CHAPTER 3

THE PROJECT AREA

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3-1. Physical Conditions

(a) Land

1) General

The project area is located in the northern part of the Kurigram district which is comprised of a major part of Fulbari, Nageswari and a minor part of Bhurungamari and the Kurigram upazilas. It lies between latitude 25°46' and 26°06' north and between longitude 89°30' and 89°46' east.

The land in the project area shows a typical type of alluvialplains found in the Tista delta. The project area consists of 42,800 ha of land bordered by the Dudhkumar, Brahmaputra and Dharla rivers, and the elevation is approximately between 65-128 feet (20-39m) above sealevel.

In Bangladesh, generally, the most important factor which decides land productivity is the inundation condition. Accordingly, a land type classification method based on a specific range of inundation depth during the peak rainfall period in the Kharif (rainy) season is provided on Table 3-1.

Table 3-1 Land Types Defined on the Basis of Flood Depth

Land Types	Physiography	Flood Depth	Nature of Flooding
F_0	Highland	Not flooded or flooded to 30cm	Intermittent
F_1	Medium highland	30 to 90cm	Seasonal
F_2	Medium lowland	90 to 180cm	Seasonal
F_3	Lowiand	over 180cm	Seasonal
F_4	Very lowland	over 180cm	Seasonal / Perennial

Source : Master Plan Organization (MPO) based on SODAPS (Computerized version of the Soil Survey reports of SRDI)

Table 3-2 shows the land distribution in the project area according to the above criterion. As a whole, the land has a gentle topography with a slight slope from north-west to south-east.

Table 3-2 Land Classification Based on Flood Depth in the Project Area

(unit : ha)

Upazila	Highland (F_0)	Medium highland (F_1)	Medium lowland (F_2)	Total
Bhurungamari	1,720 (70%)	610 (25%)	130 (5%)	2,460
Fulbari	5,860 (60%)	3,410 (35%)	490 (5%)	9,760
Kurigram	2,440 (35%)	3,480 (50%)	1,050 (15%)	6,970
Nageswari	10,340 (65%)	4,770 (30%)	800 (5%)	15,910
Total	20,360 (58%)	12,270 (35%)	2,470 (7%)	35,100

2) Soils

The soil in the project area is composed of unconsolidated young alluvial sediment derived from the Dharla and Dudhkumar rivers. They exhibit different degrees sediment development especially in their profile characteristics mainly due to relief, drainage condition, texture and their age. They are classified into three main groups according to physiographic units, i.e., active floodplain, young floodplain and older floodplain. The active floodplain along the river channels are still in their formation. Crops are not grown there. Young floodplain is comprised of young charlands and infilled channels having loamy sediment. The older floodplain has a level and an irregular landscape having ridge, interridge depressions and basins.

In the project area 11 soil series and 2 miscellaneous land types (i.e. sandy and silty alluvium) were identified. The soil series recognized in the project area have been correlated with the Soil Taxonomy, the USDA soil classification System. According to the Soil Taxonomy, all the soils belong to the Entisols or Incepti-sols series. Detailed classifications and soil profile descriptions are given in Appendix I-2.

These soil series were mapped either in association or in consociation (Fig. 3-1). Fig. 3-2 is a schematic cross section showing an example of landscape-soil relationships.

General description of mapping units is given in Table 3-3, and details of each mapping unit are described in Appendix I-3.

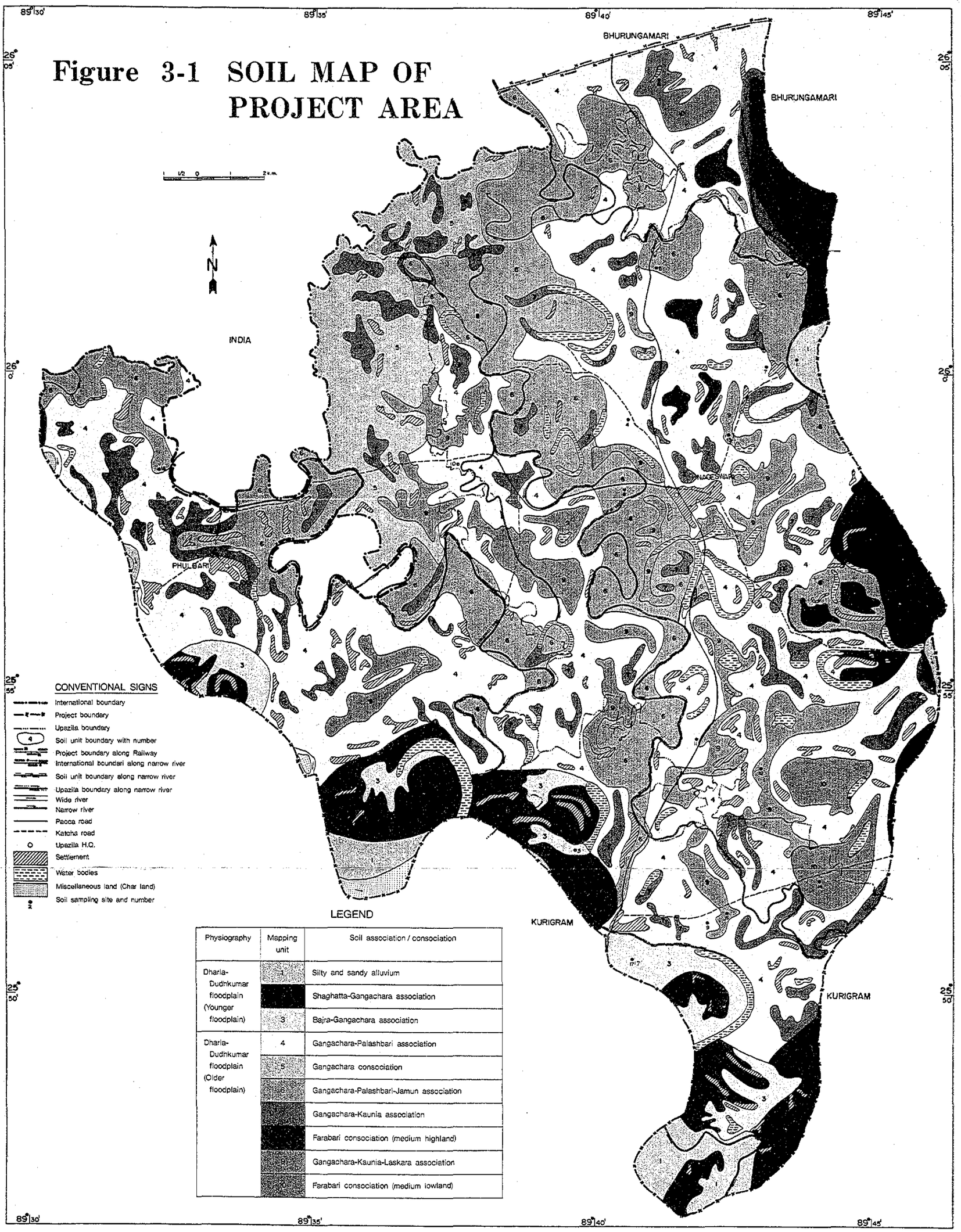
The soil analysis results show that the soils in the project area are slightly acidic to neutral, and their fertility is low to moderate. The texture varies from loam to clay. Nearly all the ridge soils were considered loam to silty clay loam, while basin soils were recognized as clay. Detail descriptions of the chemical and physical properties of these soils are shown in Appendix I-4 along with soil analysis data.

Table 3-3 Soil Mapping Units and Their Extent in the Project Area

Map unit	Area(ha)	Non agr. land (%)	Agricultural land				
			land	type (%)	Soil series	(%)	Irri.suitability
1	890	nil	MH	(60)	Silty alluv.	(40)	Not suitable
					Sandy alluv.	(20)	
			ML	(40)	Sandy alluv.	(20)	
					Silty alluv.	(20)	
2	4,090	5	H	(20)	Shaghatta	(20)	Mod.suitable
			MH	(75)	Gangachara	(50)	
					Shaghatta	(25)	
3	1,310	nil	MH	(60)	Gangachara	(30)	Mod.suitable
					Shaghatta	(15)	
					Bajra	(15)	
			ML	(40)	Bajra	(40)	
4	15,650	15	H	(75)	Palashbari	(20)	Mod.suitable
					Jamun	(10)	
					Gangachara	(45)	
			MH	(10)	Gangachara	(10)	
5	2,450	10	H	(80)	Jamun	(10)	Suitable
					Gangachara	(70)	
			MH	(10)	Gangachara	(10)	
6	7,710	10	H	(80)	Pirgacha	(5)	Mod.suitable
					Palashbari	(30)	
					Jamun	(25)	
					Gangachara	(20)	
			MH	(10)	Gangachara	(10)	
7	2,940	nil	MH	(100)	Gangachara	(60)	Suitable
					Kaunia	(40)	
8	460	nil	MH	(100)	Farabari	(90)	Suitable
					Uttargaon	(10)	
9	2,590	nil	MH	(70)	Gangachara	(40)	Suitable
					Kaunia	(30)	
			ML	(30)	Laskara	(20)	Suitable
					Uttargaon	(10)	
10	940	nil	MH	(20)	Gangachara	(10)	Suitable
					Kaunia	(10)	
			ML	(80)	Farabari	(70)	
					Utargaon	(10)	

Note: H; Highland, MH; Medium highland, ML; Medium lowland.

Figure 3-1 SOIL MAP OF PROJECT AREA



LEGEND

Physiography	Mapping unit	Soil association / consociation
Dharla-Dudhkumar floodplain (Younger floodplain)	1	Silty and sandy alluvium
		Shaghatta-Gangachara association
	3	Bajra-Gangachara association
Dharla-Dudhkumar floodplain (Older floodplain)	4	Gangachara-Palashbari association
	5	Gangachara consociation
		Gangachara-Palashbari-Jamun association
		Gangachara-Kaunia association
		Farabari consociation (medium highland)
		Gangachara-Kaunia-Laskara association
		Farabari consociation (medium lowland)

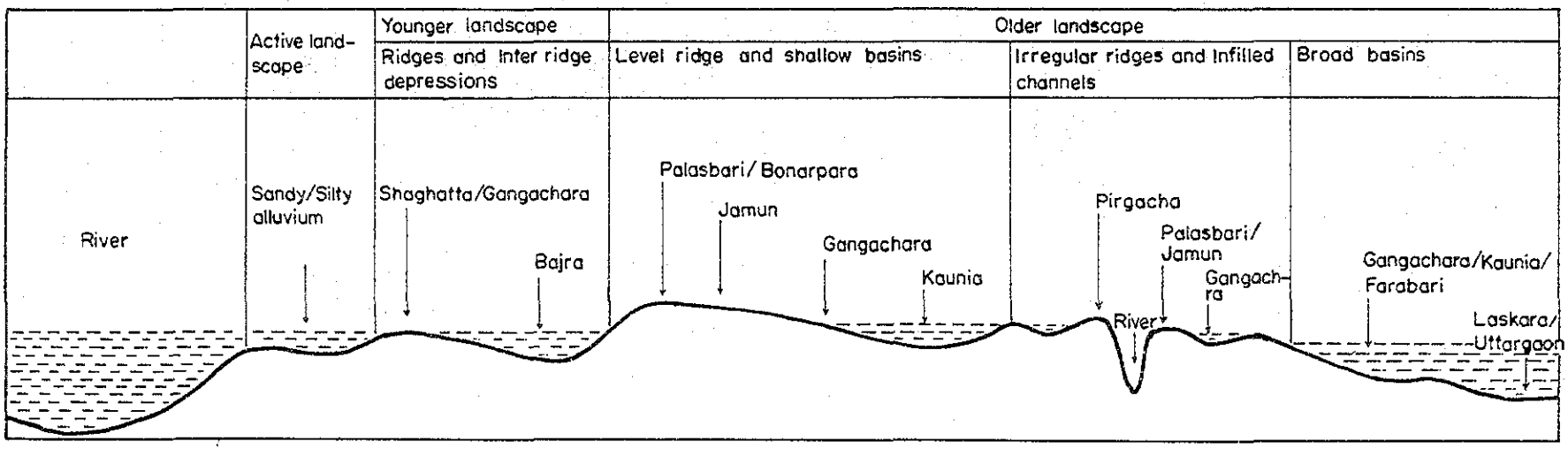


Fig. 3-2 Schematic Cross section of Landscape and Soil

(b) Meteorology

The closest meteorological station is situated in Rangpur. All meteoro-logical data were collected from the Bangladesh meteorologcal department, the official authority to supply data on any station in Bangladesh. A list of hydrometeorological data that was collected during the study is presented with a time period is in the Appendix Ⅱ. The data was examined and the required analyses/calculations were done. A description of the meteorological data is presented below.

