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ORIGINAL ARTICLE

Intensive Irrigation Practices & Groundwater Depletion In Seven Selected Blocks In The Rarh (west Of The Bhagirathi) In Murshidabad West Bengal.

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Abstract: *The district of Murshidabad is highly potential for agriculture and developed with crop rating more than 200% .Out of total agricultural land about 70% yields 3 crops annually and the rest single crop . Population growth rate is very fast is (4% annually). Irrigation in the study area is almost wholly groundwater based. The paper is mainly concerned with the groundwater depletion following the Green Revolution in the western part of the Bhagirathi of the district. The people living in the area were simply driven by dire necessity of making up the scarcity of food crops. Following the Green Revolution, introduction of high yielding varieties of dwarf species brought about an abrupt change in crop pattern entailing an environmentally adverse impact on the land & water resources. The ground water condition has substantially deteriorated for the last 30 years. Both pre & post monsoon water levels have gone down by 1m to 5m in an average.*

KEYWORDS: Murshidabad, agriculture, groundwater

INTRODUCTION

While water is an integral part of land/soil productivity base its misuse/abuse can cause both soil degradation and erosion. India is rich in water resources; it is endowed with a network of great rivers and vast alluvial basins to treasure groundwater. Seventy percent of India is subject to varying degrees of water stress (T.N.Khoshoo, Presidential Adress).Very extensive and persistent falls in groundwater levels in both areas of the shallow unconfined and deep semi-confined aquifers, and their associated effect are of serious concern. Both population and economic activity have grown markedly over last 30 years and much of this development has been dependent upon groundwater resources. The enormous exploitation of groundwater has reaped large socio-economic benefits in terms of agrarian employment, hunger alleviation, grain production and potable and industrial water supply but has also encountered increasing environmental difficulties. The recently emerging phenomenon of worldwide climate change due to unabated emission of green house gases has only too added to the challenge the world faces today.

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RESEARCH BACKGROUND

Irrigation accounts for over 90% of water consumption in India, as in many South Asian countries (Rosegrant et al., 2002, FAO, 2003).The impressive productivity gains in cereal production achieved in certain areas during and onwards the Green Revolution, are now showing signs of decline or stagnation. Emerging empirical evidence shows that under intensive rice-wheat monoculture systems, it is difficult to sustain productivity over a long term. Intensive cropping under Green Revolution has been associated with the built up of salinity in dry areas and water logging in wet areas, depletion of ground water reserves, formation of hard pan(subsoil compaction), soil nutrient imbalance and increased incidence of pests (Pingali and Rosegrant, 2001). In our country irrigation water and energy crisis are highly subsidized by government. Ground water for small scale irrigation is well nigh free to farmers who can privately invest in tube- wells and open wells. These kinds of policies often lead to overuse causing depletion of under- ground reserves (World Bank, 1993). Over the last few decades, there has been a phenomenal increase in ground water extraction for irrigation worldwide. Higher rates of depletion are observed in many countries like USA, China, India and Mexico where increasing population pressure and expected economic gains have created strong incentives to harnessing the vital resource (Rosegrant et al, 2002). Between 1970 and 1995, the area underground water irrigation increased by 105% while the area under surface water irrigation grew by only 28% (Shah, 2002). At present groundwater irrigation accounts for about 60% of the 50 million hectares of irrigated land in our country. The availability of institutional credit for setting of tube wells and highly subsidized electricity for pumping water have induced a remarkable increase in the number of wells(less than 1 million in 1960s to 19 million in 2000 (Shiferaw et al. 2003), primarily in drier areas where surface water is scares. While this has made a substantial contribution in terms of raising agricultural productivity and farm incomes for the poor and marginal farmers, excessive extraction without reinvesting in recharging facilities has led to a steady depletion of scarce ground water resources in many parts of the country. The situation is already critical in northern Gujrat, southern Rajasthan, coastal Tamil Nadu, parts of Haryana and Punjab (shah, 2002). The UK based NGO "WATERWISE" is carrying research work focusing on water efficiency in the UK. An international workshop on the topic ′Intensive use of ground water′ was held in Madrid (Spain) in December 2001. On October 28, 2002 at Colorado Convention an elaborate discussion on the topic ′Groundwater depletion and overexploitation- a global problem′ was carried on. In 2004 Denver Annual Meeting (Nov. 7-10, 2004) Impact of Land use Change on Groundwater Recharge in the Western United States was discussed. Recently the state government of West Bengal has banned lifting of groundwater with pumps in 54 blocks of 8 districts of the state where 80 per cent of groundwater has been depleted (The Anandabazar Patrika, July 1, 2007).

