CHAPTER - ONE
INTRODUCTION

1.0 BRIEF INTRODUCTION

Land, water and human beings have cherished relationship since human civilization. Researchers and scholars have defined this intimate relationship differently in their writings. Alluvial tracts of Bengal Delta Basin are a subject of research and psychoanalysis for past few decades. Bengal Plain is divided into active delta, moribund delta and mature delta. Murshidabad District in West Bengal lies in the moribund deltaic part of Bengal Delta Plain. This district has chronological and geographical importance. It is the central part of West Bengal connecting the north of the state with the south. During partition of India and East Pakistan (now Bangladesh), on the eve of August 1947, Murshidabad was allotted to erstwhile East Pakistan for few days. Before the details of Radcliff Award were published such inter alia had created geographical connectivity difficulty within West Bengal, India. As soon as details of the Radcliff Award were published the administration of Murshidabad was re-transferred to West Bengal (Gazateer of India, West Bengal; Census 1979, Handbook, Murshidabad by A. Mitra; pp: 7). The present shape of the district has remained more or less constant since 1879 in spite of the evidence of changing courses of Padma River.


The river Bhagirathi, a tributary of the Ganges has presented a perfect picturesque of physical configuration. Abundance of fertile land and water has flourished this district in agriculture naturally. With the advent of Green Revolution since 1970’s, the introduction of groundwater exploration has given more assured crops to the farmers. High yielding varieties of seeds, chemical fertilizers, pesticides, groundwater availability, cheap labour, agricultural technology and engineering had
Figure no: 1.i Block map of Murshidabad District
helped in increased production of crops and productivity of the field. A drastic landuse pattern had changed in the district. Like north-western India and southern India various traditional crop cultures had changed into specialized crop rotation with the introduction of Green Revolution.

The present study is about hydromorphology (special emphasis on groundwater) in Murshidabad district and enhanced modern irrigation. The knowledge and practice of the people had played a crucial role in agricultural transformation. The special prominence is laid on the process of use of groundwater and its consequences. How the Green Revolution is responsible for changing the quality and quantity of fresh water of the district? Geologists, geochemists, and hydrologist from all over the world are engaged in describing the probable cause of groundwater contamination with redundant deadly chemicals like arsenic, fluoride. Being a student of geography this research is a trial to relocate the inland surface water bodies which were once an asset of this water abundant Murshidabad district and gathering information about how human knowledge, their practices and ability directly affect the hydrology and morphology. Changing landuse has persuaded away inland surface water bodies converting them either into agricultural field or settlement especially in sub-divisional towns and its peripheral areas. The education and knowledge of the workers in the field that is the farmer can be the catalyst of agricultural progress.

1.1 ORIGIN OF THE RESEARCH PROBLEM

Mankind’s dependence on environment to extract their basic needs has given birth to restless pursuit of social and scientific progress. Comfort and security has resulted in increased stress on environment – especially on land and water. Our demand for the ‘blue gold’(water) is increasing at a faster pace with passing time and thousand more people are compelled to survive in a water stressed condition throughout the world. Water scarce regions are those areas where availability of water is less than 1000 meter cube per person; moderate is 1700 meter cube per person (G8 summit to the World Water Forum, 2007). World data are collected from 2003-07 where India is some where between 1700 meter cube to 1000 meter cube per person. Cultural landscape
spectacularly controls the society, economy and balanced ecosystem. The main problem of our society is any type of technological introduction in society is done without prior mass education. Consciences grow when some hazards already has taken place due to misuse of the technology.

Hydromorphological Problems like silting of watershed, arsenic contamination in ground water, flood, and erosion are nothing new to researchers in deltaic part of West Bengal but everything is kept in books. It is an imperative situation for communicating those works through mass education and mass communication recurrently. The problems, consequences and the reasons behind such land-water anomaly are needed to disclose publicly. Various suggestions from specialized researchers and the affected people itself must be considered while planning and taking effective measures.