1) Rainfall: Records from seven stations in and around the project area were collected. Out of the seven only Bhurungamari and Kurigram are the closest to the project's boundary. The locations of the rain gauge stations are shown in the Appendix Ⅱ. The annual maximum rainfall was recorded at 4901mm in 1974 at Kaunia being the highest, 4405mm in 1967 as the second highest at Bhurungamari and the lowest was 2922mm at Ulipur. The highest monthly average was found at 612mm at Lalmonirhat in the month of July. The daily, monthly, annual maximums and annual averages are presented in Table 3-4. Annual rainfall and monthly averages are shown in the Figures 3-3 & 3-4.

Table 3-4 Rainfall data

Unit: mm

Station	Maximums			Annual average
	Daily	Monthly	Annual	
Bhurungamari	236	1,264	4,405	3,217
Kurigram	285	1,434	3,355	2,318
Lalmonirhat	254	1,586	4,070	2,569
Ulipur	305	1,023	2,922	2,283
Chilmari	306	1,266	3,838	2,219
Kaunia	321	1,555	4,901	2,466
Rangpur	258	1,379	3,326	2,200

Fig. 3-3 Total Annual Rainfall

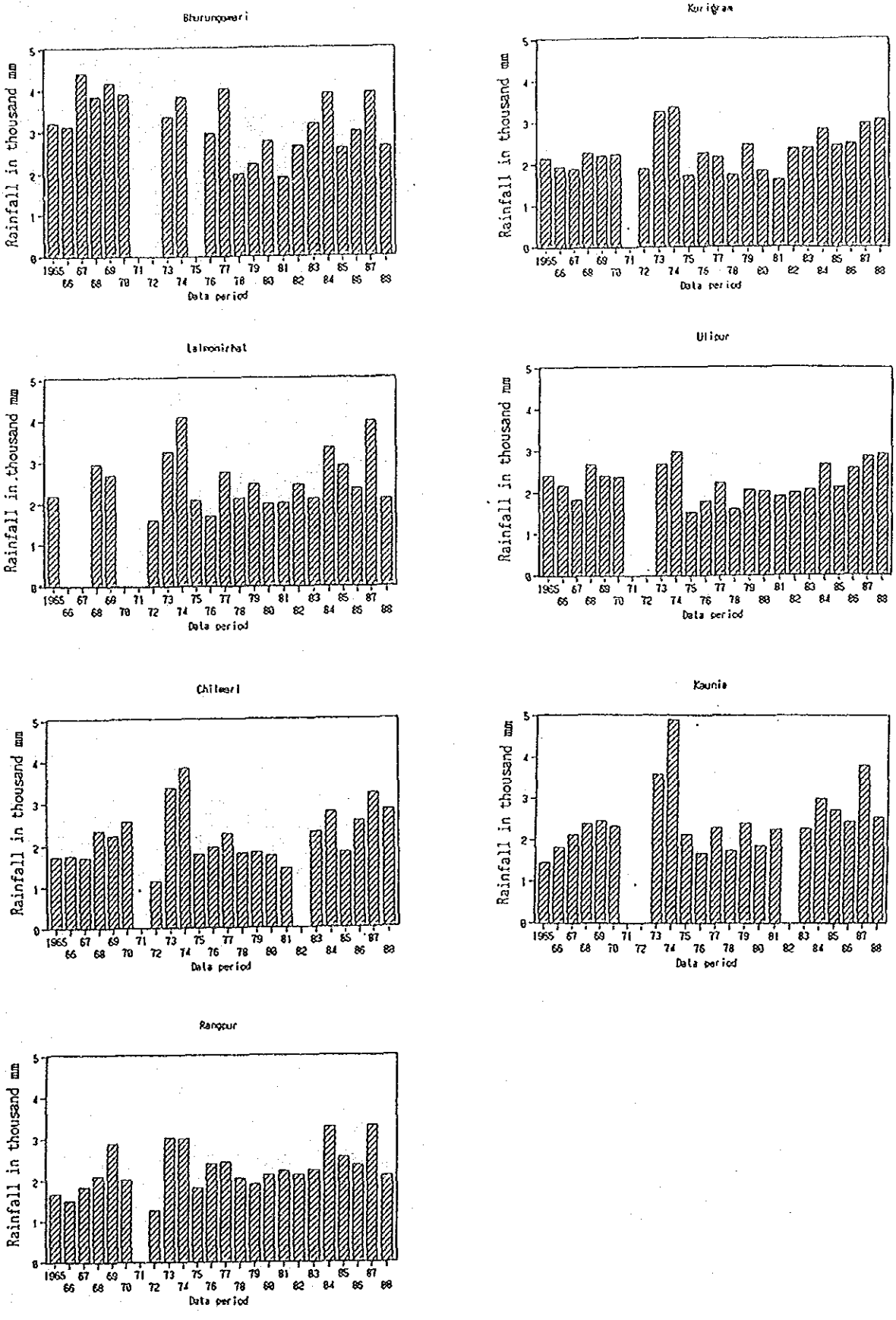
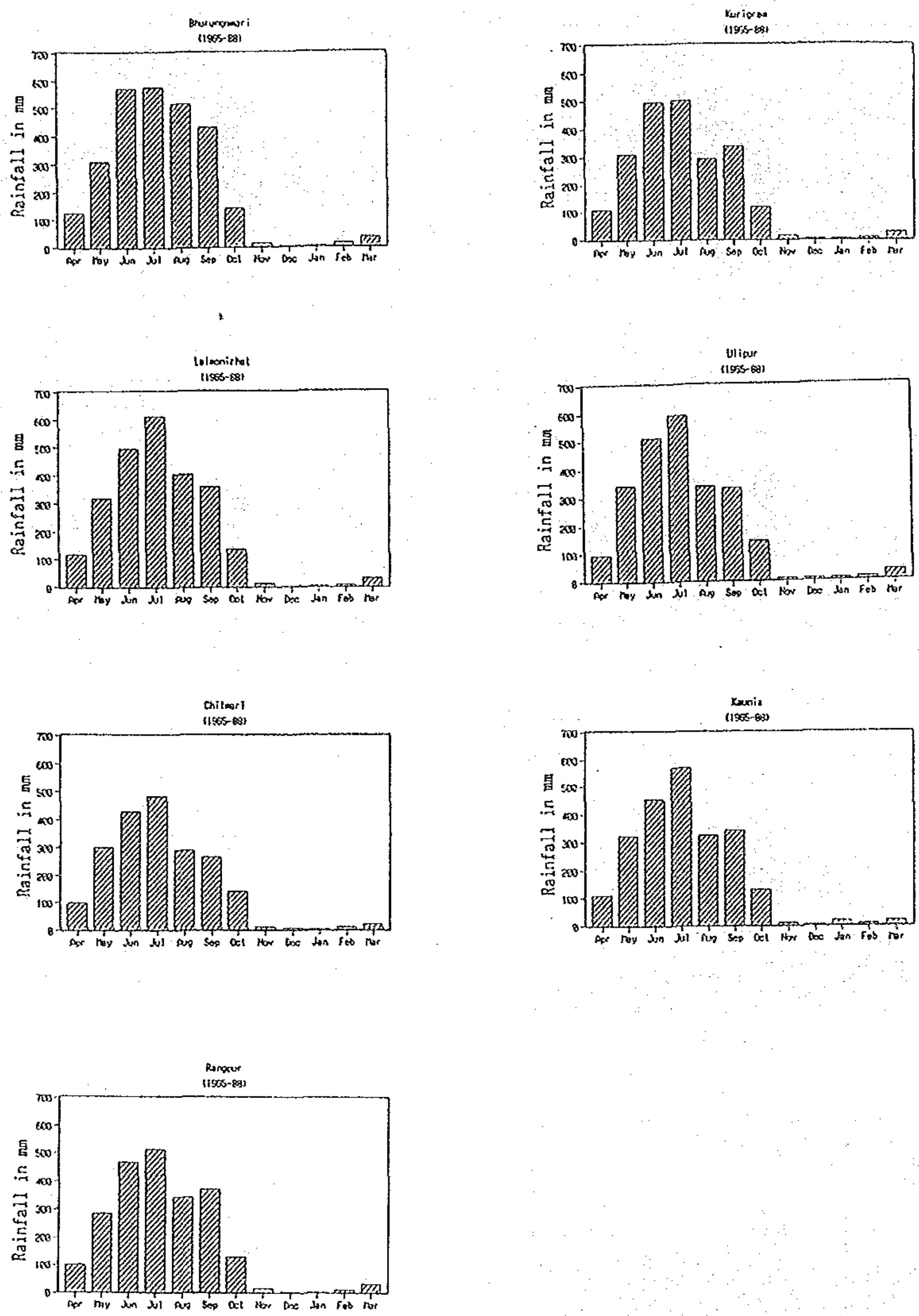


Fig. 3-4 Monthly Average Rainfall



Analyses: According to area percentage, the rainfall of Bhurungamari station was selected for analysis. For drainage purposes the probability analysis of daily maximum exceedance, consecutive 3, 5, 10, 15 and 30 days rainfall were monitored. The results are shown in Table 3-5. From examples of similar projects in the country, a consecutive 5 a days rainfall of 5 a year return period (508 mm) is selected for drainage and flood control analysis.

Table 3-5 Probable consecutive rainfall at Bhurungamari

Unit: mm

Return period	1 day	3 days	5 days	10 days	15 days	30 days
2	165	311	425	548	673	1,015
5	196	377	508	659	815	1,218
10	214	416	552	722	899	1,328
20	230	452	589	778	972	1,421
50	250	496	613	843	1,060	1,528
100	264	528	660	888	1,124	1,600

For irrigation purposes, annual effective rainfall, annual drought days and annual consecutive drought days for Bhurungamari and Kurigram were calculated and presented in the Appendix. Then a probability analysis of non exceedance for gross and effective annual rainfall was performed. The results of these analysis are presented in Table 3-6. For annual and maximum consecutive drought days, the probability analysis of exceedance was performed and the results are presented in the Table 3-7.

Table 3-6 Probable minimum annual rainfall

Unit: mm

Return period	Bhurungamari		Kurigram	
	Gross	Effective	Gross	Effective
2	3,204	2,240	2,251	1,615
5	2,597	1,856	1,856	1,400
10	2,288	1,670	1,670	1,303
20	2,036	1,525	1,525	1,230
50	1,758	1,369	1,369	1,155
100	1,574	1,270	1,270	1,109

N.B. In the estimation of effective rainfall three assumptions were made: i) more than 80 mm rainfall was also treated as 80 mm ii) less than 5 mm rainfall was neglected iii) 20% gross loss

Table 3-7 Probable maximum drought days

Unit: mm

Return period	Bhurungamari		Kurigram	
	Consecutive	Annual total	Consecutive	Annual total
2	103	281	112	299
5	140	296	149	309
10	165	305	172	314
20	189	312	193	318
50	221	320	220	323
100	246	326	239	326

2) Temperature, Humidity, Sunshine, Wind speed and Evaporation: Records of the above meteorological parameters were collected for various durations. After carefull examination analysis were performed. Analysis show that the maximum temperature was recorded as 38.2℃ in April, 1968 and the minimum was recorded as 7.3℃ in January, 1969. During the monsoon season humidity is very high. The average figure is as high as 87% in the month of July. November has the maximum average sunshine, 8.7 hrs and July has the minimum 4.0 hrs. The maximum wind speed is observed usually at the begining of the monsoon season i.e. when the country is hit by cyclones and storms. The average maximum wind speed was recorded as 181 km/day in

April and June. For evaporation, April has the maximum and January has the minimum, 6.9 and 2.4 mm/day respectively. The monthly averages of these analysis are presented in graphs in Figure 3-5.

