Nature's Bounty or Scarce Commodity-- Competition and Consensus Over Ground Water Use in Rural Bangladesh

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ABSTRACT

Bangladesh is a country synonymous with abundant water and floods. However, there is a distinct dry season, when temperatures are high, precipitation very low, demand for irrigation water high and surface water flow reduces considerably. The resultant impact lowers the ground water table and a seasonal crisis affects millions of people dependent upon hand pumps for drinking water.

This crisis has exacerbated in recent years as irrigation coverage has increased dramatically further lowering the ground water level. As water has always been found in abundance, rules/norms for using this common resource has never been codified and people are confused confronting the emerging reality. The competition over the finite ground water resources between mechanically powered Deep Tube wells (DTW) and manual handpumps for drinking water supply are forcing communities and authorities to think about instituting regulations over the use of ground water. Technocratic and regulatory approach favors a zoning and regulatory control perspective. However, as conflicts are increasing, people and communities are beginning to develop local level controls and self management of this critical common resource.

This paper explores the context of this emerging situation. Evidence is there that due to cultural and religious sanctions water is not denied to any one but exchanges do occur between parties. Often recipients of drinking water have to provide equal amount of surface water to the irrigation channel in order to receive DTW water. As more and more handpumps become inoperable due to the irrigation triggered draw-down, people are questioning the relentless use of the common property for the benefit of modern irrigated agriculture. The equity implications complicate the conflict further as rich landowners either own/control irrigation pumps (and therefore water during the dry period) and are major beneficiaries of irrigation. Therefore, the emerging informal rules over the harvest of the common resource is affected by existing power relations in the society. What remains to be analyzed is to what extent are the conflicts arising out of common property harvesting supporting the development of informal rules and how that agreed consensus is equitable and sustainable as an option compared to technocratic administrative controls.

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I. Background

Bangladesh is country of 120 million people living within an area of 1,47,570 sq. Kilometers, largely formed by the floodplain and delta of two major river system of South Asia, Brahmaputra (called Jamuna in Bangladesh) and the Ganges (for most part called Padma in Bangladesh). The semi-tropical high rainfall (from a mean annual of 1500-5000mm) area is crisscrossed with numerous rivers (most of which originate outside the country) and their tributaries. Considering the soil characteristics, high rainfall and flow of surface water from a very large catchment area, the county is generally endowed with good but uneven ground water resources. The rainfall is monsoon determined and is concentrated during the months of June-September. The rest eight months receive 15-20 percent of the annual rainfall. There is a distinct hot and dry period during March-May and water shortages are acute in parts of the country during this period. This is also the period of winter rice cultivation requiring constant irrigation, compounding the water scarcity further.

The hydrogeological conditions allow extraction of ground water cheaply with simple technologies almost everywhere in the country. In terms of water table there are four major types of area, i.e., the Low Water table area (LWTA) where water is available below 8 metres, Shallow water Table Area (SWTA) where water is available within 7 metres, Coastal Saline Area (CSA) where water at shallow depth is saline, and the hilly terrains of Chittagong Hill Tracts (CHT) Area (Figure 1). In the early eighties about 75 percent of the country was under the SWTA, while around 8 percent of the country was under LWTA. The CSA and CHTA area are rather static, although, due to upstream withdrawal of surface water by India during the dry months, salinity is increasing in the coastal areas of Bangladesh. However, the LWTA is increasing rapidly and is forecasted to cover around 50 percent of the country by the year 2000 (DPHE). In the SWT area water is extracted by common No. 6 handpumps for drinking water purposes, while mechanized shallow pumps draw water for irrigation. In the LWT area deepset handpumps are used for drinking purposes while mechanized deep tube wells is common for irrigating crops. The CSA and CHTA uses different deep tubewells and other technologies for extracting ground water.

In Bangladesh, government has always been involved in the provisioning of water for all purposes with varying level of involvement. Until recently, it was the exclusive responsibility of the government to provide drinking water. In the rural areas, this has changed considerably in the recent past as individuals are sinking and operating No. 6 suction mode handpumps in increasing numbers (Sadeque and Turnquist, 1995). Despite the impressive private sector participation in SWTA, the other areas are still dependent upon government provisioning of water supply and the available technologies are relatively more expensive. In the absence of piped water system in the rural areas beneficiary contribution remains limited to a small down payment at the time of installation and minor repairs only. For ground water irrigation however, the introduction of mechanized pumping although government induced has almost become totally privatized now. Prevalent technologies are mechanically operated Shallow Tubewells (STW) and Deep Tubewells (DTW) and farmers either buy individually or form a group to buy one. STWs are usually .05 cusec and the DTWs are typically 2 cusec in capacity. The availability of ground water in most areas has resulted in proliferation of tubewells both for drinking and irrigation purposes. Currently there are over 2.5 million handpumps in operation, less than one third of which are government and the rest are privately owned. It is

estimated that around half a million STWs and nearly 35 thousand DTWs are currently in operation for irrigation purposes. The STWs, due to their low cost, are increasing rapidly and around 40-45 thousand are added every year. Irrigation season in Bangladesh are the months of February-May, when the water table also remains at its lowest, and precipitation is minimum. It is during this period that the mechanized irrigation pumps are increasingly viewed as a competitor to handpumps providing drinking water.