1.2 A LOCAL SCENARIO

The effect of green revolution had started a little later in Murshidabad district. Inclusions of shallow tube well (nowadays private Chinese machines), deep tube wells in irrigation had started during 1982-85. Unlike other parts of the country, Murshidabad saw profit in agriculture in late 1980s, but gradually, the diminishing marginal return law of economics in productivity of crops is reported in the district quite often (refer chapter four, table no.4.xiv and figure no.4.ii &4.iii). Irrigating field has become costly with increased rate of diesel and kerosene (refer chapter five table no. 5.xi). Meanwhile, a global concerning issue sprang up in this district is the arsenic contamination in water, drying and silting of inland wetlands like ‘nalas’, ponds, ‘beels’, minor distributaries and other water bodies. During summer fluctuations of groundwater layers, arsenic and iron contamination in groundwater and rising cost of irrigation are burning issues currently among farmers in Murshidabad even in lower depth region of the district. After each shower of rain; farmers forget their problems and hence, micro irrigation projects, water conservation and water harvesting projects lag behind. The expenditures done in surface water renovations are irregular and unscientific. The district is so fertile and abundant in water that almost all types of crops are grown in this district. But arsenic contamination in human ecosystem is an unmanageable problem already discussed by scholars refer
Anandabazar Patrika, 3rd Dec., 2012, pp: 1&7). People are gradually engulfed by this life risking metallic poison. More over, the amount of silt is increasing in inland wet lands (ponds, ‘khals’, ‘beels’) and small distributaries. Money is received from Central Govt. and State Govt. for rain water harvesting and micro irrigation but the funds are not optimally used for minor irrigation and wetlands conservation. The sluggish growth of surface irrigation on the one hand and the easy availability of ground water on the other have made the farmers more reliable on the ground water irrigation. Today, the farmers want more diesels. They have knowledge how to cultivate crops but neither is conscious about developed crop culture nor are they educated in it. They totally depend on God or the scientists if ground water gets evacuated. They are least bothered about the recharge zones and therefore convert the ponds and beels (backwaters) into paddy and jute growing land with rising population. Only dependence on groundwater for irrigation has taken many indebted farmers life in southern India and western India; this story should not be repeated in Murshidabad district of West Bengal.

PROPOSAL OF RESEARCH WORK
1.3 STUDY AREA

Murshidabad is one of the densely populated districts of West Bengal. Total population is 7,102,430 people according to provisional 2011 census. Male population is 3,629,595 and female population is 3,472,835 only. Population has increases about 21.07% compared to the population of 2001. The total geographical area is 5324 sq km and the land size holding is only 0.61 hectare per person only. About 80.22% of population lives in rural areas. At the apex of the Ganges delta, Murshidabad district stretches between 23 degree 43 minutes to 24 degree 50 minutes North and 89 degree 49 minutes to 88 degree 46 minutes East in Central of West Bengal. Geomorphically, the district occupies the interfluves region between the Padma-Ganga river roughly constitutes its eastern boundary and the Bhagirathi, the northern most tributary of Padma-Ganga. The river Bhagirathi flowing from north to south through the district, divides it into two almost equal portions – to the west of the river the land is locally known as ‘‘rarh’’ and the east as ‘‘bagri’’. Murshidabad is low lying and alluvial often flooded by the spills of Bhagirathi. It has humid climate and fertile soil. On the western side the surface is high and undulating, the soil is hard clay, on which winter rice alone grow well and drier than the eastern tract; ground water level often go down during dry winter months. Due to the low lying and clay and silt mixed alluvium soil in the eastern part, problems like arsenic contamination in ground water; siltation and braiding of rivers are often reported by the geomorphologies’. The changing land use demand more and more water for three to four crops in a year. Little attention is received by the fact of disappearance or depletion of ground water.
Figure no: 1.ii Location map of the study area in Murshidabad District
1.4 RELEVANCE OF THE STUDY IN THE STUDY AREA

Murshidabad district is a land of strong historical culture and geographical importance but socially and economically it is tranquil. The standard of living emphasizes on ignorance, unawareness and lack of knowledge in societal aspect. The
population has increased quantitatively not qualitatively. Number of works regarding the river mapping, flood management, ground water management, soil management has been done but very few works are available regarding the insight of the people, their needs (food, clothing and amenities), enhanced agricultural knowledge, awareness about irrigation, awareness about arsenic contamination in ground water which is becoming fatal in many cases and perception about the present hydromorphological problem and above all their suggestions to minimize the above said problems. Today the total crop production is more or less dependent on ground water irrigation. It will be impracticable to suggest stopping of exploitation of groundwater. Private shallow pumps are gradually rising in number to make assured crop yield with traditional practice of watering the plants. A mismatch is created between traditional knowledge, practice of crop cultivation and modern irrigation system. Presently, question arises about the sustainability of the green revolution. This revolution had flooded granaries for the time being on the one hand but on the other hand almost every part of India is suffering from unwanted chemical concentration like arsenic, iron, fluorides, cadmium etc. in portable groundwater and depletion of groundwater. It is time now to economically and optimally blend the age old irrigation by inland surface water (ponds, shallow nala etc.), tank, and river water with the modern irrigational method i.e cost-effectively exploiting of groundwater with shallow tubewells and deep tubewells.

Mass human knowledge and practice is the only noble way to solve the economical, environmental and social crisis of this district.