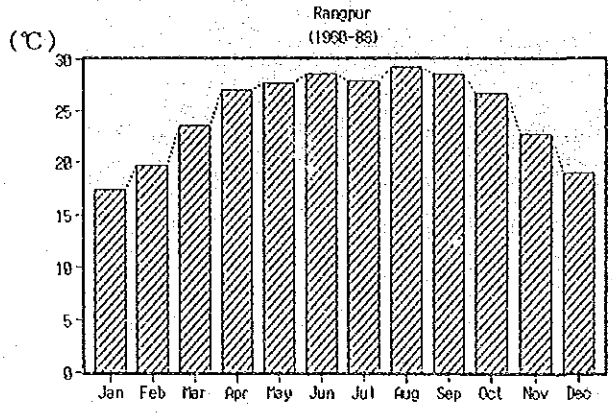
3) Evapotranspiration: Monthly evapotranspiration for the project area was calculated using collected data from different established methods. The calculated results are shown in Table 3-8. Results obtained with the Penman method are used for consumptive use calculations.

Table 3-8 Monthly evapotranspiration

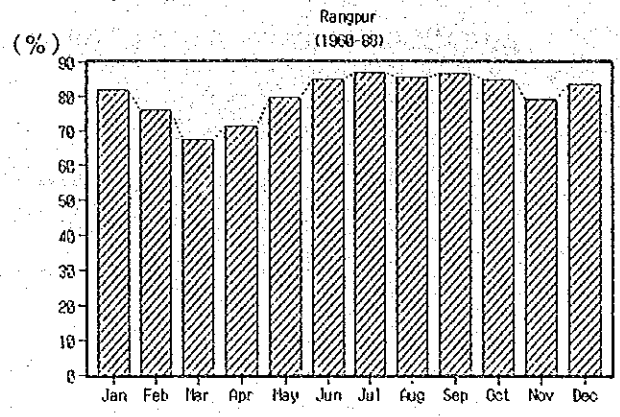
Unit: mm/day

Methods	J	F	M	A	M	J	J	A	S	O	N	D
Penman	2.5	3.6	4.9	5.6	5.1	4.9	4.1	4.2	3.9	3.9	3.4	2.5
B.Criddle	2.2	2.5	3.0	3.6	2.7	3.3	2.8	2.8	2.8	3.1	2.7	1.8
Radiation	2.5	3.3	4.2	4.8	4.5	4.8	3.5	3.8	3.6	3.7	3.6	2.5
Pan evapo.	2.0	2.7	4.0	3.3	4.5	3.3	3.3	2.7	3.1	3.2	2.9	2.0

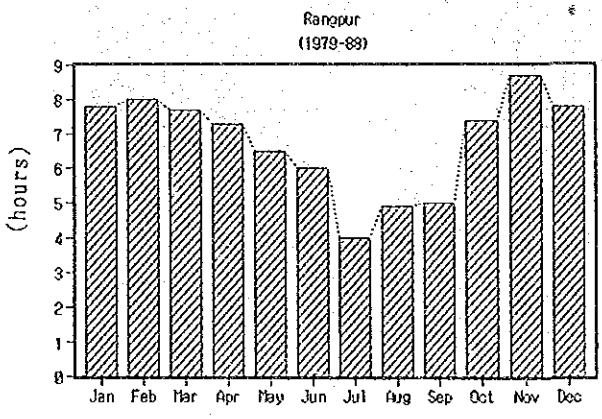
Fig. 3-5 Monthly Average Meteorological Data



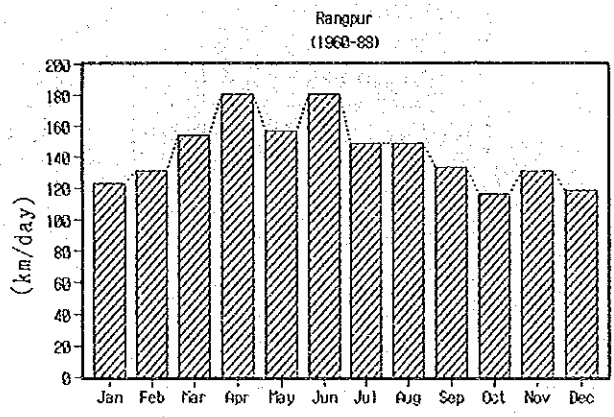
Temperature



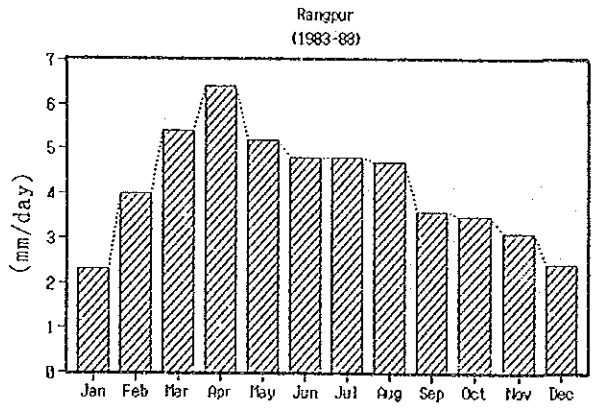
Humidity



Sunshine



Wind speed



Evaporation

(c) Hydrology:

All hydrological data were collected from Surface Water Hydrology-II, BWDB. Before performing any analysis, all data were examined. The hydrological conditions of the project area are described below.

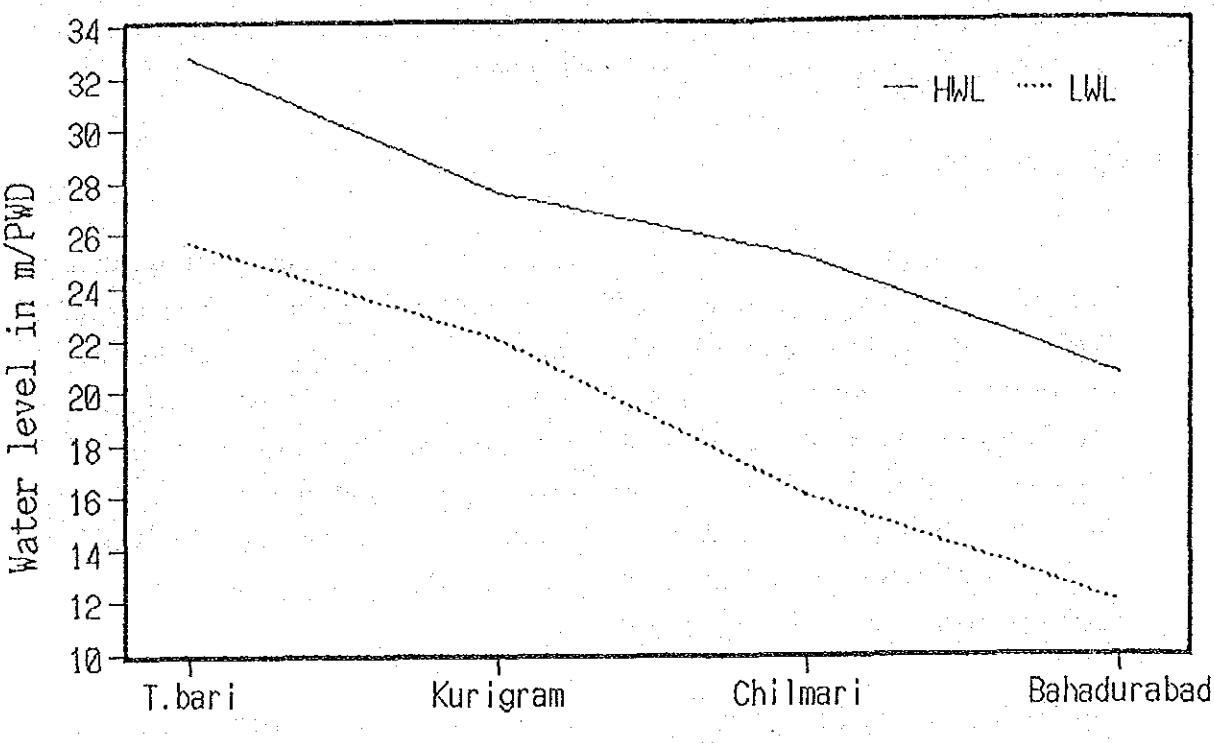
1) River systems:

The Dharla: Originates at the foot of the Himalayas and enters Bangladesh just a few kilometers upstream of Talukshimulbari in the Fulbari Upazila. Then it follows a meandering course along the western boundary of the project and joins the Brahmaputra near the Kadamtali downstream part of Kurigram. The Dharla has a drainage area of 5200sq.km and discharges(average) 504 CMS annualy at Kurigram. The highest water level was recorded at Talukshimulbari, 32.76 m/PWD in 1966 and the lowest was 25.64 m/PWD in 1982. A water surface profile from Talukshimulbari to Bahadurabad of the Brahmaputra is shown in Figure 3-6(a).

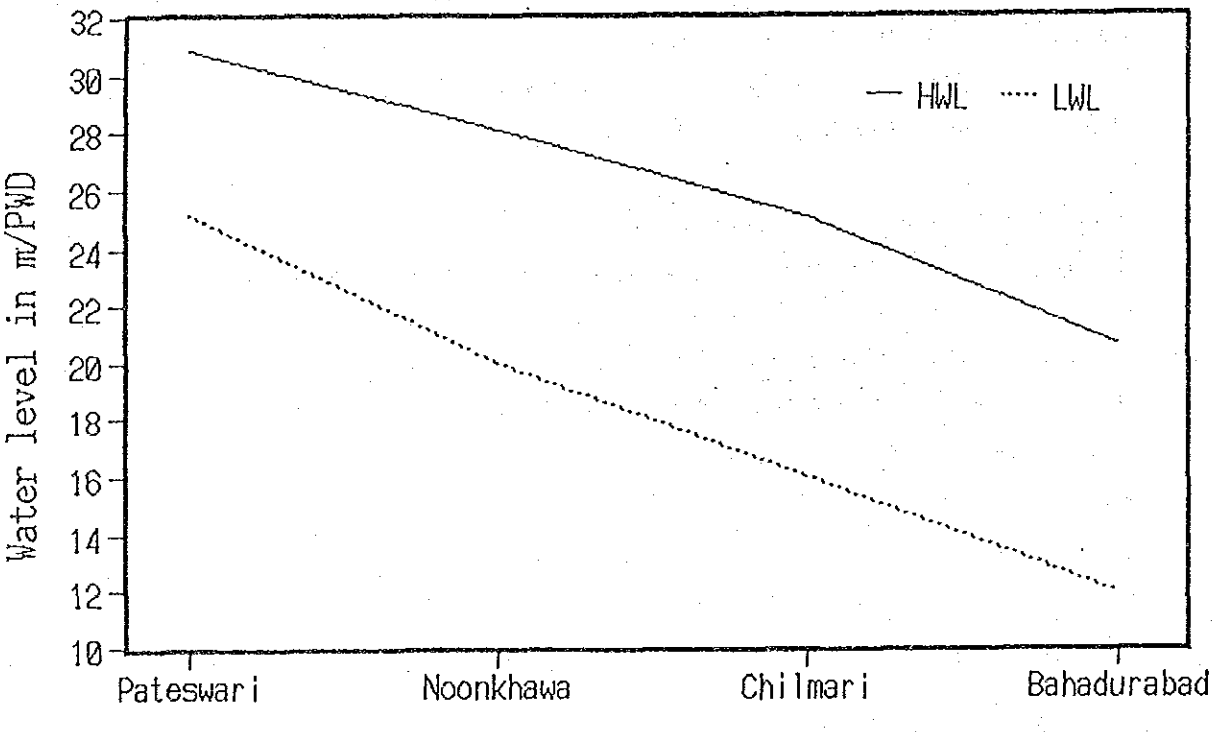
The Dudhkumar: Also comes from the Himalayas and enters Bangladesh upstream of the Pateswari railway bridge. Then it flows along the eastern boundary of the project. Dudhkumar meets the Brahmaputra at Noonkhawa, 32 km downstream of Pateswari. It has a drainage area of 5880 sq.km. At Pateswari the average annual discharge was computed as 449CMS. The observed maximum and minimum water levels were recorded as 30.86 and 25.47 m/PWD respectively. The water surface profile from Pateswari to Bahadurabad is shown in Figure 3-6(b).