OBJECTIVES

This part of the district solely has been supported by agrarian economy. After Green Revolution the area was brought under intensive irrigation programmes extending deep tube well and shallow tube well facilities to harness water for the water thirsty high yielding varieties. This paper aims at fulfilling the following objectives

•Identification of the vulnerable part under study based on available records, empirical observations, and the database, traditional and current .
•Exploring the responsible factors and the magnitude distribution of the impact.
•Working out a neat method of effect mapping with a view showing spatio-temporal changes in the scenario.
•Evolving an effective strategy for minimizing the adverse impact on the environment.

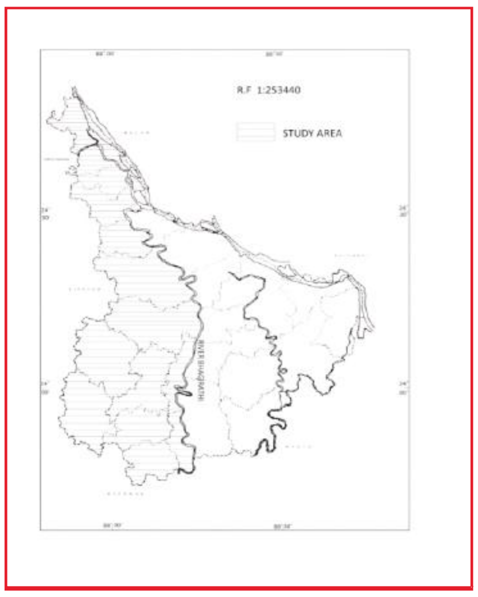
METHODOLOGY

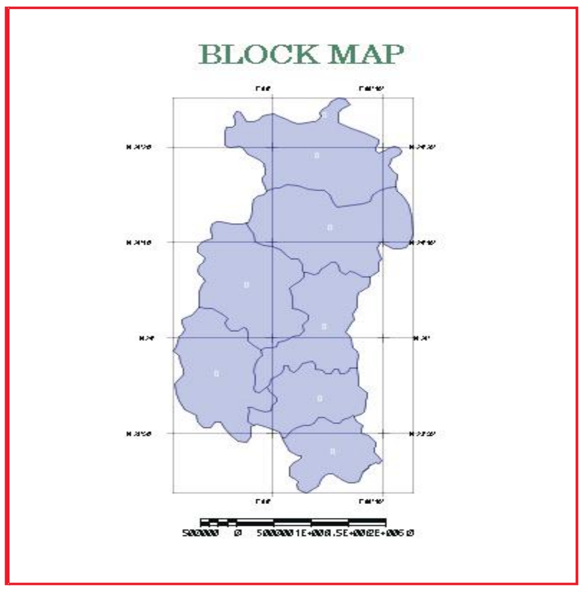
Collection of sets of data about the impacts on the natural environment or ecosystem in the area under study. Compilation and processing of the datausinf various statistical, mathematical and geographic accounts and analysis. Noting the distribution of impact over space and time. Preparing a set maps that can facilitate the identification of areas of various intensities. The data base for the study is to be derived from various sources- both primary and secondary encompassing the components of impact, viz, land use and water management, developments, socio-economic situation, impacts of change in crop pattern involving intensive agriculture, population and poverty thrust etc. These are to be collected from various Governmental Departments- of Revenue, Agricultural, Agrimech Department etc.

CHARACTERISTICS OF STUDY AREA

LOCATION

Murshidabad is the northern most district of the Presidency Division situated at a height of 19m above mean sea level, between 24°50′20″ and 23°43′30″s N and between 88°46′ and 87°49′17″ E. The district is distinctly divided into two zones viz, ′RARH′ & ′BAGRI′ which are situated on the western and eastern side of the river Bhagirathi respectively. The study area comprises seven selective blocks of the Rarh region of the district.