Murshidabad district is a water surplus region of West Bengal. The ponding time is very good \(^2\) (Pal, S. & Bhattacharya, A.; 2008), the infiltration capacity of the soil is fantastic, groundwater is eventually recharged every year with adequate rainfall and the total district is an area of oxbow lakes and spill channels. The groundwater is available at 5-10 feet below ground level (bgl). In spite of so many positive attributes for water availability, the district is suffering from both hydrological and morphological problem. The western part of the district suffers from lowering of ground water level and silting of rivers while the eastern part the district suffers from acute arsenic contamination and silting of rivers. The reduction of areas of inland wetland in the district is sharply visible since 1980’s. Only photographic evidences can show how ‘khals’, ‘beels’, ‘nayanjali’
has been converted disturbing the drainage system of the whole district causing artificial flood in many cases.

There is a vast difference in cost of production with surface water irrigation and ground water irrigation (refer table no 5.xi &xii). The various water management programmes, micro irrigation programmes and renovation of traditional water bodies are malfunctioning for surface water irrigation and also the resources are not properly created to store water in the lean season.

The main foci of this study is to analyze the positive and negative aspects of groundwater irrigation, to evaluate the economic benefit of micro irrigation, to formulate the future strategies or policies to use the precious ‘blue gold’ and also to know the peoples’ perception about hydro-morphology, related problem, knowledge and plan to depart awareness to them regarding groundwater.

### 1.5 QUESTIONS

With the dawn of Green Revolution in India especially in Western India groundwater exploration initiated. People reported about groundwater exploitation just after three decades, then report came on groundwater mining, and now people complains about groundwater piracy specially in number of districts of Western and Southern India. Newspapers reported about groundwater quality deterioration all over India³ (Times of India, 2\textsuperscript{nd} May, 2012). Now few questions are to be answered:

- Do groundwater irrigation process holds its sustainability in these present circumstances?
- Why agricultural mechanization did not flourished in West Bengal like other part of India?
- All the loop holes of groundwater irrigation and its resultant consequences are known to government with the precedence of Western and Southern India, then why again advertisement comes on television for another Green Revolution in Eastern India with the hands of ground water exploitations?
Why no planning, any training is done before launching any new techniques and implements on agriculture through block and gram panchayat level by agricultural department?

Where are the awareness programs? Why people do neither get facilities of arsenic free portable water nor are they interested in spending negligible amount of money for the sake of arsenic (As) free water?

Why emphasis and proper arrangements are not made to encourage surface water irrigation where ever possible parallel with groundwater irrigation?

Today a revolution is needed i.e. the ‘blue gold’ revolution. Recharge of groundwater has become limited while surface runoff has increased due to various factors like, deforestation, silting of rivers, continuous crops cultivation in stagnant condition in the field and above all anthropological causes. Murshidabad district is a red alarm zone of Arsenic contamination in groundwater which is consumed through food and water daily by lakhs of people. Only photographs in rural health offices do not create alertness, wakefulness, responsible, knowledgeable for healthy life. Unremitting training programs, awareness programs may change the situation.

1.6 OBJECTIVES

• To revise the relationship between changing land-use pattern and ground water irrigation use.
• Compare and contrast between the rate of groundwater use, surface water potential created and preserved; in the post green revolution period (1978-2010).
• To find out whether arsenic contamination in ground water is related vertically or horizontally from surface water source in the study area. Is groundwater irrigation currently feasible?
• To study the economics of micro water management schemes/ programs launched and in operation in the district for past ten years.
• Study the peoples’ perception about the hydro-morphological problems occurring in the post green revolution era (questionnaire survey).
• To propose an integrated micro level approach for renovating, creating and judiciously managing agricultural society to minimize the hydromorphological problems and once again try to attain sustainability in agricultural water use.

1.7 HYPOTHESIS

Although the district seems to be developing in agriculture but it is obtained at the cost of the quality of groundwater. Therefore, hypothetically it can be said,

a) Groundwater is inexplicable important for the growth of agriculture hence the earth will soon get vacuum and also arsenic contamination in groundwater cannot be controlled.

b) The lack of scientific knowledge of people about irrigation and recharge zones encourages more groundwater exploitation with least alternative and

c) The traditional practice of watering the plants is a topic of rationalization which is difficult to change by the practitioners.

1.8 METHODOLOGY OF WORK
District gazetteers, statistical handbooks, district annual action plan, district planning map, mouza maps of samples taken, police station map, various periodicals of agricultural development office, agricultural bulletins, weather reports, libraries, grampanchayat level data for various samples, reports of NABARD and irrigational water were collected. Various journals were consulted to focus on the status of the district and works by researchers on the hydrology and morphological change since 1970’s. LISS –III, 2007 images has been included due to unavailability of topographical maps. The research work is based on inductive and deductive research methodology.