The Brahmaputra: Is one of the biggeset rivers in Bangladesh. The total drainage area upstream of the project is about 540600sq.km. and carries about 50% of the annual runoff of the country. The annual average discharge at Bahadurabad is 18800CMS. The observed records of discharges and water levels of these three rivers are shown in Tables 3-9 & 3-10.

Fig. 3-6 Water Surface Profile of Rivers



(a)



(b)

Table 3-9 Discharge records

Unit: CMS

Rivers	Data period	Gauging station	Observed	
			Annual Max.	Annual Min
Dharla	1968-87	Talukshimulbari	6,450	28
	1973-88	Kurigram	7,810	52
Dudhkumar	1968-88	Pateswari	7,190	56
Brahmaputra	1960-88	Bahadurabad	98,600	2860

Table 3-10 Water level records

Unit: m/PWD

Rivers	Data period	Gauging station	Observed	
			Annual Max.	Annual Min.
Dharla	1962-87	Talukshimulbari	32.76	25.64
	1961-88	Kurigram	27.50	21.78
Dudhkumar	1962-88	Pateswari	30.86	25.47
Brahmaputra	1960-88	Bahadurabad	20.62	11.95
	1962-88	Noonkhawa	28.10	19.99
	1962-88	Chilmari	25.07	16.02

Analyses: For drainage purposes a probability analysis for annual maximum flood runoffs in three rivers was performed. The results are shown in the Table 3-11. The water levels corresponding to the 5 day consecutive design rainfall in the three rivers have been worked out and at the same time water levels at the outlets of each drainage blocks were calculated. Then flood routing analysis were done. In addition, water levels and their behavious according to time during the five year flood in the Dharla, Dudhkumar and Brahmaputra including the outlets of the drainage blocks were worked out. At that time flood intensity and its duration at each drainage block were estimated.

Table 3-11 Probable flood runoff

Unit:CMS

Return Period	Dharla	Dudhkumar	Brahmaputra
2	2,510	2,170	64,408
5	4,295	4,405	74,110
10	5,850	6,460	79,859
20	7,631	8,897	84,994
50	10,381	12,794	91,229
100	12,804	16,330	95,681

For irrigation purposes a probability analysis for minimum annual run-off was performed. The results are presented in Table 3-12.

Table 3-12 Probable minimum runoff

Unit:CMS

Return Period	Dharla	Dudhkumar	Brahmaputra
2	66	73	3,777
5	56	64	3,059
10	52	59	2,685
20	50	56	2,377
50	47	52	2,031
100	45	50	1,801

2) River cross section:

The Dharla: Seventeen cross sections from the proposed barrage site towards upstream at an interval of 1.6km surveyed in 1987-88 were collected and studied. No previous data were available for comparison. However, from the field investigation it was observed that the river has changed its course in few places by eroding the banks and creating Chars in the mid stream. Necessary measurements have been proposed in the flood control chapter.

The Dudhkumar: During the phase-1 study, the Pateswari pumping station site was surveyed and compared with the data surveyed during the pre and post monsoon season of 1987-88. It was noticed that the main stream flow has moved towards the left bank due to sedimentation on the right side. Considering flow this trend, groing work on the left bank and excavations on the righ bank have been proposed in order to secure sufficient flow at the intake mouth. Also an additional survey has been conducted for more cross sections starting from Pateswari down to the Tangonmari regulator on the Brahmaputra river.

3) Sediment analysis: BWDB does not have sediment data for the Dudhkumar river. Therefore, samples were collected in the wet and dry seasons mid stream at the Pateswari pumping station and tests were performed in the laboratory of the Bangladesh Standards and Testing Institution. The test results are presented as follows.

Season	Depth from the surface	Sediment in ppm
Wet (Oct'89)	3.9 m 2.0 m 1.0 m	281 240 218
Dry (Feb'90)	2.0 m	18.8

4) Water quality: The main source of irrigation water for this project is the Dudhkumar river. In order to know water suitability for the purpose of chemical analysis a collected of samples was done. The results of the analysis are given in the table below.

Composition	Amount
pH	7.4
Iron (Fe)	1.04 (ppm)
Chloride (Cl)	2.13 (ppm)
Sulphate (SO4)	2.47 (ppm)
Hardness as $CaCO_3$	1.40 (ppm)

From the analysis data, it is judged that the water quality is quite suitable for irrigation. Although the value of pH shows slightly alkaline side possibly by calcium ion etc. in samples, it is within the acceptable range for irrigation. Iron concentration often high in ground water samples, but the concentration level in surface water ranges within the acceptable level, 5 ppm. Chloride concentration in the sample also shows satisfactorily low level (quality standard shows 500 ppm. as a limit), while sulphate ion level gives only 2.5 ppm., also enough below the acceptable standard, 270 ppm. Water hardness expressed in Ca CO_3 lies within favourable range for soils and crops.

3-2. Social Conditions

(a) Population and Socio-economic-strata

According to the 1981 population census, the total population of the four upazilas related to the Study area was approximately 664 thousand. The population density was 623 persons per sq.km, being rather high compared with 583 of the whole Kurigram zila and 605 of the country as shown in Table 3-13.

The average annual population growth rates were 3.0% from 1961 to 1974 and 2.4% from 1974 to 1981. Such a rapid population increase must have been one of the major factors which restricted the alleviation of poverty and the satisfaction of basic human needs in the area.

The per capita land availability of the Study area was 0.2 ha. (0.16 ha in the Kurigram District and 0.13 ha in the country)

Approximately 86% of the population dwell in rural areas. The average household size per dwelling unit was of 5.6 persons, of the same level as 5.6 for the district, 5.5 for the region and 5.7 for the country.

The sex ratio (100M/F) and the dependency ratio were 104 and 102 respectively, while these were 106 and 100 of the country.

By the way, the total population as of 1989 in the four upazilas related to the Study area has been estimated to be 803 thousand, assuming that the average annual population growth rate has been 2.4% as it was between 1974-1981.

A trial estimation by summing up village-wise data from the 1981 population census has been made for a population number in the Study area, of which the result is approximately 348 thousand. Further examinations will be conducted to get a more precise figure in the Phase II Study.

The working population (excluding the household working population) accounted for 44% of the total population aged 10 years old and above, of which 77.8% were engaged in agriculture, 5.1 in business and 0.9 in manufacturing. On the other hand, the population of non working (excluding students) and unemployment (which is 2.3% of the total working population according the Labor

Force Survey in 1983-84) was 21% of the population aged 10 years old and above excluding students and household workers. This ratio was less than 26% for the country as shown in Table 3-14.

For the dwelling units in the Study area, 87.6% were kutcha, 11.6% sami-poucca and 0.8% pucca. The homestead areas including the court yard per household were 360 sq.m.

According to the agricultural census in 1983-84, the number of households without homestead land approximately accounted for 13% of the total households. This ratio was rather high, compared with 11% in the districts and 9% in the country.

According to the Upazila Profile (1989), for religion, 91% of the total population were Moslem.

Table 3-13 Population Characteristics

	Population	Households	Average Household Sizes	Per Capita Availability of Land	Population Growth Rates (1974-81)	Population Density	Sex Ratio	Dependency Ratio
Study Area	persons 664,314	No 117,162	persons 5.6	ha 0.12	% 2.4	persons/sq km 623	104	102
Kurigram Zila	1,266,425	234.077	5.6	0.16	2.2	583	103	
Rangpur Region	6,510,050	1,186,220	5.5	0.14	2.6	677	105	
Bangladesh	87,119,965	15,075,887	5.7	0.13	2.8	605	106	100

Source: Bangladesh Population Census 1981

Table 3-14 Working Population

	Population of 10 years old and Above	Households						Not working Population (excluding student and in cluding Unemployment) of 10years and Above	
		Total	Agricul-ture	Manufac-turing	Business and Others	% of Total Popula-tion	% of Popula-tion of 10 years old and Above	Total	% of the Population of 10 years old and above(exclud-ing students and Household Workers)
Study Area	persons 440,199	persons 193.832	% 77.8	% 0.9	% 21.3	% 29.2	% 44.0	persons 49,345	% 20.7
Bangladesh	(thousand) 58,169	23,617	61.3	4.3	34.4	29.7	44.5	(thousand) 7.837	25.7

Source: The above

(b) Living and Cultural Standards

In the area of the four upazilas related to the Study area, the social infrastructures supporting the people's living has been getting better year by year. The number of hand pumps per 1,000 households for drinking water has increased from 41 units in 1981 to 64 units in 1989. At present, the number of hospitals and doctors are 5 and 39 respectively, while the number of beds in hospitals is 0.16 per 1,000 persons.

The Study area is connected with the district headquarters by rail (excluding the Nageswari upazila) and by roads, although ferry boats and piers are not well equipped to carry buses and trucks across the Dharla River. The transportation means available in the Study area are a railway, buses, trucks, rickshaws, and carts. There are two trunk road routes in the Study area, which are classified as feeder roads by the standard. One connects Kurigram, Nageswari and Bhurungamari and the other Nageswari and Fulbali. The upazila headquarters are connected with most of the union parishads by kutcha roads. Apart from a few trunk road routes, trucks, buses and passenger cars are practically not available, especially in the rainy season. The road length per sq.km is 2.18 km of which 2.10km are kutcha roads and 0.08 are pucca roads. The number of buses and rickshaws per 1,000 persons are 0.08 and 4.7 respectively.

There are 83 huts/bazars in the Study area, which means one hut/bazar for every 8,000.

The number of post offices and bank branches are 0.36 and 0.22 per 1,000 households respectively in the Study area.

According to the 1981 population census, there were 319 primary schools, 57 high schools and 5 colleges in the Study area. The literacy ratios (5 years old and above) were 16% for both sexes, 23% for males and 8% for females as shown in table 3-15. These ratios were considerably lower than 18%, 26% and 10% of the region and 24%, 31% and 16% for the country respectively. Moreover, the attendance ratios of primary school remained at such low level as 15% for both sexes, 18% for males and 13% for females. (24%, 32% and 13% for the district)

As for electricity, the coverage is limited to some important spots such as upazila centers in the Study area.

Under the circumstances, the upazila governments in the Study area have been allocating 56% of their budget fund to sections related to living and education towards the improvement of the people's basic human needs.

Table 3-15 Literacy Ratio and Attendance Status of Primary Schools

Unit: %

	Literacy Ratio			Enrolement Ratio in Primary Schools			Attendance Ratio in Primary Schools		
	Both sexes	Males	Fe-males	Both sexes	Males	Fe-males	Both sexes	Males	Fe-males
Study Areas	15.7	22.9	8.2	52.2	70.3	33.7	15.9	18.2	13.6
Bangla-desh	23.8	31.0	16.0	57.2	61.0	53.1	21.8	23.0	20.7

Source: Bangladesh Population Census 1981

(c) Administrative Organizations

Admimnistratively, the country is divided into four divisions. Each division is sub-divided into zilas (districts). After an administrative reorganization was carried out in 1984, the country now has 64 zilas. Each zila consists of several upazilas or thanas. Each upazila consists of a number of unions comprising several villages in rural areas and each thana does have a number of wards in the metropolitan cities and other urban areas as shown in Figure 3-7.

Bangladesh is governed by a unitary form of presidential type government. The president is the chief executive of the country. He has a council of ministers who assist him in the discharge of his duties. The four divisions are placed under division commissioners and the administration of each zila is headed by a deputy commissioner.