II. The Declining Water Table

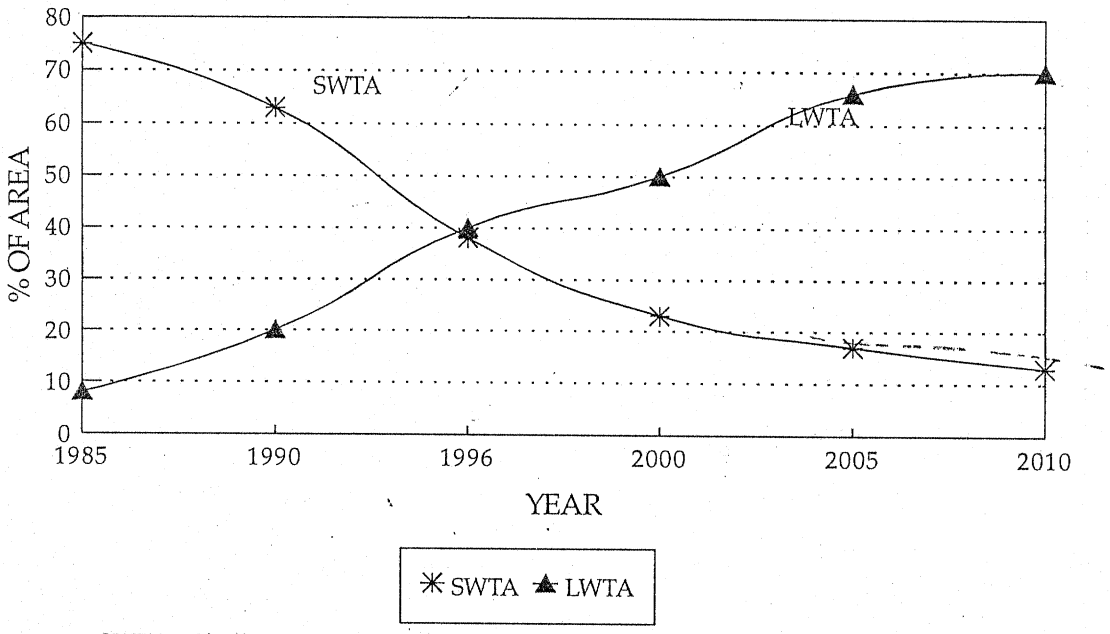
With an average annual rainfall of 1500-5000 mm, presence of numerous rivers flowing through the country and floodplain depressions and marshlands, it is often difficult to comprehend that the water table in Bangladesh, at least in certain areas are actually consistently declining. The availability of groundwater is dependent on properties of groundwater storage reservoir and the annual recharge from rainfall, rivers and flooding. Seasonal lowering of groundwater level caused by increasing ground water development runs the risk of periodic tubewell failure due to large annual variability of rainfall distribution (National Water Plan, 1990). Therefore the Water Plan has accepted the seasonal failure of handpumps and goes on to conclude that only Deep Tubeweels can realize complete development of agricultural potential (NWP, P. 10-71, 1990).

Food self-sufficiency has always been a top priority in successive five year development plans of Bangladesh. To achieve that goal huge investments were made in flood control and irrigation development. The Fourth Five Year Plan (1990-95) noted that in order to achieve food auturky the country needs to transform the agriculture sector from "rainfed to irrigated agriculture" (The Fourth Five Year Plan, 1990). Ground water based minor irrigation has been the mainstay of this transformation. After the deregulation of the minor irrigation sector and privatization of all equipments in the late eighties, the sector began witnessing a phenomenal growth in the number of mechanized pumps. Although the more expensive DTWs registered a slower growth, the STWs grew by 40-50 thousand each year during the 1990-95 period. In the LWT areas, DTWs are the major source of irrigation. DTWs, typically of 2 cusec capacity can irrigate 25 hectares of rice land. DTWs when in operation create a conical depression in the water table and pumps out water from that displacement. That is why they are associated with temporary drawdown of water table in the adjoining areas. Typically, in the relatively elevated LWT areas of North-west Bangladesh, ordinary No. 6 handpumps become inoperative during the dry months when water table recedes below 7 metres. With the large scale introduction of DTWs and STWs, water table recession during the dry months has exacerbated rendering more and more hand tubewells (HTW) inoperative. The numerous traditional low cost HTWs are thus become useless in the LWT area. Beginning in 1986, the Government of Bangladesh-UNICEF Rural Water Supply and Sanitation Program has started sinking a new lift mode pump, locally known as "Tara Pump" , which can access water from water table upto 15 metres. For the LWT areas this is the appropriate pump for drinking water supply. However, they are still not widely available as they are usually 5-6 times more expensive and are and although manufactured by private sector is still only available through the public sector distribution system.

As stated earlier the LWT area is increasing rather quickly, particularly in the relatively drier North-west and highly irrigated Central region of the country (figure 2). Government agencies like the Department of Public Health Engineering (DPHE) and Bangladesh Water Development Board (BWDB) monitors ground water through wells and have developed comprehensive data base on

ground water level since the last decade. Contour map and hydrographic chart from these data base shows the declining ground water table (figure 3 and 4). From a mere 8 percent of the country in 1980 LWT area has increased to 15 percent in 1988 and was forecasted to increase 40 percent in 1995 and over 50 percent in the year 2000 (DPHE). Figure 5 compares the LWT and SWT areas over the projected years.

Figure 5: Percentage of Area Under SWT & LWT Areas At Different Plan Periods Upto Year 2010



SWTA : Shallow Water Table Area LWTA : Low Water TAble Area

A recent DPHE-UNICEF study investigated the declining water level in 386 Thanas (County like administrative unit) out of a total 486 Thanas of the country. Table 1 shows the comparative scenario of this study. The expanding LWT area and shrinking SWT area is evident from this table as well.

Table 1 : Number of Thanas Under SWTA & LWTA

	1995	2000	2010	F.Dev
SWTA	196	159	131	113
LWTA	152	189	217	235
Sub-Total	348	348	348	348
Outside Study	138	138	138	138
Total Thana	486	486	486	486

The implications are quite dramatic for rural water supply option in Bangladesh. Based on the current drinking water needs, 400,000 HTWs will be required to be replaced by Tara Pumps in the LWT area by the year 2000, to ensure current level of access. The cost implications are stupendous. Estimated cost of this replacement (hardware only) at current prices would be at-least 5 billion takas. With increased use, and upstream withdrawal of water from common international rivers, ground water level recedes temporarily in the dry months. But the problem, as evident from the accelerated rate of decrease is perhaps largely due to increased ground water pumping for irrigation. The perception of affected people of the LWTA as victims of water deprivation are becoming marked with acrimony towards irrigation.

III. Ground Water Use Policies and Regulations

Water resource management is increasingly assuming a critical need for the growing population of Bangladesh due to growing demand and increasing conflict between alternative uses. Water is both a public and private good and therefore the allocation system must take into account the needs of all users, particularly the poor. It is also an economic and a scarce commodity and therefore its use should be determined by opportunity cost pricing. However, that should not ignore such basic needs as access to safe drinking water, sanitation and hygiene practices. As water is a common resource and has wide ranging uses, its development and management should involve all users and beneficiaries.

Although, comprehensive survey of water resources and their development strategies has been enunciated by the government since 1990 (NWP, 1990, 1991 and Bangladesh Water and Flood Management Strategy 1995), Bangladesh still does not have an approved water policy. Consequently the planners and managers of water resources operate with a segmented approach and is target oriented. Therefore efforts are usually disjointed and supply driven which are usually detrimental to national interest and ignore such important principles as water balance, conjunctive use of water and efficient utilization of an unitary economic resource.