1.8(a) **PRE-FIELD STUDY**

The study area is a water abundant, fertile agricultural region. Study of literature, administrative records related to physiographic, hydrology, socio-economic status clearly shows red alarm in the district regarding hydrology which is affecting the morphology (land use) and the mass population. History about the irrigation and changing land use vis-a-vis changing cropping pattern was studied. Collection of secondary data, information and various bulletins from news- papers were documented. Collection of base map specially district planning map, cadastral map and a few historical maps for micro study about the districts was collected. Literatures available in websites were thoroughly consulted regarding landuse, water and adoptive measures to solve ground hydromorphological problems of the neighboring countries especially Bangladesh.

1.8(b) **FIELD STUDY**

The samples chosen were purposive in nature. Gram panchayats were chosen mainly from near the rivers or streams (2 to 5 km) and another is far away from the rivers or streams (15-20 km) in the ‘bagri’ region and from the ‘rarh’ region one Grampanchayat was chosen from the centre of the block. About 300 respondents from ‘bagri’ region and another 300 respondent from ‘rarh’ region water interacted from 2008
to 2012. The study of sample size was defined as the minimum required number of sampling units that are needed to build sound statistical conclusions and inferences. This was done by Jordan Custom’s desired level of statistical confidence and tolerance for statistical error. The following formula was used to draw inferences on the population:

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SS = \frac{(Z^2 \cdot P \cdot (1-P))}{C^2}
\]

<table>
<thead>
<tr>
<th>SS</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>Z value (eg. 1.96 for 95% confidence level)</td>
</tr>
<tr>
<td>P</td>
<td>percentage picking a choice, expressed as decimal (0.5 used for sample size needed)</td>
</tr>
<tr>
<td>C</td>
<td>Confidence interval, expressed as decimal {0.07 = \pm 7)</td>
</tr>
</tbody>
</table>

The parameters of inductive study were:

- Change in agricultural land use pattern and behavioral change of the inhabitants of the study area was identified.
- Hydrological and morphological changes that have taken place since 1970’s were verified.
- Questionnaire/schedule survey was documented to cross check the data published in various secondary sources and understand the perception of the local people about the hydromorphological problem.
- Frequent visit in certain selected area especially in pre-monsoon and post-monsoon season for close communication in the study area at micro level. Photographic records, peoples’ perception survey, opinions, suggestion were carried in various sampled blocks. NGO’s and older citizens were consulted with the problem almost in every angle.
1.8(c) **POST-FIELD STUDY**

- All map layouts and surveys were put together and arrange them with spatial and temporal importance.
- Checking, mapping and proposed modification is done to draw the conclusions of the present problems and needs.
- Statistical calculations were done in Microsoft excel 2007 and Principal Component Analysis and Bivariate Analysis was done in SPSS 20.0 software.
- Processing and map making of collected information with the help of geographical information system ARCGIS 9.3, verification from satellite images and data from LISS III (2007) and validation in schemes are assured through quality assurance standardization techniques.

1.9 **LIMITATIONS**

The research proposal underwent various limitations---

First of all no topographical map is available for ‘bagri’ region for consultation as this portion of Murshidabad shares the international boundary with Bangladesh. All the map work is done with the district planning map, cadastral maps of different mouzas and satellite image for the district.

Secondly, the district annual plan periodicals are very haphazardly maintained and irregularly published by administrative office, Grampanchayat wise or block wise data for 1970’s and 1980’s are almost unavailable. Scope for tally of previous year’s statistics on various research related issues was sometimes very unsatisfactory.

Thirdly, numbers of grampanchayat or ‘anchals’ were inaccessible and sometimes socially unrest. For convenience one mouzas from each case study block was sampled and in some cases two mouzas were sampled.

Fourthly, the concept of ‘mouza’ is for land and land resource related while grampanchayat offices do not consider mouza as their working unit they deal with ‘anchal’ which may consist of the whole of a mouza or part of it. Collections of data
were sometimes too difficult. Few mouza maps are out of print and all sheet number of a particular mouza is often unavailable. Grampanchayat wise data for water resource is meager.

1.10 CONCLUSION

After having a glance at the agricultural statistics it may be considered for the convenience of this research work that for Murshidabad District 1970-1980 was pre-green revolutionary period, soon after 1980 the onset of green revolution occurred, the entire decade of 1990’s was mid-green revolutionary period and after 2004-2005 the post-green revolutionary period can be counted.

Therefore, this research is urgent in need, to find out the ways how to educate the society to make them realize, understand the necessity to conserve fresh, sweet water, conserve the groundwater recharge areas, to adopt appropriate practices of irrigation for different crops and how to become the beneficiaries of various State Government and Central Government Schemes under MGNREGA specially in the field of water conservation, micro irrigation and soil development. Education and mass communication among human being can confirm in conserving and optimally use of resources; employ the wisdom and natural world knowledge and overall advancing of a country.

REFERENCES: