considerably.

Water usage per head per day: It has been estimated that average 160 litres of water are consumed per head per day by the people of Raiganj Municipality area. Random sampling suggests that the consumption ranges from 150 litres to 170 litres which includes drinking, bathing, cooking, washing clothes, house and cars (if any), washing cattle (if any), gardening (if any). In rural areas it may be more due to irrigation purpose, but, there, surface water usage, i.e., water extraction from ponds and other sources, even from river and rivulets may be done which is difficult to estimate. Here the farmers depend more on the monsoonal rain because in the dry months as the underground water level sinks down heavily.

So the population pressure index on water usage can be calculated by multiplying the population with the prescribed water consumption, i.e., 160 litres, during the last 30 years. If we consider 1991 as the base year the excess pressure on water consumption may be as below:

Table 2: Decadal increase of water consumption/day due to population increase in Raiganj Block

Year	Population strength	Water usage/head/day	Total consumption/day
1991	253600	160 litres	40576000 litres
2001	362285	160 litres	58445600 litres
2011	430221	160 litres	68835360 litres
2020	483870*	160 litres	77419200litres

*Considering at per the estimated population growth rate,12.47%, of West Bengal

It is very alarming (from the data of Table 2) that in 1991 when the people of Raiganj Block used to consume 4,05,76,000 litres of water per day, now they are consuming 7,74,19,200 litres every day! The population of Raiganj Block in January 2020 is based on the state decadal growth rate (12.47%) which may probably be low, since next complete census in Raiganj Block, as well as, of North Dinajpur District will be held in 2021, but it has always been found that the population growth rate of Raiganj block is higher than that of the State's decadal growth rate. We are consuming extra 3,68,43,000 litres of water per day in respect to the year 1991. The consumption shows a steady increase throughout the last three decades (table 2).

As throughout the entire Raiganj Block, there is no centralised water supply system to the houses still now, the entire pressure is on the underground aquifers and those have also some limits. Underground aquifers are also gradually losing their store amount (not capacity) as the water is not being recharged sufficiently in comparison to the extraction. Work on groundwater recharge in Andhra Pradesh has shown that the heavy rain-fall events of more than 300 mm with prolonged time lead to the rise of the groundwater levels, thereby, increasing the groundwater recharge. So, it reveals that irrespective of the total amount of annual precipitation on the ground, continuous high precipitation events, exceeding a rainfall of 300 mm in any particular year, can help to rise of the groundwater levels in that year (Prasad and Rao,2018). But in Raiganj block, the aquifers are gradually drying up because of forceful extraction and unpredictable scanty precipitation in consecutive two or three years. The highest decadal population growth rate of Raiganj block in respect to the whole West Bengal during the last three decades has led to excess groundwater extraction in the range of 7,74,19200 litres per day in 2020 which is partially being recharged. So, there may always be a cumulative deficit which may become severe in the near future.

Acknowledgement

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