Inspite of the absence of a stated policy, Bangladesh does have a set of laws (some dating back to the British colonial and Pakistani period) governing the use and control of water. Most relevant of them are The Bengal Irrigation Act, 1876, Bangladesh Irrigation Water Rate Ordinance, 1983, East Bengal Embankment and Drainage Act, 1952, State Acquisition and Tenancy Act, 1950 and Ground Water Management Ordinance, 1985, subsequently held in abeyance. The Irrigation Acts were designed to determine Levy of water rates, while the Embankment and Drainage Act defined the construction, O&M of embankments and drainage structures. The Acquisition Act of 1950 recognized the rights of State on subsoil resources (ground water). The purpose of The Ground Water Management Ordinance was to address siting, installation and spacing of minor irrigation equipments (STW, DTW). With the passing of the State Acquisition and Tenancy Act of 1950, the ambiguity on the control and ownership of subsoil water stemming from English Common Law tradition dissipated. Although State ownership of ground water became recognized with that Act, it was never treated accordingly and remained in the common domain, neither public nor private. This principle still determines the control and use of water as will be elaborated in the next section. The Groundwater Management Ordinance of 1985 was the first attempt to regulate the fast growing minor irrigation sector. It was during the heyday of regulations in the economy and agricultural development like other sectors of the economy, were led by parastatals. However, the Ordinance which aimed at regulating siting, installation and spacing of DTWs and STWs, met with severe

resistance since it was promulgated. It was never acted upon seriously as deregulating moves were already underway and the parastatal (Bangladesh Agricultural Development Corporation, BADC) entrusted with its implementation was itself being downsized.

There are number of government agencies under several ministries dealing with water issues. Their mandate are different and therefore priorities they set out are also often conflicting. Planning and management of water resources under such conditions are therefore for obvious reasons rather disjointed disregarding critical factors. Surface water is under the Ministry of Irrigation and Water Resources. Ground water activities are carried out and monitored by individuals, Water Resources Ministry, Ministry of Environment and agencies under Local Government Ministry although the legal framework on control and ownership of ground water is held under Common Law traditions leaving the scope of regulation rather difficult. However, inspite of not having a stated policy, the National Water Plan of 1990, 1991 and the Bangladesh Water and Flood Management Strategy as well as Five Year Development Plans addresses all the important issues as part of the water resource management strategy. As often is the case the Strategies and Plan documents contain all the right rhetoric but are rarely put to use when water related activities are undertaken. Lack of a single institutional focus and mechanism as well as the absence of a comprehensive policy that is binding on all, is the cause of such adhocism in the sector.

IV. Conjunctive Use of Water: The Bone of Contention

As stated earlier, there are two principal sector of water use in the rural areas, i.e., agriculture and drinking water supply. The NWP, 1990 recognizes the serious conflict between expanding irrigation abstractions and viability of potable water supplies obtained through suction hand tubewells (No. 6 HTWs). As the HTWs are mostly sunk in homestead plots which are on an average 1+ metres above the crop field level, operation of mechanized STWs for irrigation also affect the availability of ground water for HTWs. The NWP conducted several sophisticated tests showing the adverse effects of irrigation abstraction upon the HTWs in North-western districts (NWP, Vol. 1, P.8-14-18).

In the LWT area of North-west Bangladesh (Rajshahi, Naogaon, Chapai Nawabganj and Natore Districts), increasing irrigation activity has severely affected drinking water supply abstracted from HTWs. As water rights are largely undefined and uncodified in Bangladesh it is critical to study the issues surrounding conjunctive use of water particularly for irrigation, drinking water supply, fisheries and the impact upon each of these sub-sectors. A rapid appraisal was undertaken in two localities of the North-western LWTA, during first week of April, 1996. They are Ilsha Bari village of Chandipur Union, Sadar Thana of Naogaon District and Hatgovindpur Village of Mohanpur Union, Godagari Thana of Rajshahi district.

IV.i. Study Locales

Both the village communities are typical of Bangladesh. Ilisha Bari is community of 130 households and 800+ people, nine kilometers away from the district town connected by metalled road. Most households (50%) are engaged in agricultural activities, while the rest are mainly involved in wage labor (25%), weaving, pottery and other artisans (10%) and the rest are self-employed and professionals. Other than ponds there are no other source of surface water in the village. Hatgovindpur is more agrarian in occupational composition. The total population is approximately 900 and households are 125. Over 60 percent households are engaged in agriculture, as owner

farmer, or sharecropper. The rest are wage labor and selfemployeds. The village is fairly remote, 9 kilometers from Thana headquarter connected by metalled road. It also does not have any surface water source other than ponds within the homestead area. Both the villages have 15+ HTWs for drinking water supply. Recently under the government-Unicef RWSS Program 2-3 Tara Pumps have been installed in the villages. DTWs are in operation since early eighties in each of the villages for Boro rice cultivation during dry months. Land ownership is skewed, over 40 percent people are functionally landless having no agricultural land of their own.

IV.ii Methodology

The rapid appraisal of the two communities were conducted with intensive field study of two days for each community. A social map of the villages were constructed with para (neighborhoods), roads, groves, crop field, location of tubewells. Homesteads were clusters of houses of same lineage, or individual nucleus. A checklist of important issues centering around domestic water requirement, fetching, access to tubewells and safe water, tubewell functioning, perceptions regarding water rights and policies governing water use, risks and hedging against constraints etc. was developed to guide interviews. Interviews were held with HTW owners/caretakers, women users, Tara pump caretakers, DTW operators/managers. Focus Group Discussions were held with women from poor households having no irrigated land, households with irrigated land and Tara pump allottee groups.

Information collected through interviews and discussions were cross checked and are summarized in the following sections.