RELIEF & LANDFORM

The study area is an upland which stands above the Recent Flood Plain with elevation ranging from 20m-35m above the mean sea level. The highest elevation is being 35m at Nabagram. The general slope of the land is towards the south & south –east. Landform of the study area is older alluvial terraces. It forms the Delta Flank Geomorphic division of the district.

CLIMATE

The study area belongs to the sub humid semi-tropical zone of Indian Peninsula. It ranges the prominent south east monsoon which sets in about the second half of June and recedes by the 1st week of October generally. About 75% rainfall occurs during the monsoon.

Table1. RAINFALL CHARACTERISTICS OF THE STUDY AREA

Blocks	Rainfall in mm		
	1997	2002	2004
Sagardighi	1555.6	1407.9	1210
Nabagram	2043.3	1306	955
Burwan	1377.3	1743	1158
Kandi	1297	1676.2	1220.6

Source: IMD.

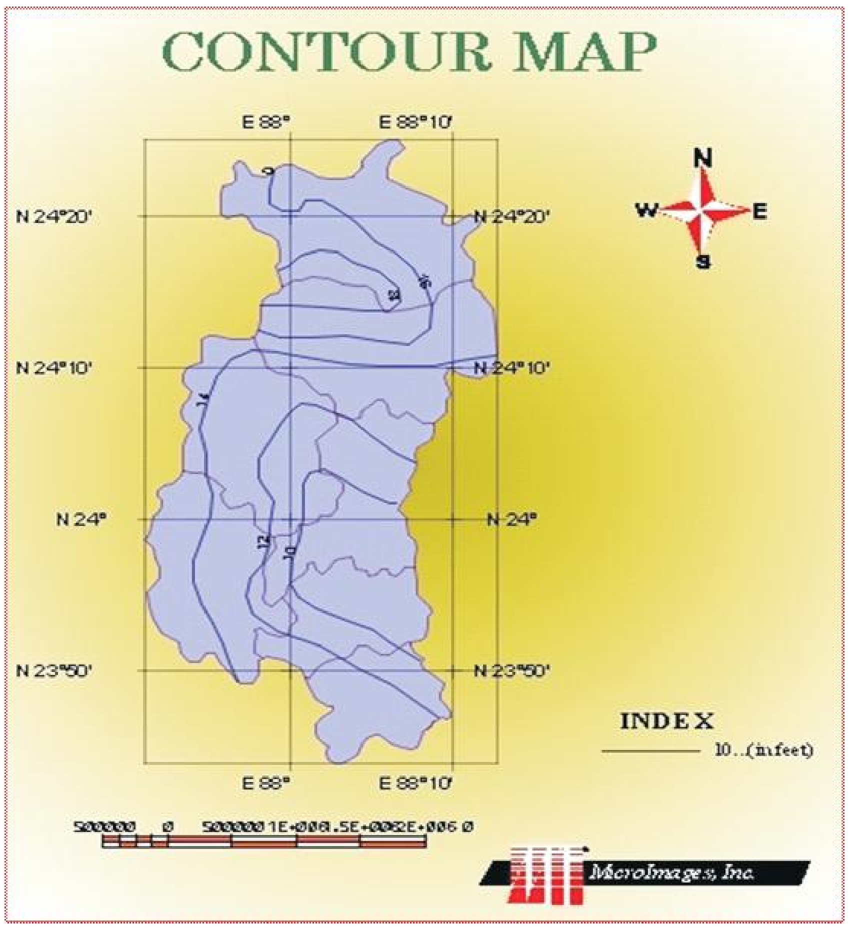
DRAINAGE & SOIL

The Dwarka, the Mayurakshi & its tributeries and the Babla are the main rivers in the study area. These rivers rise from the north western uplands of Rajmahal and falls into the Bhagirathi. Soil of this area is dominantly clay & laterite clay type. The land is raised & slightly undulating having gentle slope from west to east. Soil of these blocks is comparatively heavy contrast between gray and red in colour (mixed with iron & iron oxide), very low in in organic carbon content and soil reaction is slightly acidic. Soil PH is from 5.5 to 7.5, classified as Rajmahal Rivine Land soil.