The representative of a local government called upazila parishad, which is headed by an elected upazila chairman, consists of elected union chairmen and upazila level officers from government agencies. The upazila level officers are under the control of the development offices of the government and, at the same time, they work under the control of the elected upazila chairman. They seem to have the function to tie up the will of the local people with the national development policies at the upazila level. There is an upazila Nirbahi officer who works as the principal staff officer to the upazila chairman but has no direct

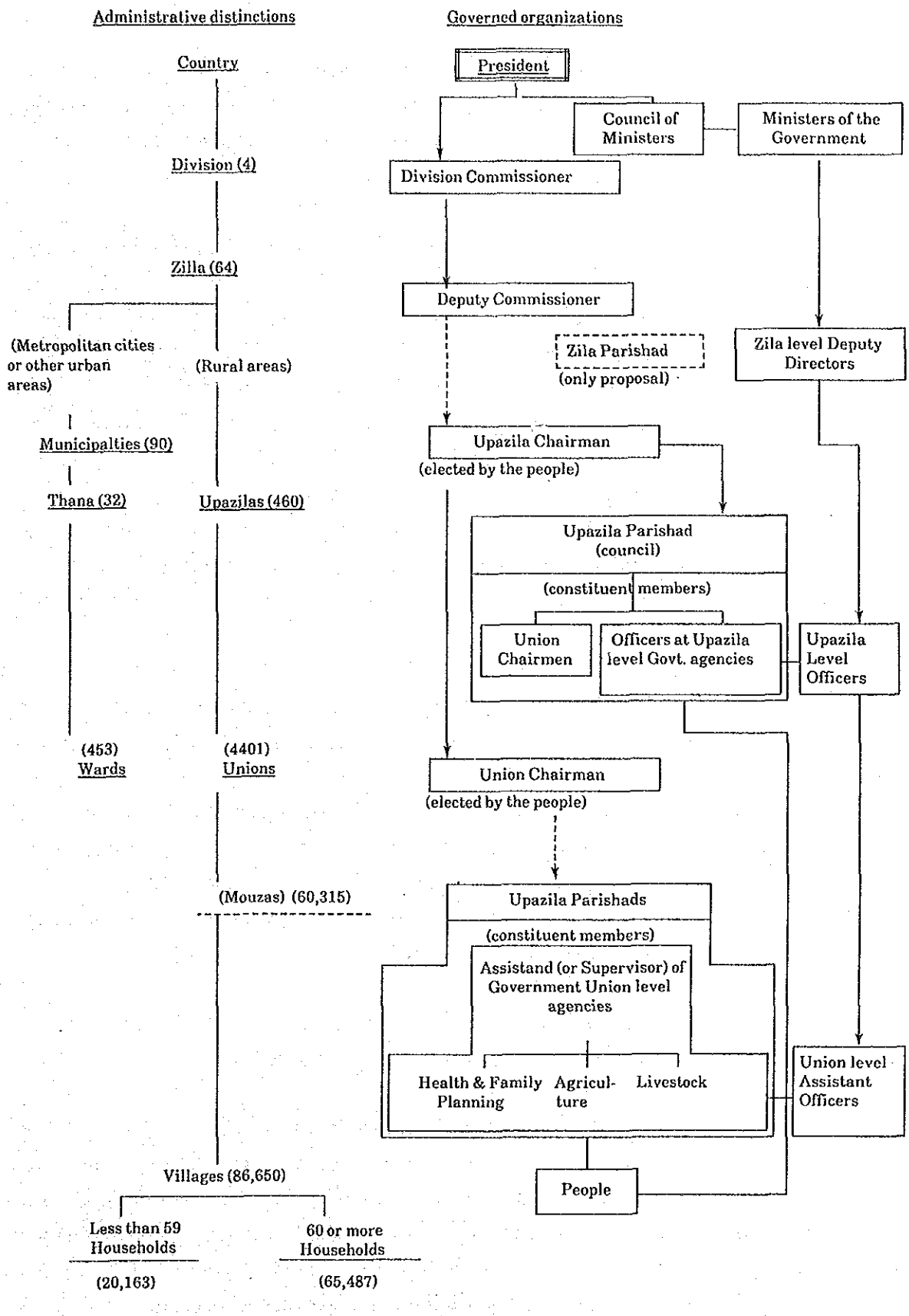
control over other officers, i.e, an upazila engineer, an upazila agriculture officer, an upazila finance & planning officer, and other officials from major national departments. The national government takes measures to finance the development programs to be undertaken by upazila parishads.

Thus, the upazila parishad has become the focal point of all development activities at the local level, taking the administration to the door-step of the people and making it more responsive to the people's needs and capable of providing quick decisions to solve local problems. All the programs have to be undertaken on their own at reasonable scale. This parishad has also the implementing authority for divisible components of national level projects and programs.

A union parishad is the lowest local government which is headed by an elected union chairman, who works as a constituent member of the upazila parishad. The union chairman is assisted by the officials of health & family planning, agriculture and livestock sections, which are closely related with the day to day lives of the people. Each official also belongs to an union level department of each government development office.

Regarding the Study area, there are 25 unions in the four upazila parishads of Kurigram, Nageswari, Bhurungamari and Fulbari which belong to the Kurigram district (zila).

Fig. 3-7 Administrative Chart of Bangladesh



Source: 1986 Statistical Yearbook of Bangladesh and others.
Note: 1) On chart of governed organizations, → shown to have authority of both control and coordinate, and --- shown to have only authority of coordinate.

(d) Economy

According to the 1983-84 Agriculture Census, the area of the four upazilas related with the Study seem to have a relatively high agricultural potentiality. The net cultivated land was 68,000 ha which occupied 82% of the total land area. The ratio of farm households to total households was 69%.

According to the 1981 Population Census, the working population of 10 years old and over accounted to 193,833, i.e., 29% of the total population and 44% of the population of 10 years old and over. These ratios showed that the employment ratio was at the same level as the average of the country. On the other hand, the non-working and unemployment ratio, except for students and home workers, was 21%, which was lower than the country average. Accordingly, the employment opportunities seemed to be at higher level than the country.

With regards to occupation, agriculture (including non-crop production) was dominant with 78% of the working population, which was 15% higher than the country average. On the other hand, business was 5% and manufacturing was less than 1%.

According to the Small Scale and Cottage Industries in 1989, where there were 5,925 units of small scale and cottage industries in the four upazilas, employing 16,813 persons. Among the main types of cottage industries, rice mills had an overwhelmingly large number of 1,150 units with 57,600ton capacity and 2,310 workers. Besides, there were 168 dal mill units, 68 wheat mill units, 63 oil mill units and 10 gur making mill units. The total units of these mills were 1,459 and 2,893 persons who were engaged in them. It is noticed that most of these cottage industries are closely related to agriculture.

The number of banks (including branches) in the four upazilas is 28 of which 18 are nationalized commercial banks and 10 are private banks.

In the Kurigram district, on an annual average between 1985/86-1987/88, the government procured 9,135 ton of food grain of which 4,115 ton were rice and 4,205 ton were wheat, while it released 37,252 ton of food grain of which 5,087 ton were rice and 32,165 ton were wheat. Accordingly, the latter exceeded the former by 28,117 ton of which 157 ton were rice and 27,960 ton were wheat. This implies that the Kurigram district is not self-sufficient in food grain at present.

The per capita net consumption of food grain in the Kurigram district is supposedly 174 kg per annum or 477 g per day, which corresponds to an in take of 1670 kcal of nutrition per day. This value can barely keep the 1600 kcal of the poverty line-1. (poverty line-2, 1800 kcal, poverty line-3, 2200 kcal)

The GDP of the Rangpur region was Taka 37,749 million in 1987/88 (at current market prices), which contributed 6% to that of the whole country. The sharing ratio of the agricultural sector to the GDP of the region was 47% as shown in Table 3-16. This ratio was considerably high compared with 39% for the whole country. This means that the economy in the Rangpur region depends on agriculture to a relatively high degree. Both large-scale and small-scale industry sectors occupy 1% each of the GDP. The GDP per capita was Taka 4,429 which was 84% of that of the country.

The dependency degree on agricultural economy is supposedly higher in the Study area than in the Rangpur region. Therefore, the per capita GDP seems also lower in the Study area than in the region.

Table 3-16 Gross Domestic Product of Rangpur Region at Current Market Price (1987-88)

(Million TK)

Sectors	GDP	
Agriculture	17,618	46.7%
1) Crops	15,106	(40.0)
2) Forestry	231	(0.6)
3) Livestock	1,692	(4.5)
4) Fisheries	589	(1.6)
Mining & Quarrying	-	
Industry	804	2.1
1) Large Scale	298	(0.8)
2) Small Scale	506	(1.3)
Construction	2,589	6.9
Power , Gas , Water & Sanitary Services	149	0.4
Transport , Storage & Communication	2,897	7.7
Trade Services	3,182	8.4
Housing Services	3,740	9.9
Public Admn. & Defenece	1,926	5.1
Banking & Insurance	703	1.9
Professional & miscellaneous Services	4,139	10.9
GDP at current market price	37,747	(100.0)
Indirect tax net of Subsides	2,445	
GDP at current factor cost	35,302	
Population (In million)	7.97	
Per Capita GDP at factor Cost (In TK)	4,429	

Source: 1989 Statistical Yearbook of Bangladesh

3-3. Agriculture

(a) Land use

In the project area crops or cropping patterns are related to the land type. The Major cropping patterns on the highlands is either Aus/jute-rabi crops or Aus/jute-T.Aman followed by rabi crops or fallow. Medium highland ridges or shallow basins are cropped with occupied by Aus-T.Aman followed by fallow some local rabi crops. Medium highland and medium lowland basins are mainly cropped with T.Aman (late variety) followed by HYV Boro. With the introduction of irrigation, HYV Boro is cultivated irrespective of land type and soil type.

The land use in the project area is summarized in Table 3-17.

Table 3-17 Present Land Use in the Project Area

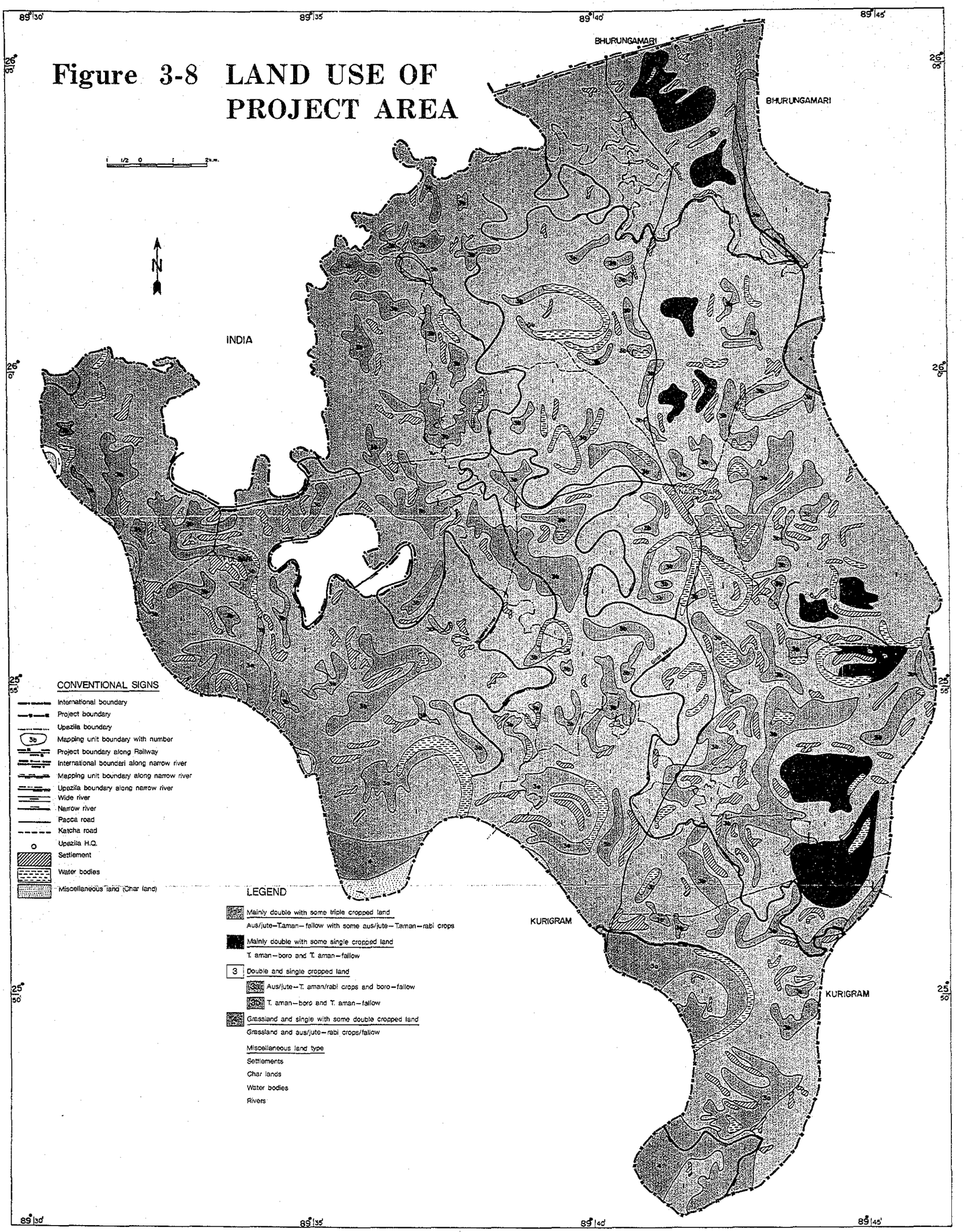
Land use	Area(ha)	(%)
Cultivated area	35,100	(82.0)
Grassland	350	(0.8)
charland	120	(0.3)
Settlements	5,290	(12.3)
Water bodies	1,940	(4.6)
Total	42,800	(100.0)

Land use mapping units along with some subunits have been recognized in the survey area. Land use map of the project area is shown in Fig. 3-8.