IV.iii. Impact of Declining Ground Water on Drinking Water Supply

Over the years, winter (Boro) rice has become a critical source of food and income for the study villages. The area used to be rainfed single cropped. With the introduction of DTWs they have become double cropped area and due to higher productivity and less uncertainty, Boro rice has become the major harvest for the villagers. Each year beginning in January-February the irrigation machines (DTW) starts functioning and the HTWs starts running dry, as water table recedes well below their suction capacity. The entire population of both the villages begin their vigil for collecting drinking water. The couple of Tara Pumps in their village are their only alternative. These pumps are built with a capacity to supply water to about 10-15 households. But during this long 3-4 month period they are always in operation as more and more people starts accessing water from these pumps. These pumps are provided by the government RWSS Program to groups of ten households. The Caretakers (the household that organizes the signature collection of allotees and usually pays the contribution sum), who are the defacto owners of the pump institute new rules for use of the pumps during this period. As they (caretakers) are also responsible for maintenance, the extra pressure on the pumps become a source of irritation for them.

Previous studies on access and equity issues of public HTWs, has also noted that the caretaker households control access of tubewells as well as make rules about non-owner's access (Sadeque and Turnquist, 1995). Although religious and cultural norms preclude total exclusionary tactics by the controlling household, drinking water is for taking but restrictions of various sorts are placed by caretaker family specially at times of crisis. Some of the restrictions faced by the non-owning families in Ilisha Bari and Hatgovindpur are summarized below:

- Caretaker family has the right to jump queue.
- Complete restriction on taking water for domestic purposes, other than drinking.
- Families related to owners have better, often unrestricted access.
- Low caste people are tactfully discouraged.
- Restrictions on account of the pretext that children are careless users.
- Restrictions on account of privacy of caretaker family.

Therefore, it is evident that volumetric restrictions, and a general note of discouragement hangs over non group (Tara pump allottee) members. Volumetric restrictions affect the lives of people in more than one way. Health-hygiene of people suffers most as sufficient quantity of safe water is not available. In the study area prevalence of various skin diseases were noticed, with the women and children as the worst sufferer as bathing water is scarce. Children do without bathing for consecutive days. Adult men takes bath in ponds which usually has a couple of feet of muddy water. In a country where the monsoon season (June-September) brings in enormous amount of rain and a third of the country is regularly inundated, scarcity of water for bathing is a tragedy that these helpless people cannot comprehend. Upstream water withdrawal by India of the major rivers of the region Ganges, Atrai, Punarbhava and Mahananda have compounded their woes. But it is the increased ground water abstractions for irrigation that is directly linked with the lowering of the water table beyond the limits of common suction pumps is adversely affecting the lives of LWTA people without unrestricted access to improved technology that can ensure clean water for them.

As the Tara Pumps are meant for drinking water and are situated in homestead clusters they are favored as the source of drinking water during the dry months. However, people sometimes secure drinking water from DTWs irrigating the crop field. But as they are further away from homesteads and women and children are the principal carriers of water, DTWs are not a favored source. Although the capacities of the DTWs are far greater and users need not touch the machines to collect water, it is nonetheless not that convenient or easily accessible by people. Costs are associated with the sinking and operation of DTWs and it is now mostly private. Therefore, public welfare at private cost has become problematic. Increased power costs and uncertainty of electrical power availability has further compounded the problem. For the farming community of these LWTA winter rice cultivation has become increasingly critical for household food security as increasing aridity in the region and high input prices now means that cultivating minor crops has become unprofitable and the only alternative is irrigation based cereal production. Due to these factors there are some restrictions on fetching water from DTWs imposed by the operators and managers as well. They are summarized as below:

- Non-irrigating households are least favored in collecting DTW water.
- Women cannot bathe in the open area of the crop field.
- Washing cannot be carried out at the DTW pump site.

- Physical limits on carrying water from distant crop field.
- Operation of DTWs on odd hours (usually late evenings).

Dry season water shortage is a phenomenon that LWTA people are and will have to live with. Although many of the rural people are not knowledgeable about the technical issues associated with declining ground water table, they envision some causality with the operation of DTWs and the lowering of ground water level. People in our study area are yet to articulate sophisticated arguments regarding the indivisibility of ground water resources for public welfare. But they are aware that for a commodity like water, exclusionary policies and subtractibility from one's welfare due to use by others is unjust. Ground water is finite although recharges can fill up used portions under ideal conditions. But nonetheless, they are often not replenished to their original state and the effects are visible. Hydrographic data indicates a slow but consistent decline of ground water over the years, which is more than seasonal drawdown. Therefore, it cannot be treated as an open access resource like open water and deep sea fishing, where people can and do harvest for individual maximization. Our study area people also voiced their concern in the same vein, regarding the nature of this "God given resource", or common property resource in academic lexicon. The immutability of water as a common resource for the benefit and sustenance of everybody is engraved in the perception and world view of the rural inhabitants, who are feeling the erosion of their inalienable right to this resource.

Based on our discussion with users, the following are two case studies depicting differential treatment meted out to people of different socio-economic background.

Jobeda Khatun, a widow of around 40 years lives with three of her children, a son aged 20, and daughters aged 17 and 13. Her husband was a weaver, operating indigenous handloom producing Gamcha (very thin low cost towels), and Lungi (a dress for men). He died 3 years ago, at age 50+. Jobeda and her daughters now operate the loom, while her son is a casual wage labor. They are functionally landless with a tiny homeplot shared with other kin members. When her husband was still alive and having reasonable income they installed a HTW on their homeplot 10 years ago. This privately owned HTW serves around 5-7 households in the cluster. Like many other HTWs in the village their pump also becomes inoperative during the dry months of February-April. Jobeda and her daughters scramble for water during these three months. The nearest Tara pump is about 500 metres away, from where they collect water. As they are all grown up females neither she nor her daughters can venture to the DTW, far away in the crop field to collect water. Besides, the DTW is seldom operated during day hours and as landless non agricultural household they are least favored in receiving DTW water. Poor Jobeda complains as to why should they be deprived of water which is everyone's right. The DTWs are drawing their share of water for the benefit of the rich, who have farm land. Jobeda feels they are doubly deprived. As landless they do not share the benefits of agricultural modernization (irrigation being a very visible symbol), while their HTW does not yield water during the dry season due to the operation of DTWs.

Box 1: A Non Agricultural Private HTW Owner's Woes in Ilisha Bari

While non agricultural poor households have apparent difficulties in accessing water from DTWs or Tara pumps, relatively well to do households have somewhat different experience as evidenced from the next case study.