GEOLOGY

The region is made up of older alluvium of Pleistocene sediments in which clay material predominate, bearing the signs of laterisation. Calcareous nodules & lithomarge with clay are also found on the surface. All the materials are deposited by the rivers rising from the Chotonagpur plateau and the Rajmahal hills.

In the study area the surface material is older alluviam which is 5 m to 27 m thick and predominantly clay in the subsurface.Below the clay bed sand and gravel bed is encountered. At Nabagram and Sagardighi blocks the clay thickness is rather higher and there are two clay beds –one between surface and at a depth of 9-27 m and another at a depth from 34mto65m.Tertiary clay of steel gray colour starts at a depth from 80-115m and bottom is not encountered. Within these two clay beds there are sand beds of varying thickness.



AQUIFER CONDITION
In the study area the aquifers are made up of different grades of sand and gravel that extend from 140 to 150 m .Here confined and semi-confined condition is developed due to presence of thick clay bed, in parts of Kandi, Khargram, Nabagram and Sagardighi blocks, in particular.

Table 2. AQUIFER CONDITION OF THE STUDY AREA

Blocks	Average depth at which granular-zone encountered(m)	Average thickness of aquifer (m)
Sagardighi	30	30
Nabagram	25	28
Khargram	15	25
Kandi	10	30
Burwan	10	30
Bharatpur1	20	20
Bharatpur2	20	30

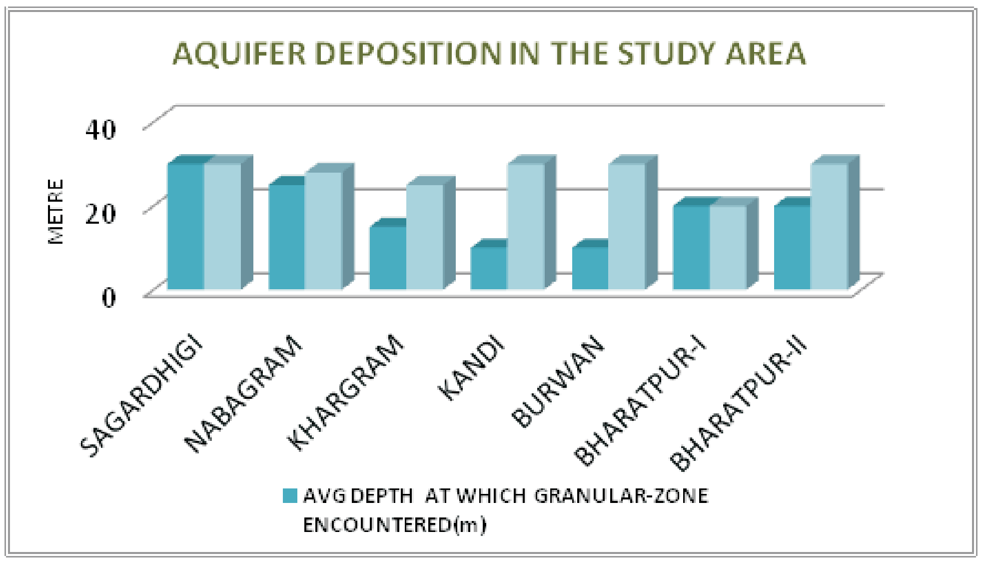


TABLE 4. HYDRO GEOLOGICAL CONDITION

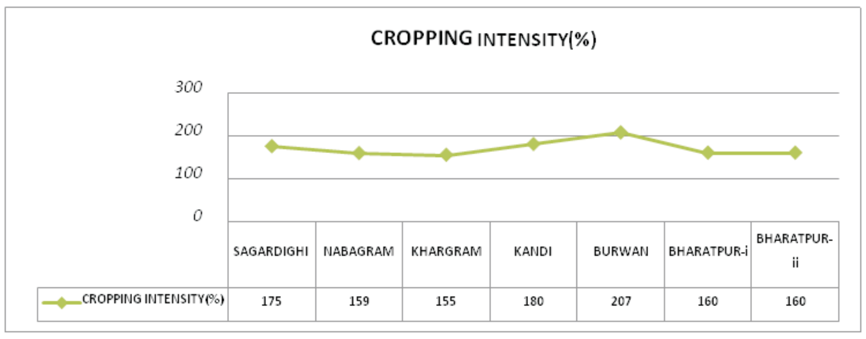
Age group	Lithology	Hydrogeological condition	Ground water potential	Feasible ground water structure
Pleistocene	Older alluvium, silt, sand, ferrogenous concretion, gravel and pebbles.	semi-confined aquifer	Moderate to good yield 100-150 cubic m/hr	Generally medium duty, often heavy duty tube wells within 80-100 m depth range.

FINDINGS

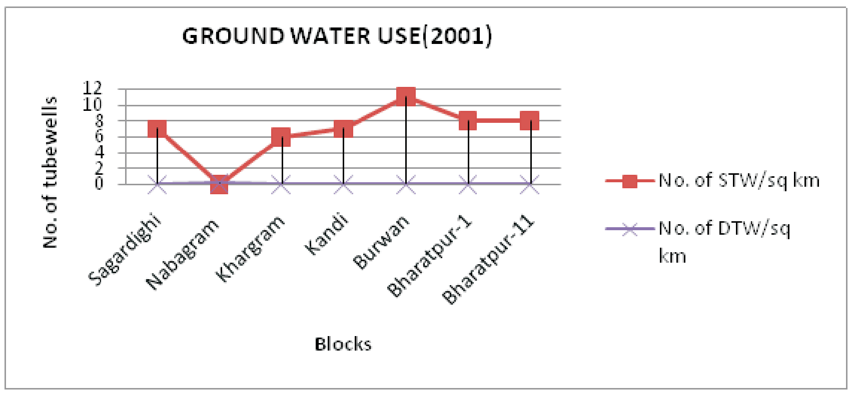
CHANGE IN AGRICULTURAL PATTERN

In the study region population growth is very fast and growth rate is about 4% annually. Agriculture is the main landuse with cropping intensity more than 150%. Rice is staple food in this area. Only four blocks out of the total Rarh region of Murshidabad have got benefit from the Mayurakshi Project for irrigation-Nabagram (2662ha), Khargram (940ha), Kandi (420ha) & Burwan (600ha).The Rarh produced good amount of rice by means of canal irrigation. The people including traders from the Bagri region to the east of the Bhaguirathi used to collect paddy or rice mainly across the study area. Thus as a result of historic Cordon imposed by the West Bengal Government, the supply of paddy /rice sharply declined. Consequently, the farmers found it hard economically. In the mean time, the Green Revolution brought

HYV (High Yielding Variety) dwarf species of wheat and paddy. The farmer fell greedy of tangible boost in harvest. These species are very much water –thirst. Cultivators started draining out huge amount of water from wetlands, bowl shaped beels, ponds etc. to cultivate paddy, they began to destroy forest, grasslands, fallow lands and changed the sowing period, they began to draft huge amounts of groundwater by highly subsidized tube-wells and pumps. Thus the whole landuse and cropping pattern of the region changed within few years. The traditional rain fed kharif and Rabi crops like indigenous varieties of Aman and Aush paddy, oilseeds, pulses etc. all were replaced by water-thirsty HYV paddy and thus eco –friendly traditional cropping pattern disappeared. Owing to the chronic vagary of the monsoon the rain fed kharif harvest had remained a regular failure before the Green Revolution. Unfortunately, the revolution entailed a huge ravage of the multi-crop pattern,bringing about almost irreversible ravage of ecosystem, local stream, water bodies, wetlands went dry and grasslands, bushes and thickets vanished at the cost of alleviation of severe hunger.