Land use mapping unit No. 1 is mainly comprised of double with some triple cropped land. The main cropping patterns in this unit are Aus/Jute- T.Aman-fallow with some Aus/jute-T.Aman-rabi crops.

Land use mapping unit No.2 is mainly comprised of double with some single cropped land. The Main cropping pattern in this unit are T.Aman-Boro and T.Aman-fallow.

Figure 3-8 LAND USE OF PROJECT AREA



Land use mapping unit No.3 is comprised of double and single cropped land. This unit comprises subunits 3a and 3b. The Main cropping patterns are Aus/jute-T.Aman/Rabi crops or Boro-fallow in subunit 3a and T.Aman-Boro or T.Aman-fallow in subunit 3b.

Land use mapping unit No.4 is mainly comprised of single with some double cropped land. The Main cropping patterns in this unit are Aus/jute-Rabi crops/fallow.

(b) Cropping Pattern and Farming Practices

1) Agricultural Characteristics

Agriculture in the project area may typically be sedentary or subsistent in nature. The cropping intensity was higher than the national average owing to bestowed favourable natural conditions, and quite recently the area has further been strengthened through the rapid expansion of tube well irrigation.

The farm size for the majority of farmers in the project area are small and marginal. It follows that the average farming family has enough manpower to cover its small cropping acreage, but does not have ample means for the purchase of inputs.

Paddy is still by far the dominant crop found in the project area, mainly consisting of local varieties of T-aman and B-aus. The second important food grains are wheat, whose production have increasingly expanded although the acreage for these crops begins to level off or slightly decline .

Very low shares are currently given to cash crops among which jute dominates and no comparable one exists. Such low shares to cash crops has resulted a remoteness to the area, or poor transportation access to the markets, and the dominance of small holdings (Table 3-18).

2) Cropping Patterns

The present cropping patterns (excluding chaarland) are comprised in a way that paddy (and sometimes jute) play a major part. Key factors which determine existing cropping practices include economic conditions for basic food security, environmental changes like diffusion of tube well irrigation, susceptibility to natural calamity because of soil conditions, topographic conditions, climatic condition such as low temperatures, hailstorms etc., and finaly the lack of technical knowledge which holds back the produdion of cash crops or high yielding varieties (HYV) etc..

Fig.3-9 shows the prevailing major patterns. However, hundreds of patterns exist and individual ones tend to undergo change under economic or other various conditions. The total acreage per crop is not necessarily in conformity

Table 3-18 Estimated Crop Production in the Project Area

(Major Crop Only) unit: ton, ha.

Upazila / Crop	Nageswari Area	Nageswari Prod.	Bhurngamari Area	Bhurngamari Prod.	Fulbari Area	Fulbari Prod.	Kurigram S. Area	Kurigram S. Prod.	P.Area Area	Total Prod.	Average Yield
B-Aus L	5,057	4,001	619	529	5,153	3,750	3,410	3,081	14,239	11,361	0.79
T-Aus L	382	818	9	12	-	-	-	-	391	830	2.12
T-Aus HYV	1,166	2,347	105	249	310	268	534	697	2,115	3,561	1.68
B-Aman L	269	432	24	45	152	45	32	28	477	550	1.15
T-Aman L	6,283	9,058	1,383	2,265	7,012	9,873	3,252	4,702	17,930	25,898	1.44
T-Aman P	1,698	3,385	652	1,620	216	421	221	460	2,787	5,886	2.12
T-AmanHYV	3,616	9,024	487	1,238	365	697	1,346	3,078	5,814	14,037	2.41
Boro HYV	2,822	8,086	477	1,393	927	2,798	1,645	4,252	5,871	16,525	2.81
AusAmanMx	990	1,639	195	361	78	134	101	144	1,364	2,310	1.69
Jute L	930	1,339	145	212	236	158	1,491	2,160	2,802	3,869	1.38
Jute HYV	914	1,533	118	192	616	750	404	608	2,052	3,083	1.50
Mustard	342	306	67	55	138	120	73	45	620	521	0.84
Kaun	487	366	72	59	631	330	47	30	1,237	786	0.63
Wheat L	827	1,117	205	293	50	34	-	-	1,082	1,444	1.33
Wheat HYV	988	2,050	189	364	349	545	755	1,099	2,281	4,058	1.78
Sw . potato	173	1,367	8	76	13	67	17	127	211	1,636	7.75
Potato	362	3,491	34	318	96	703	108	826	600	5,338	8.89
Vegetable	201	4,180	13	76	113	-	22	83	349	4,339	-

Source: estimated from the data by BBS Rangpur Office (five year 1984-1989)

with the present shares of the same crop in the cropping patterns.

Crop diversification represents an up-dated national strategy in agriculture and here also much effort has been paid by extension services. Some fruitful results thereof have been obtained coupled with the development of tube wells or low lift pump irrigation. In such a way some crops from temperate zones like HYV wheat and potatoes have widely been popularized.

Another feature to be mentioned here is that the cropping periods for certain crops are not fixed as is illustrated in the figures, but flexibilty prevails in response to the prevailing climatic conditions. For example, the transplanting of Aman paddy is subject to delays due to rainfall shortages, and a delay in transplanting overgrown seedlings may cause a serious yield drop. Such a delay can influence the successive Rabi crops, and so on.

From the illustrated patterns, the following salient features can be observed in the existing cropping practices in the project area:

- In flood-free or highland areas, both HYV paddy and major cash crops like jute and potatoes are preferred, because of a lowered risk and shorter sowing delays caused by lingering inundation. However, the highlands and medium highlands are subject to drought damages due to precarious rainfall. As a matter of cause, the highlands with tube irrigation show the highest cropping intensity among all the cultivatable land.

- In low-lying areas, paddy is the only reliable crop resistant to moisture or flood water submersion. Coupled with the preference of rice culture on higher land, the dependency on rice has already reached higher levels than the national average.

- B-Aman has almost dwindled but B-Aus still remains though it tends to decline. A major constraint for cropping is evidently flood, limiting the expansion of HYV or cash crops for the Kharif season. Nevertheless, it does not usually affect much of the sowing of Rabi crops because the average elevation is not as low as the water levels of the rivers.

- The coverage share with rabi crops on the total cropping acreage has been increasing, but still remains at a much lower level than that of the Kharif season.

In this regard, highlands or medium highlands show a higher rate of coverage than in low- or medium lowlands.

- Minor crops consist of small grains like kaun (foxtail millet), cheena (indian millet), etc. in early Kharif (but sometimes as Rabi crops also) summer vegetables and Rabi crops such as mustard, rape, potatoes, winter pulses (khesari, mashkarai, moshri etc.) or red-chilly and other spices. The expansion of acreage for these crops has been limited because of weaker competitiveness and remoteness in marketing activities. Sugarcane, corriander seed, beedi tobacco, ground nut and sesame also comprise minor cash crops in the study area.

- Rabi crops can be cultivated either in the beneficiaries of tube well irrigation or in low-lying depressions where traddle pumps or other watering devices are available. In many beels and small rivers Boro paddy is planted, while winter vegetables are mostly grown in homestead areas, except for such cash crops as potatoes, chilly and cabbage.

- As a whole, double cropping per year represents the dominant cropping pattern with less single cropping (mainly in lowlands and medium lowlands) and even less triple cropping (mainly irrigated highlands and medium highlands). The highest cropping intensity is as a matter of course observed in the highlands or flood free areas mainly developed in the northern and western parts of the project area.

Perennial crops and crops with longer growth periods like sugarcane are seldom found, but areca (betel) nut is an important cash income source or rather a "specialty" product in this district, though it is only planted on homestead land without manuring.

- Tree crops such as date, jackfruit, a citrus called jamblan, guava, lime, mango or carambola are sporadically planted in homestead gardens, and are of little economic values.

Fig. 3-9 Present cropping Patterns in the Project Area

Place	% Land	Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.
Nages-wari	Fo Ir 15	Potato / B-Aus L./Jute / T-Aman L
		Wheat / T-Aman L/HYV
		Boro HYV / T-Aman L/Pajam
		Wheat HYV / Jute HYV / T-Aman HYV
	F1 Ir 7	Wheat/Mustard / (Veg) / T-Aus HYV
	Fo 40	Mustard / B-Aus L/Aman / T-Aman L
	F1 Rf 23	Wheat / T-Aman L
		Pulse / B-Aus L / Pulse
		Sweet Potato / T-Aman L
		Chilli/Dunia xx / Fallow
	F2 Rf 5	Kaun/Boro L / B-Aman L
		Wheat
		Wheat L / Fallow
Bhrun-gamari	Fo Ir 20	Wheat HYV / G.M. / T-Aman HYV
		Boro HYV / T-Aman Pajam/HYV
		Mustard / B-Aus/Jute L / T-Aman L
	F1 Ir 5	Wheat L / Jute L / T-Aman L
	Fo Rf 35	Pulse / B-Aus L / T-Aman HYV / Mustard or
		Veg' / Jute or B-Aus / T-Aman L/Pajam
	F1 Rf 30	B-Aus L/Kaun / T-Aman L
		Mixed B-Aus & B-Aman L / Pulse
	F2 Rf 10	Boro HYV / Fallow
		Wheat/Pulse / Fallow
Ful-bari	Fo Ir 10	Wheat HYV / Jute HYV B-Aus / T-Aman L
	F1 Ir 13	Boro HYV / T-Aman Pajam
		B-Aus L / T-Aman HYV
		Potato / T-Aus HYV / T-Aman L / Spice/
		Wheat / Jute HYV / T-Aman HYV
	Fo Rf x 30	Mustard / Kaun/Boro L / T-Aman L
		Wheat / T-Aman L / Pulse/
		B-Aus L / T-Aman L
	F1 Rf 27	Jute L/B-Aus L / T-Aman L / Pulse
		B-Aus L/Kaun / T-Aman L
	F2 Rf 10	B-Aus L / Fallow
		Vegetable / B-Aman L
Kuri-gram Sadar	Fo Ir 10	Boro HYV / T-Aman HYV
		Wheat HYV / (Jute L) / T-Aman HYV
	F1 Ir 10	Boro HYV / T-Aman L/Pajam
		Potato / Jute HYV / T-Aman HYV
	Fo Rf 10	Mustard / Kaun/Jute L / T-Aman L/HYV
	F1 Rf 35	B-Aus L/Jute L / T-Aman L/Pajam
		Jute L / T-Aman L
		Boro HYV / T-Aman L
	F2 Rf 25	Jute L/B-Aus L / Fallow / Pulse
		B-Aus L / Fallow
		Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.

Source: Kurigram Farmers and Farm Interview Survey by the Team

Note: F_0; type of land free from flood or with occasional minor flood whose water depth never exceeds 0.3 meter.

F_1; land type possibly submerged by flood with the depth 0.3 - 0.9 m.

F_2; land type with fairly deep floods with the depth 0.9 - 1.8 m.

Ir ; irrigated, Rf; Rainfed

L ; local varieties

* T - Aus HYV - T Aman L also included here.
** Corriandar Seed

Only frequently performed types are shown and many other existing types / crops are omitted. Therefore calculated rates of crop from this Fig. not necessarily match BBS data.

Many other different patterns than illustrated here are also existing, accordingly totals of % are not equal to 100.

3) Farm Practices

Recently considerable changes in farm practices have been observed while the majority of farmers still follow traditional ways of farming. Agricultural extension activities and BADC tube well irrigation projects have succeeded in introducing modern farming techniques. HYV has expanded year after year. Simultaneously, larger amounts of chemical fertilizers, micro-nutrient chemicals and pesticides have been consumed in proportion to acreage increases under HYV. However, farm mechanization seems to be too early to introduce in the area judging from the ample amount of farm labour available and from the lack of maintenance service networks.

Intensified extension activities have enabled farmers to obtain new techniques such as the proper selection of crops/varieties through the supply of seed by the BADC and traders (imported vegetable seed is also available in open markets). The timely and adequate application of inputs as well as their proper selection consistent with the cropping situation is popularized among farmers who are willing to improve their technique levels.

The wider diffusion of locally improved varieties and HYV naturally leads to poorer harvests brought about by nutrient deficiency or a mistake made with the dose and kind of fertilizer application, soil degradation by continuous cropping and/or the abusing use of chemical fertilizers by wealthy farmers, outbreak of pests and/or plant diseases because of the HYV's susceptibility. Irrigation and embankment construction can mitigate damages from floods and drought, but new ones from insects and fungal attack tend to increase in parallel with the expansion of acreage under HYV.

According to the interview survey by the study team, around 75-190 kg of urea is now used by 60% of the surveyed households, 75- 200 kg of TSP at 12% and 25-120 kg of MP are applied at 7%, per hectare of HYV crops like T-Aman, Boro, wheat, potatoes and vegetables (average consumption in the district shows 75 kg of urea, 22 kg of TSP and 8 kg of MP per ha per year). Also, basudin, dimecron and other insecticides (fungicides are not yet popular) worth about 200-400 taka per ha per crop are sprayed for HYV paddy etc..(refer to Appendix Table V-3-7).

It would be worthwhile to refer to the popularity of cowdung application throughout the project area. The results from the farm interview survey referring to the above show that 1.6-3.1 tons per ha of cowdung have been applied to HYV paddy, wheat,jute and potatoes. In addition, another supply of organic matter goes to croping fields as a result of the traditional tethering of livestock on farm roads or bunds in paddy fields.

As for labour, land preparations, ploughing, leveling prior to the broadcasting or the transplanting of paddy, and the sowing of other grains are usually practised by draught power, averaging 65-90 hours per hectare applicable to each crop. Other practices, like nursery work, clod breaking, transplanting, weeding, intercultivating, manure spreading or top-dressing, harvesting, threshing are all manually practised. The total labour required per crop ranges from 170-250 man-days per ha.. Also, pesticide application is often performed by hand sprayers provided by extension services.

A traditional practice to be noted here is the preparation of paddy nurseries which are usually established is depressed, or low land along the shores of beels or even half-dried small rivers and dighis. Only 5-6 % of a paddy field is necessary to establish nurseries to provide enough seedlings to cover all the acreage under paddy. However, small and marginal farmers often suffer from land shortages to provide their own nurseries, so they often purchase bundles of seedlings to meet their demand for transplanting. When the transplanting season is near,seedling venders are available in local markets for this purpose.

Finally, it was discovered from the above cited interview survey that draught power has been underutilized because of feed shortages and weakness due to an overpopulation of bullock pairs. In other words, abundant manual labour can offset weak draught power.

4) Crop Yields and Damages

The agricultural land in the project area has a fairly high potential in crop production as observed from the results of soil analysis. Generally, soils with lower elevations tend to have finer textures (especially around beels, along drainage waterways etc.) and these have often not been overexploited with intensified frequent cropping, owing to longer fallow periods during flooding.

High levels of potential yields have been affirmed by the results from on-farm trials guided by the BARI station Rangpur.

Paddy yields in the project area still remain low but those from HYV and pajam have already reached 2-2.5 tons per ha.. It is observed that yields of HYV have larger fluctuations from year to year than those of local varieties. Boro HYV almost always shows the highest yield levels, which would be attributed to stable, favourable conditions such as enough sunshine, lower pest or fungal damages owing to cold weather and longer growth periods.

HYV wheat also have relatively high yield levels, because they receive along with HYV potatoes irrigation water from tube wells and higher doses of fertilizers. Farmers sometimes prefer HYV Boro to wheat, but have to choose less profitable wheat due to an insufficient water supply in some cases.

It is of particular importance for small and marginal farmers to secure food crop harvests. This is why they often grow millets like kaun, cheena and even buckwheat in spite of their low yields, just because these crops are resistant to drought, insect attacks and require much lower amounts of fertilizer.

So far as crop damages are concerned, no statistical details are available. The farm interview survey mentioned above also provides simple data on recent damages farmers have suffered from floods and drought. Drought damages were reported on local Aus (mostly broadcasted), wheat, HYV Aus and HYV jute, though the extent never exceeded 30% of the expected yields. Floods affected local and HYV T-Aman giving no more serious damages than 25% of damage-free levels as it is reported in agricultural statistics in Bangladesh. These milder cropping environments might reflect ample precipitation and high land elevations. (refer Appendix Table V-3-5 and V-3-6).

Damages from pests and diseases might be increasing as HYV expands. However, such details are only available on the basis of estimations by extension officials, which give 15% of the expected yield levels free from these damages. (refer Appendix Table V-3-7).

(c) Livestock Production

The popular livestock in the project area consists of cattle, goats, chicken and ducks, while buffaloe, sheep and geese are few, and horses and pigs are rarely seen. The importance of livestock for farmers lies in their draught use for cultivation and transportation, and also as a kind of savings deposit for the immediate need of money or food. There prevails a chronic feed shortage especially during winter periods to maintain herds properly. Self-suppliable domestic feeds are only paddy and wheat straw, grass or other roughage from the roadside or charlands.

Sometimes oil cakes or rice mill by-products can be fed, but ruminant animals are mostly tethered on farm roads, or pastured in grassy or bushy groves or chaarlands. The landless population often take part in catering for cattle or goat herds for pasturing, whereas some well-off farmers install cattle shades within their homesteads where their cows etc. are fed with cut straw or grasses.

The dependency on grain straw in the project area seems to have reached more than 60 per cent of the total nutrition requirement, which is estimated at 4.5 kg per cattle per day of total digestable nutrients (T.D.N.), or 5.6 kg per adult buffalo per day. The low nutritional levels reflect the low weight or the lean appearance of bovine animals. Estimaties (see appendix Table V-3-10) show that an adult bovine animal takes 0.6 ton of grain straw and 7.5 tons of roughage or natural grass per year.

The carrying capacity of bovine animals in the project area is estimated at 3,8 cattle and buffaloe per hectare, implying serious feed shortage per head. They are heavily dependent on rouphages from outside the project area, where about a third of their nutritional requirements is estimated to be met by feed resources in river deposits or chaar land.

Poultry (chicken, ducks or sometimes geese and guinea fowls) give an important cash earning source for marginal and small farmers, and to this end a supply scheme of a pair of stock birds has recently been implemented. Around twelve thousand birds of White Leghorn, Rhode Island Red and other varieties have been distributed from the Kurigram Poultry Farm, through the Nageswari Livestock Officer to interested farmers in upazilas in the project area. Likewise, higher milk yields are now pursued by some advanced farmers through artificial

Table 3-19 Livestock in the Project Area
(estimated as of 1987) unit: household, head/fowl

Livestock	Nageswari		Bhurungamari		Furbari		Kurigram S.		Project Area	
	h.hold	head	h.hold	head	h.hold	head	h.hold	head	h.hold	head
Adult										
Bullock	12,300	67,512	1,985	14,040	6,107	34,290	5,563	14,112	25,955	129,954
B.Calves	-	17,887	-	1,170	-	9,680	-	2,163	-	30,900
Buffaloes	-	2,098	-	234	-	1,077	-	354	-	3,763
Goats	13,067	24,746	183	234	7,367	24,424	6,276	19,597	26,893	69,001
Sheep	-	523	-	351	-	218	-	1,637	-	2,729
Chicken	17,383	95,512	2,428	25,740	7,164	79,007	8,350	25,204	35,325	225,463
Ducks	-	11,112	-	11,700	-	30,755	-	10,989	-	64,556

Source : estimated from a survey by the team extracted from the information collected from Upazila Livestock Officers etc. cross-checked with Libestock Census in 1984. Blank (-) indicates that holders are mostly the dame as those holding bullocks or goats or chicken.

insemination, for which frozen semen is supplied from Rangpur to each of the four upazila cattle mating stations.

Other than draught animals, cattle and buffaloe serve as a kind of reserve property like a depositing bank account. This is why their population is so high with nearly 4 head per hectare, or one or more pairs per farm household with barely two acres of cultivatable land (see Table 3-19). Another probable reason why ruminants are lean would lie in the heavy attack of liver fluke and other parasites which also relate with their overpopulation.

It would be worthwhile to note that livestock, especially bovine animals provide farmers with cowdung, a useful material for either daily cooking fuel or self-supplied manure for crops and homestead plantations.

(d) Fishery Production

Fishery activities are traditionally popular among the population in the Project area, where more than 1,500 marshes or ponds are available for fishing. Even small children are engaged in angling and net fishing using bamboo traps, casting nets, dip nets, scaff nets etc. throughout the year. This exploitation of fishing resources without extending productive measures such as releasing fishing fry or other protective means has already aggravated the production per water surface.

Recently, fishery officers have become aware of this fact and bulletin warning posters to publicise the notices of legal closing periods (from July 1st to the end of December) to protect spawning females and tiny fry have been posted.

Among the economically important fish species, carp families like rui (Cyprinus carpio), katla (Catla catla), murigel (Cirrhina mrigala), silver carp (Hypophthalmichthys molitrix) can be artificially cultured but spawn only in frowing river, while most catfish species like boal, magur (clarias botrachus) are hardly ever artificially cultured. Virtually, any tiny fish species whose sizes are less than 5 cm and which are prohibited to be caught during the closed season serve as the most important protein source for landless or marginal farmers.

Fishery statistics are seldom available and most catches by the local population are not recorded in statistics, as shown in Table 3-20 because they are instantly self-consumed or sold at roadside stalls immediately after being caught.

Table 3-20 Estimated Annual Fishery Production

Unit : catch in ton / year

Upazilas	Species	Kuri-grma	Nage-swari	Bhrun-gamari	Fulbari
annual catch	Rui Carp	176	-	144	32
(2,443 tons)	Katla Carp	-	-	-	50
	Mrigel Carp	-	-	-	35
	Silver Carp	-	340	12	-
	Hirsa Catfish	-	408	-	-
	Boal Catfish	-	(5)	(5)	(10)
	Small fish	(42)	612	(267)	(298)
	Shrimp	(5)			(5)
(Number of)	Fishing ponds	60	640	382	427
	Fishing boats	561	45	n.a	247

( ) only estimation

With regard to fish culture, two hatcheries are being constructed in Kurigram Upazila (near Ulipur) and Rajarhat, due completion in April 1990. The Kurigram hatchery is planned to produce 500 lakhs of fry per annum or 5 thousand kg. Another small scale hatchery is also being provided in Nageswari, where 50 kg equivalent of fingering will be grown and distributed, the completion of which is scheduled in March 1990. All these hatcheries are provided by the Integrated Fish Culture Project.

Mainly rui,katla murigel and silver carps a long with such fast growing carp species as milk carp and grass crap are cultured by the participant farmers with 1400-2000 square meters of owned ponds, to whom fingering is supplied from the hatcheries. Besides, input like fertilizers and seed to grow napier grass as feed for fish, rice or wheat bran,mustard oil cake etc. are also supplied in kind from the kurigram fishery Office and the managers of these hatcheries, through this project. Any farmers eligible for the participation to the project can be trained in the training program provided by the project, where such techniques as how to manage fish culture in their ponds. They also learn how to neutralize water with lime, to remove water hyacinth from the surface of their ponds, to feed fish in a proper way and to project their fish from predators. Feed of vegetative origin can be used for comnivorous species such as Tilapia Nilotica.