Lutfunnesa, aged around 45 is a housewife in a joint family household, where her husband, Emajuddin Pramanik is the eldest brother. His two other brothers are also part of this joint family. Emaj and his immediate younger brother Tasir jointly manage their family farm of around 15 acres, while his youngest brother is a migrant worker in Saudi Arabia. They are all married and have around a dozen children between them. They have over 5 acres of land under the DTW command area. They also have HTW on their homeplot which was provided by the government and they, as the caretaker family, looks after (also effectively controls) the tubewell. It also runs dry during the dry months. Lutfunnesa sends their young children and often their lone live-in servant to fetch water from the DTW. They get unrestricted access to the DTW, but often faces difficulties as the DTW is seldom operated during day hours. They are also affected by the lowering of the water table but in the greater interest (field crop) they are not complaining. Besides, they have unrestricted access to the DTW, but they would eventually like to have a Tara pump on their homeplot, as they feel that DTWs are for irrigation and people should not access its water for domestic purposes. Currently they also procure water from a Tara pump in the village, and are in good social terms with the caretaker of that pump.

Box 2: Social Networks and Access of Water

Inspite of the competition over ground water resources for irrigation and drinking water supply and the conflicts, resentments arising out of it, there are evidence of consensus in sharing this finite economic resource as well. In both Ilisha Bari and Hatgovindpur, we came across several examples of self-management in sharing the common resource. Water is a critical life support resource and that is well recognized. Providing water to the thirsty is a cherished virtue and important sign of piety in Islam. Culturally, water is also synonymous with life for all communities and therefore its access just for the sake of it can not be denied. In both the villages and also in other parts of area, people can access water fairly easily, secure a pitcher or two of DTW water. But under drought like conditions, fetchers are often encouraged to bring in equal amount of surface water (available in ponds, ditches, canals). This is becoming more of a norm in certain areas, where the irrigation command area is extensive and lowering water table affects all tubewells.

Another type of cooperation that is emerging in the area, is operation of the DTWs in early morning hours. Usually the pumps are operated during evening hours to minimize evaporation losses, which also partly holds for early morning hours. Early morning is also the peak water use time for rural households. Many households are collecting water from DTWs at these hours. However, it is only possible to carry limited amount of water from distant crop fields. People are also allowed bathing in some DTWs (but usually no washing of clothes with soaps), but obviously only the men and children can take advantage of this.

Some of these cooperative arrangements were beginning to emerge in the late eighties when regulatory steps to control siting and installation of tubewells (Bangladesh Groundwater Management Ordinance, 1985) were in the process of implementation and regulatory control was at its highest level. People realized that negotiation was better than having controls imposed by central and distant

authorities which may not be in the interest of either parties. Additionally, regulations would result in bureaucratic control and therefore encourage corruption.

Technologies are not scale neutral nor are they gender neutral. Agricultural modernization programs in developing societies has never quite come to terms with this issue. Irrigation water and the emerging water markets are often no exception to this anathema. The opportunities in drinking water supply on the other hand is quite promising to bypass these problems. Higher value of drinking water which is also low in volume makes drinking water supply ideal case for self-management and decentralization of services.

V. Conclusion, and Future Research Scope

Ground water is a common resource, neither under complete state authority nor it is recognized in the private domain. It is now increasingly being used for productive purposes (mainly irrigation) and is coming under intense competition with other conjunctive users, i.e., drinking and domestic use and fisheries. Narrow sectoral development approach exacerbates the conflicts arising out of conjunctive use of this resource, while the absence of a comprehensive water policy furthers the sub-sectoral target orientation to maximize their development.

The erosion of common property resources and its impact on the sustenance of poor households are a relatively well recognized phenomena in Bangladesh. The dwindling forest resources of the Central Highlands are disproprotionately affecting the Garo indigenous forest dwellers of Madhupur tract (Khaleque, 1984). Flood control embankments and other infrastructures are seriously affecting the income, nutrion and employment opportunities of poor households and fishefolk communities in the flood plains (Sadeque, 1992). One of the most recent phenomena regarding conflicts arising out of common property resource use is ground water abstractions for various uses, notably, domestic water supply and field crop irrigation. It is apparent that with increasing demand on ground water use policies and may be some form of regulations are needed to deal with the emerging conflicts. While policies and regulations are developed at the central government level, due considerations from the perspectives of all stakeholders are a critical need in order to formulate principles that are equitable and generally acceptable to all. The lessons from our rapid appraisal suggests that there are points of conflicts as well as consensus in sharing the common resource. The future of cooperative use of this common resource hinges upon these points of conflict as well as consensus.

First, people having no control or legitimate use rights of deeper water table abstracting technologies (DTW and Tara pumps) face real life constraints in accessing safe water for domestic purposes during the four dry months of February-May. Their rights and ability to harness the common resource is constrained due to their lack of ownership or control over the required technology. Poor women, children and vulnerable groups outside the allottee group of Tara pumps suffer shortage of domestic water supply most. Due to their limited social network and linkage they are often not in a position of strength to negotiate water from groups who have access to it, during the period of scarcity. This raises the question of unequal access to a common resource, due to access to improved and more expensive technologies. The deprived community here becomes the victim of Conventional Exploitative Development (CED) of natural ecosystems (Regier, Mason and Berkes, 1989). Individual's welfare is here subject to subtractibility by others who have access to technology. This brings in the question of equity and adverse effect upon users of HTWs arising out of unregulated conjunctive use of water. The mitigation measures of such CED activity must

be found in the approach where points of conflicts are resolved equitably, and preferably with the participation of all stakeholder at the local level. Under such an arrangement resources are sustainably utilized with due consideration to welfare issue and consensus among all users are forged with local level informal rules. Newer sets of rules may be developed to deal with use of ground water whose extraction during the dry season becomes dependent upon technologies not at the disposal of all. Hence the consensus amongst users and the need for new set of rules to minimize conflicts. Such attempts may resemble what is broadly known as Reform Sustainable Redevelopment (RSR), as explained by Regier, Mason and Berkes, 1989.

Second, certain critical resources have multiple uses and the user groups have differential interests. When the resource in question is governed by guidelines and priorities of several different entities, conflicts are bound to arise. Under such conditions it is ideal to have uniform principles to guide actions. Ground water in rural Bangladesh is such a case. Different institutional control of this resource, along with private sector as an important actor, use practices are no wonder often conflicting, resulting in different basis for negotiation and rule making. The choices left are several. Self-management for consensus as cited earlier is an option, self regulations as opposed to imposed controls are another option. Finally basin wide management integrating use rights of different groups are another option. However, we know little about these issues and these options constitute the core of future research scope.