The study area belongs to AES-11(Agro-ecological situation) in the district of Murshidabad.The much progress in mechanical farming following the Green Revolution the more decline in age old symbiotic relationship between the farmer and his livestock in the study area. When a land is made for Boro, a farmer in the process puddles his lands its surface gets, to an extent, impervious to water to percolate into the ground; the slate like surface layer retains the irrigated water and allows it to evaporate and fade away into the atoms. This cannot occur even in the case of rain-fed aman variety of paddy. The acreage of Boro paddy shows a continuous increase over the period from 1985-86 to 2000-01 all sustained by tube well irrigation facilities .The area of pulses shows a gradual decrease and the area under oilseeds remains constant. The area under vegetables shows continuous increasing trend. The boro cultivation that involves exploitation of huge amount of groundwater contributes much more to a steady depletion of groundwater in the study area. On the other hand, with the explosion of population the need to feed the rice-eater humanity in the area has looked up which has prompted a wild hunt for more land to be cultivated and indiscriminate conversion of wetlands by draining the water and deforestation provided the farmer with greater arable land but at the same time has led to a steady dwindling of the natural farming and replenishment of the groundwater to a disastrous proportion. The area being under the monsoon regime, the years having scares rainfall account for the groundwater going under an further aggravated stress and the farmers taking on a desperate attempt to save their crops, boro-paddy in particular, by extracting hard the groundwater already stressed- out. That obviously worsen the plight altogether.



DEPLETION OF GROUNDWATER IN THE STUDY AREA

In this part of the district a small area is covered by Mayurakshi canal command. A major part is dependent on minor irrigation and here shallow tube wells are fitted with submersible pumps. Minor irrigation structures have been increased to a great extent from 1988 to 1997.From the data provided by the minor irrigation census it is revealed that there are more than 40% increase in both deep and shallow tube wells. The density of shallow tube wells with submersible pumps is 8 to 10 per square km of the cultivable area in the region. Now the area is almost saturated with shallow tube wells. Sinking of tube wells filled with submersible pumps is a popular practice among the cultivators. In a decade (1988-1997) net groundwater draft has increased by 62% in Bharatpur-11, 44% in Nabagram, 34% in Khargram and 33% in Kandi block. At present this figure has increased by more than 100% in some part of the area .In Sagardighi block the annual water balance is very much crucial and it is only 649 hams. During 10 years(1997-2007) pre monsoon water table went down by 1.7 m in Sagardighi, 4.5m in Nabagram, 2.4m in Khargram, 3m in Kandi, 2.5m Burwan, 2.5m in Bharatpur-1 and 3m in Bharatpur-11. A steady declining trend of groundwater is a major ecological challenge in the study area.

TABLE 6. GROUND WATER DEPLETION IN THE STUDY AREA

Block Name	Water table in m(1997)	Water table in m (2007)	Depletion(m)
Sagardighi	13.34	15	1.66
Nabagram	15.14	19.69	4.55
Khargram	12.88	15.24	2.36
Kandi	12.76	16.01	3.25
Burwan	17.42	20.02	2.6
Bharatpur-1	11	12.57	1.57
Bharatpur-11	11.5	14.51	3.01