Third, the erosion and decline of CPRs in the rural context of South Asia has shown to be fulfilling the prophesy of the so called "Tragedy of the Commons", seriously affecting the poor in their attempt to maintain survival and environmental sustainability of the areas (Jodha, 1992). Researchers like Jodha (1992) and Gadgil (1989) have shown how policy shifts can protect the CPRs for the benefit of the poor as well as restore natural habitats.

VI. Emerging Policy Responses

Seasonal drawdown of water table in the LWT area has become a reality, and so are the problems associated with its conjunctive uses. As the LWT area is increasing, to ensure the sustainability of the so called almost universal coverage (stated to be 97 percentage in 1995, by UNICEF) of safe drinking water, certain actions and policy responses are needed.

Foremost of these is a clear enunciation of water use priorities and declaration of a comprehensive water policy. Any future statement on this must depart from the conventional thinking of target fixing and supply driven response. The economic value of water must be given due consideration in the policy statement. Community participation and special attention to the needs of women, children and vulnerable groups must also be given priority in tandem with economic valuation. They need not be mutually exclusive, as numerous examples of water delivery system around the world testifies (Narayan, 1995). Technology choice, demand preference and opportunity for capacity building at user level (where appropriate) and institution level also should be looked at in developing the policy statement.

A host of short and medium term recommendations to deal with the seasonal water scarcity in the LWT area are suggested below:

1. Investigate possibilities of group ownership of Tara pumps as opposed to present allotment to groups with nominal contribution sum. This will lessen the subsidy burden for the government (currently approximately 85 percent) and obviously allow for more distribution with same resources, as well as ownership of the program by the beneficiary group.

2. Although the Tara pumps are manufactured by the private sector they are exclusively distributed by the government. Initiatives for their private sector distribution should be encouraged. NGOs and nationalized commercial banks may consider providing micro loans for the purchase of Tara pumps. This must be complemented by improved capacity building for operation and maintenance, developing a private sector marketing strategy for the hardware and spares and monitoring their social acceptability.

3. Cost sharing rather than flat contribution sum, as is the case now should be introduced for HTWs (including the more expensive ones). This along with the earlier recommendations on Tara pump distribution policy is likely to support gradual replacement of ordinary HTWs by Tara pumps in the LWT area.

4. Water sharing for domestic purposes should be formalized for all irrigation DTWs. Each DTW may construct a small overhead tank and few pipe connection at the site for the benefit of ordinary HTW users during the dry season. Cost for irrigation water is still the lowest compared to all other sectors and little sharing should be easily accepted by the irrigators. Besides, as a finite and unitary resource, substractability of welfare by one group is possible and irrigators should be made aware of this.

5. Policy support for changes in cropping pattern should be seriously considered. Crops requiring less water can help reduce the level of drawdown in the marginally LWT areas. This is also critical to reverse the present unsustainable rice monoculture practice and improve nutritional standards in the country as well.

6. Finally, long term investment projects with support from IDA or ADB credit/loan may be considered to replace the hundreds of thousands of ordinary HTWs with Tara pumps. However, increased cost sharing and beneficiary participation in operation and maintenance along with private sector options must be ensured for the investment project to materialize.

Figure 1

Hydrogeological Areas

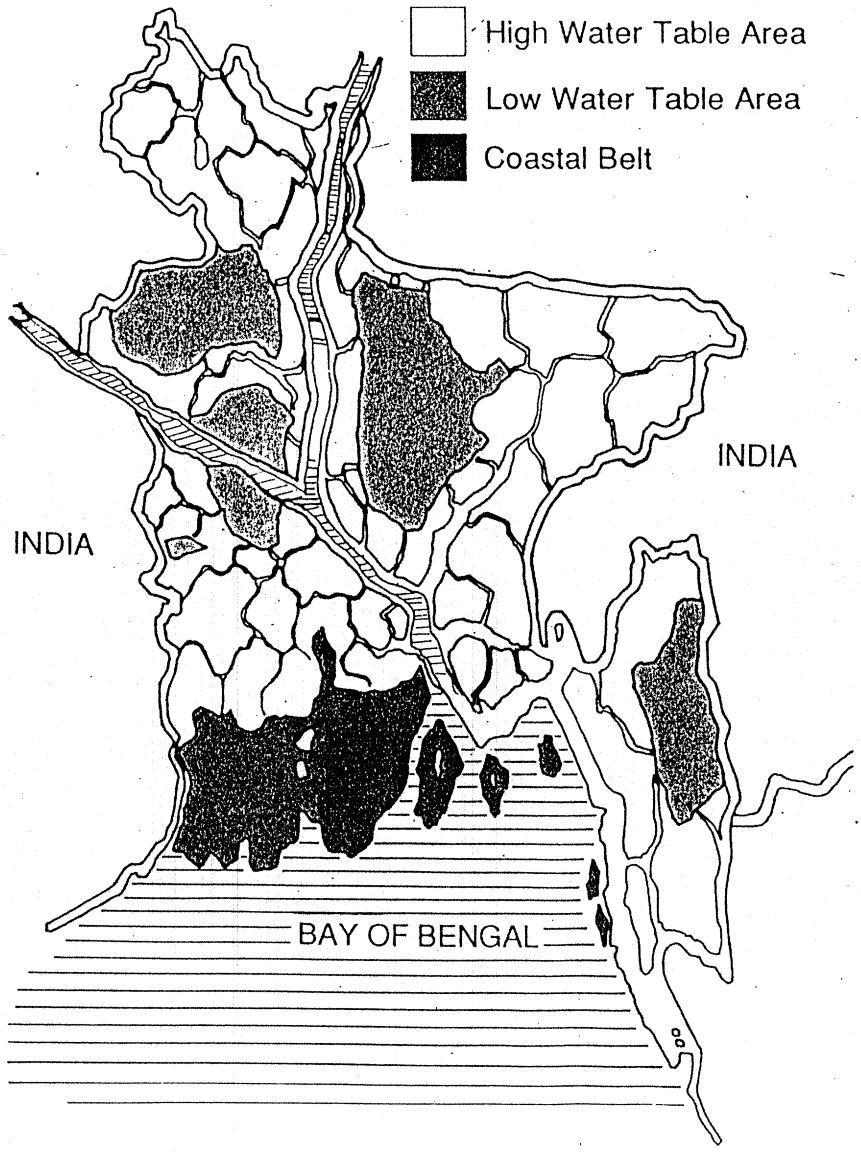
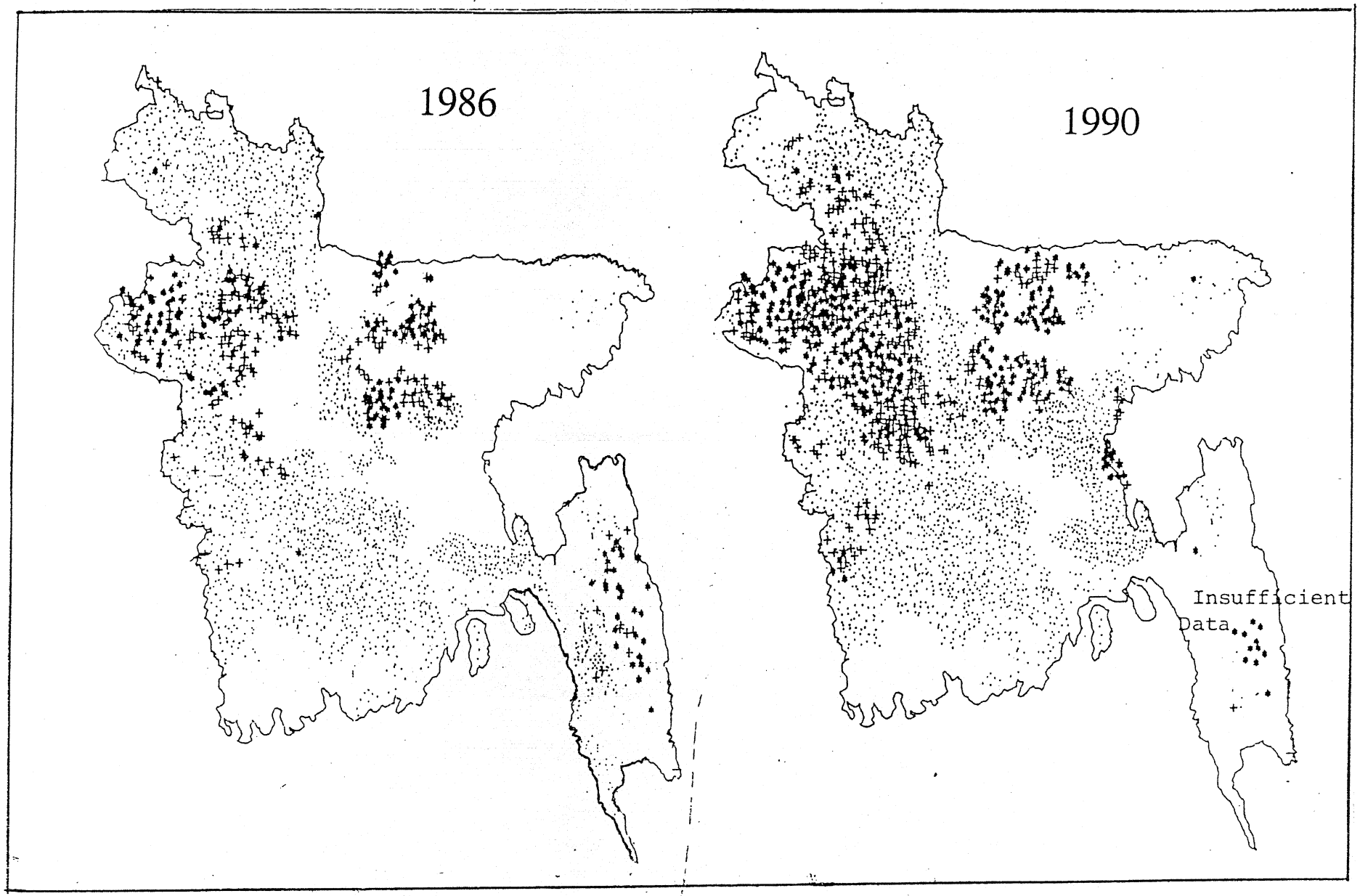


Figure 2 : Low Water Table Areas : Situation in 1986 and 1990



* : Union with observed lowest groundwater level below 30 feet
\+ : Union with observed lowest groundwater level in the range of 25-30 feet.
. : Union with observed lowest groundwater level above 25 feet

Figure 3:

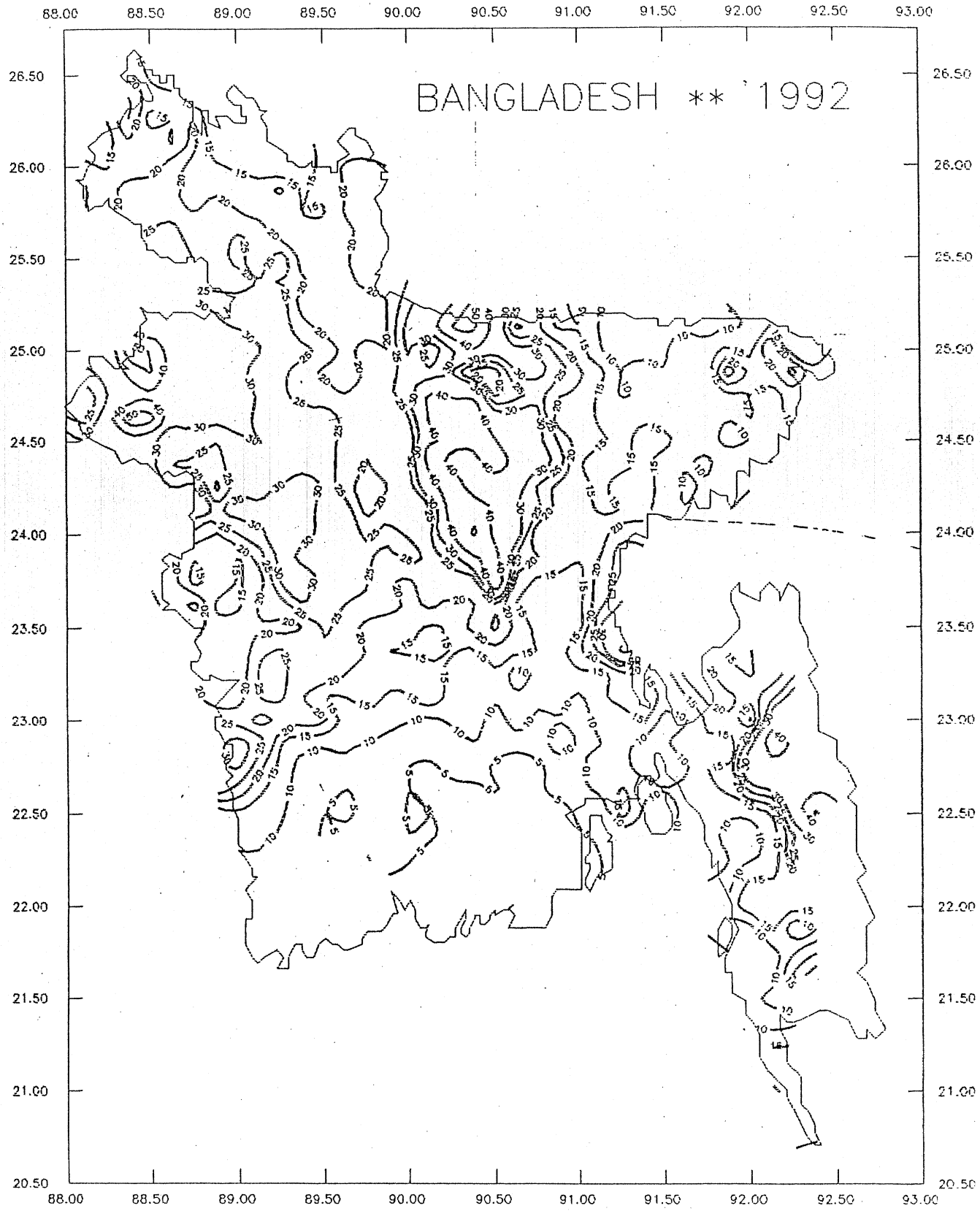

BANGLADESH ** '1992
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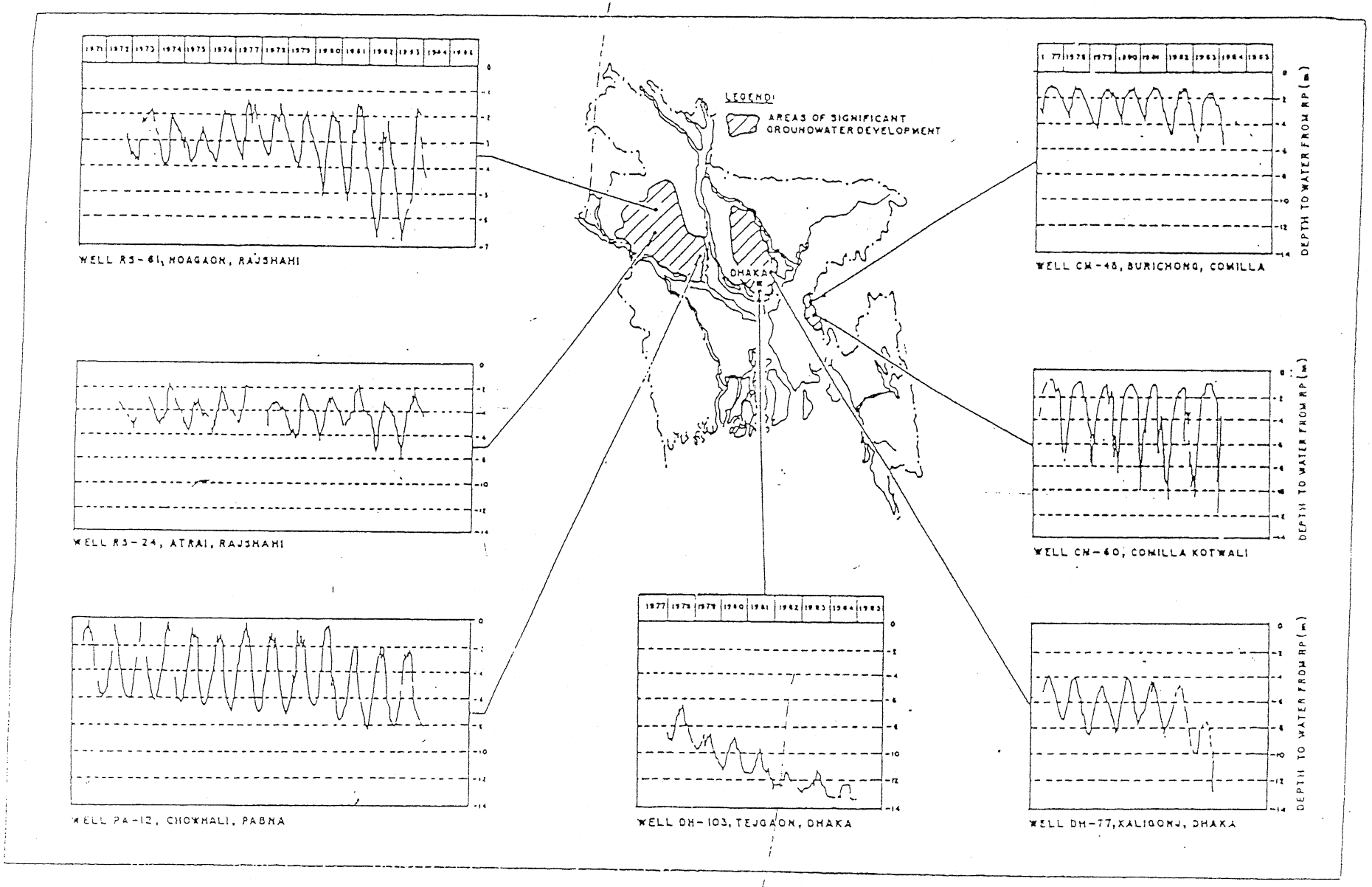
Figure 4


LEGEND:
AREAS OF SIGNIFICANT GROUNDWATER DEVELOPMENT
DHAKA
WELL RS-61, MOAGAON, RAJSHAHI
WELL RS-24, ATRAI, RAJSHAHI
WELL PA-12, CHOWHALI, PABNA
WELL DH-103, TEJGAON, DHAKA
WELL CM-48, BURICHONG, COMILLA
WELL CM-60, COMILLA KOTWALI
WELL DH-77, KALIGONJ, DHAKA
DEPTH TO WATER FROM RP (m)

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