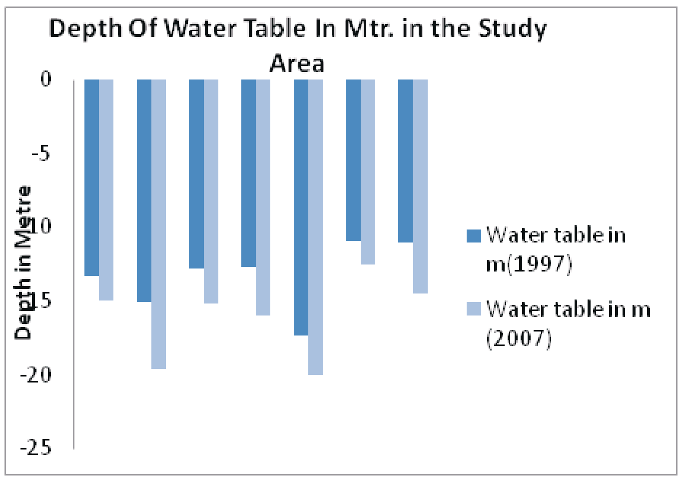
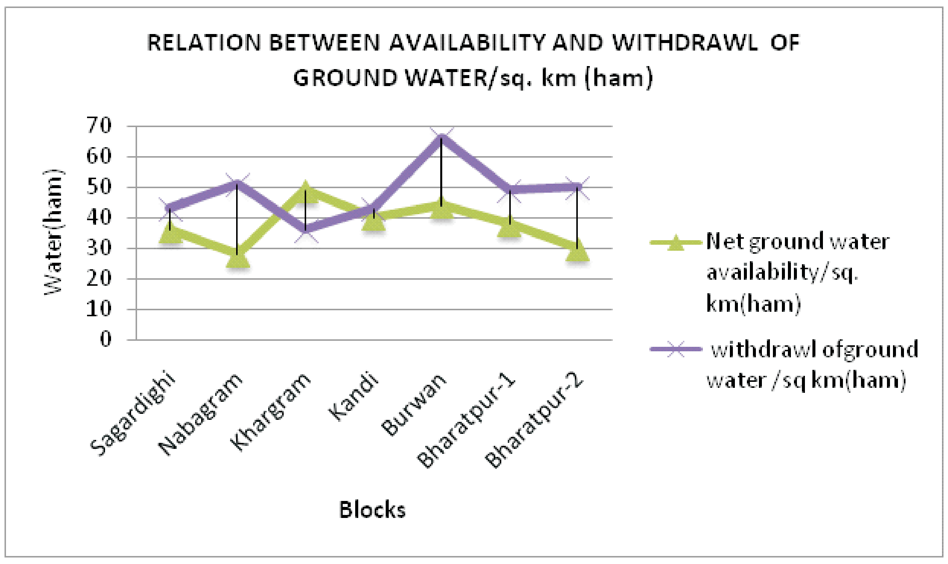


TABLE 5. NET AVAILABILITY AND WITHDRAWAL OF GROUNDWATER IN THE STUDY AREA

Block	Net groundwater availability (ham/sq.km)	Withdrawal (ham/sq.km)
Sagardighi	36	43
Nabagram	28	51
Khargram	49	36
Burwan	40	43
Kandi	44	66
Bharatpur-I	38	49
Bharatpur-II	30	50

Source: Irrigation Department



RECOMMENDATION TO SOLVE THE PROBLEM

Groundwater based irrigation should be restricted to 80% of net recharge .Farmers must adopt the traditional cropping pattern through proper cost benefit analysis to save both water soil .Construction of tube wells with submersible pumps should be restricted Geologically these 7 blocks are very much suitable for rain water harvesting . Attention should be given to surface water use by saving wetlands, tanks, rivers and other water bodies in the area. Recommendations are:

•Rainwater harvesting
•Multi-crop farming
•Construction of water reservoirs near farm-field
•Conserving the existing wetlands and water bodies
•Impeding surface run-off.

·CONCLUSION

The seven typical Rarh blocks of the Murshidabad are highly developed in agriculture with average crop rating more than 170%. Population growth is very fast(4% annually). Agriculture is main land use and farmers shifted from traditional cropping pattern to water intensive monoculture (HYV) after Green Revolution. Groundwater level varies from 15 to 20 mbgl in pre monsoon period. Depth of water level has substantially gone down by 2 to 5 m in an average during last 20 years. Groundwater development is very high. Iron concentration and electric conductivity has been observed recently.

In Prof. Swaminathan's words, "Our agriculture is now at the cross roads- between the Devil and the deep sea- ecologically, economically, technologically and socially. A "business as usual" approach will not help us save farmers and farming from the deep economic and ecological crisis they are now facing". Though it is now over ten years since the WTO regime started operating in agriculture, serious attempts are yet to be made to launch in rural areas movements for quality literacy, trade literacy, legal literacy and genetic literacy.

REFFERENCES

• Misra A .K (1989): Hydrology and groundwater resources of MSD, West Bengal, CGWB.
•Sinha M. K & I. Dasgupta (1999): A preliminary study on Hydrology of the alluvial tract in and around Kandi, MSD, West Bengal
•Groundwater Information Booklet, District Murshidabad, West Bengal, CGWB, Eastern Region, Kolkata, July, 2007.
•Comprehensive Hydrological Information of Murshidabad, Geological Div., No. 111, Berhampore, June, 1998 CGWB
• Hydrological Atlas of West Bengal, Eastern Region, CGWB