Spawns are collected from licenced fishermen who are licenced by the Fishery Office to catch spawns and found mainly in the natural spawning places like Brahmaptra river. Private traders can also collect spawns from them to grow fingerings in their own ponds. Prices of fingerings (usually 10-15 cm length) range from 70-80 taka per 1000 fingering. Ponds suitable for fish culture are mostly located in Shonahat Chaar in Bhrungamari/Nageswari where about 86 hectares of such ponds are identified. NGOs play role in these projects.

Krigram Fishery Office is also planning a new fish resource survey program in order to clarify actual situation, as a basis to extend fishery development plans throughout the district.

(e) Agricultural Economy

1) General Agro-economic situations

Basic socio-economic indicaters show that this Study area has a rather high agricultural potentiality.

According to the 1983/84 agricultural census, in the four upazilas related to the Study area, there are 74,462 farm households of which 45,816 (61%) are small farmers, 22,797 (31%) are medium farmers and 5,849 (8%) are large farmers as shown in Table 3-25. It is noticed that the proportion of small farmers in the four upazilas is lower than 64% in the Kurigram zila, 67% in the Rangpur region and 70% in the country, while that of medium farmers and large farmers is higher than 29% and 7% in the Kurigram zila, 28% and 5% in the Rangpur region and 25% and 8% in the country respectively. This implies that this area has a relatively high potentiality for agricultural development from the farmers' structural viewpoint.

According to the above census, the average size of net cultivated area per farm household in the four upazilas is 0.91 ha which is higher than 0.87 ha in the Kurigram zila, 0.83 ha in the Rangpur region and 0.81 ha in the country. The share of net cultivated area of small farmers is 23%, that of medium farmers is 47% and that of large farmers is 30% as shown in Table 3-26.

The owned areas held by all holdings in the four; upazilas is 87,665 ha, of which 2,966 ha are held by non-farm holdings and 84,699 by farm holdings. On the other hand, the operated areas held by all holdings is 88,845 ha, of which 2,032 ha are held by non-farm owned areas and the operated areas seem due to the areas owned by residents outside the four upazilas.

According to the Land Occupancy Survey in 1977/78, the proportions of owned holdings, owner-cum tenant holdings and tenant holdings are 62.2%, 37.4% and 0.4% respectively, while those in the country are 58.8%m 40.0% and 0.2%.

The status of landless farmers, who form the poor in rural areas, has an important meaning as to the dearth of basic human needs, unemployment, social uneasiness in urban areas and the backwardness in agricultural productivity.

According to the 1983/84 agricultural census, the proportions of landless to all households in the four upazilas, in the Kurigram zila in the Rangpur region and in the country are 48.1%, 48.8% and 49.4% respectively as shown in Table 3-27.

The proportion of agricultural labour households to all households is 47.5%. Approximately; 31.2% of the total farmers are agricultural labour households.

The main agricultural products traded in the four upazilas are paddy (rice), wheat, jute, and vegetables. The Government provides a guarantee for paddy, wheat and sugercane. Especially, the Government has an institution of procurement for paddy and wheat. The Ministry of Food (MOF) procures a protion of produced paddy and wheat at resonable prices, aiming at guaranteeing a minimum produce for farmers, sustaining farmers' incentive for production and assuring a stable supply of foodgrain at reasonable prices to urban consumers. In the case of paddy, the quantities procured by the MOF have ranged from 2% to 6% of the total production, which have corresponded to roughly 10~30% of actually marketed paddy. The proportions of the target procurement amount of foodgrain (including paddy and wheat) to the total production have been ranging from 3% to 5% in both the four upazilas and the Kurigram zila. The proportion of the target procurement amount of foodgrains in the four upazilas to that of the Kurigram zila is 73% the average amount from 1984/85, that is, rice is 79% and wheat is 63%. The achievement ratios to these have been ranging approximately from 61% to 67% between 1986/87 and 1987/88. Recently, the procurement prices have often been lower than market prices.

The open marketing system of major crops is divided into the following categories as shown in Fig. 3-10:

1) Rural markets (primary markets); these are the nearest open markets for farmers at village open spaces. Farmers directly bring their products including perishable vegetables, fruits and fish to the markets on foot, by bicycle, or by rikishaw to sell them themselves.
2) Urban markets (secondary markets)
   - Small and medium city markets; these are open markets in semi-urban concentration points, where middlemen collect farm products and sell to retailers and some big farmers also sell their products transported by ox-cart or by boat.

- Big city markets (terminal markets); these are open markets in urban terminal points, where middlemen, wholesalers who are big millers and big stockholders are involved in trade.

About the chemical fertilizer, the BADC is the monopoly agent and it distributes through local dealers including private wholesalers and retailers. Recently the Government has been making an effort to realize efficiently in the pricing of fertilizers by maximizing the involvement of private sectors by both wholesalers and retailers since the New Marketing System (NMS) was adopted. As a part of that, the UCCA/KSS/BSS/MBSS systems (cooperatives) have been encouraged to act as private fertilizer wholesalers.

Table 3-21 Distribution of Farm Households

	Total Farms	Small Farms (0.02~1.0ha)	Medium Farms (1.0~3.0ha)	Large Farms (3.0ha & above)
Study Area	No. 74,462	% 61.5 (45,816 No.)	% 30.6 (22,797 No.)	% 7.9 (5,849 No.)
Kurigram Zila	154,400	64.4 (99,401 No.)	28.6 (44,110 No.)	7.0 (10,889 No.)
Rangpur Ragion	798,543	67.3 (537,215 No.)	28.6 (220,824 No.)	7.0 (40,504 No.)
Bangladesh	10,045,299	70.4	24.7	4.9

Source: Bangladesh Census of Agriculture and Livestock 1983-84

Table 3-22 Distribution of Cultivated Areas by Class of Farm Households

	Total Farms	Small Farms	Medium Farms	Large Farms	Per Farm Household Net Cultivated Area
Study Area	ha 68,033	% 23.2	% 47.1	% 29.7	ha 0.91
Kurigram Zila	133,798	24.9	46.3	28.8	0.87
Rangpur Region	664,442	28.4	48.7	22.9	0.83
Bangladesh	(thousand) 8,150,240	28.3	46.0	25.7	0.81

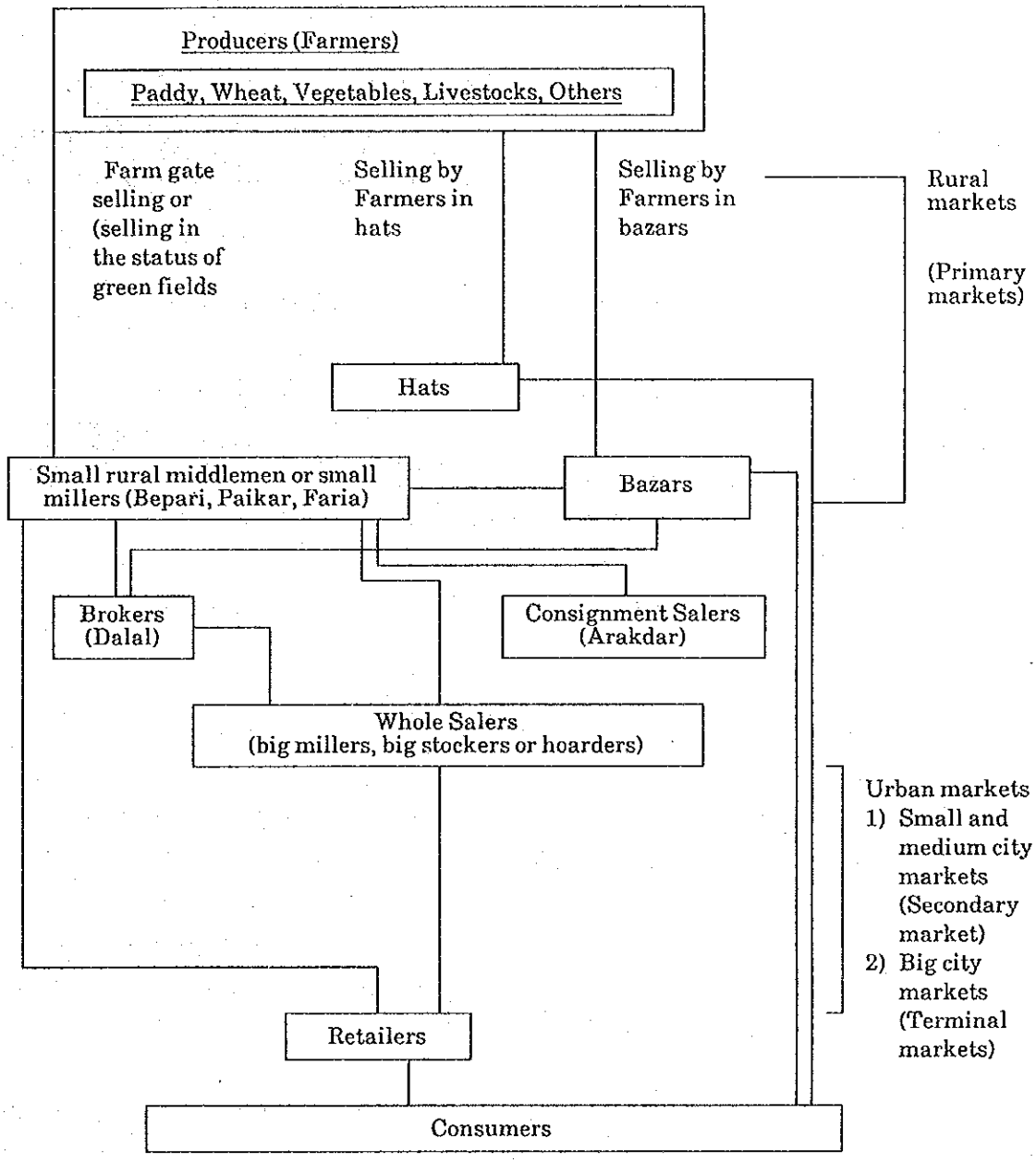
Source: The above

Table 3-23 Distribution of Landless Farmers

	All Households	Landless Farmers Classified			
		Total	Landless I	Landless II	Landless III
Study Area	ha 107,979	% 48.1 (51,915 No.)	% 12.8	% 16.9	ha 18.3
Kurigram Zila	222,127	48.8 (108,428)	11.0	17.3	20.5
Rangpur Region	1,140,525	48.8 (557,142)	14.8	15.1	18.9
Bangladesh	13,817,646	49.4 (6,831,373)	8.7	14.2	26.5

Source: The above

Fig. 3-10 Marketing Channels of Crops and Livestock Products in Open Market Systems



(f) Agricultural Supporting Services

1) Research Work

The Bangladesh Agricultural Research Council (BARC) has the responsibility to strengthen the agriculural research capabilities of the following institutes through planning, the integration of resources and the coordination of research efforts:

- Bangladesh Agricultural Research Institute (BARI, the nearest regional station is situated in Rangpur).
- Bangladesh Rice Research Institue (BRRI, the nearest regional station is situated in Rajshahi).
- Bangladesh Jute Research Institute (BJRI)
- Bangladesh Sugarcane Research and Training Institute (BSRTI)
- National Livestock Research Institute (NLRI)
- Experimental Farm (BWDB)
- Others (BTRI, INA, BIDS)

2) Extension Services

The Department of Agricultural Extension (DAE) plays the main role for the transfer of agricultural technology. Under the DAE, each of the regional directors supervise deputy directors working at district offices, which each staff 2-4 subject matter specialists and a training officer. Each upazila has an agriculture officer (UAO), a subject matter officer (SMO) and an assistant officer or a junior agricultural extension officer.

There are block supervisors in each union, who receive training from the SMO on improved technology at the upazilas and visit contact farmers (CF) to disseminate the information. CF's spread the same information to general farmers (Non-CF). This is called "Training and Visit (T&V) System", in which one BS covers 80 CF's and one CF 10 Non-CFs.

The agricultural extention system is shown in Fig. 3-11.

3) Agricultural Input Supply

The main input materials for crop production are supplied by the Bangladesh Agricultural Development Corporation (BADC), which has a department of seed production and distribution, fertilizer and irrigation equipment.

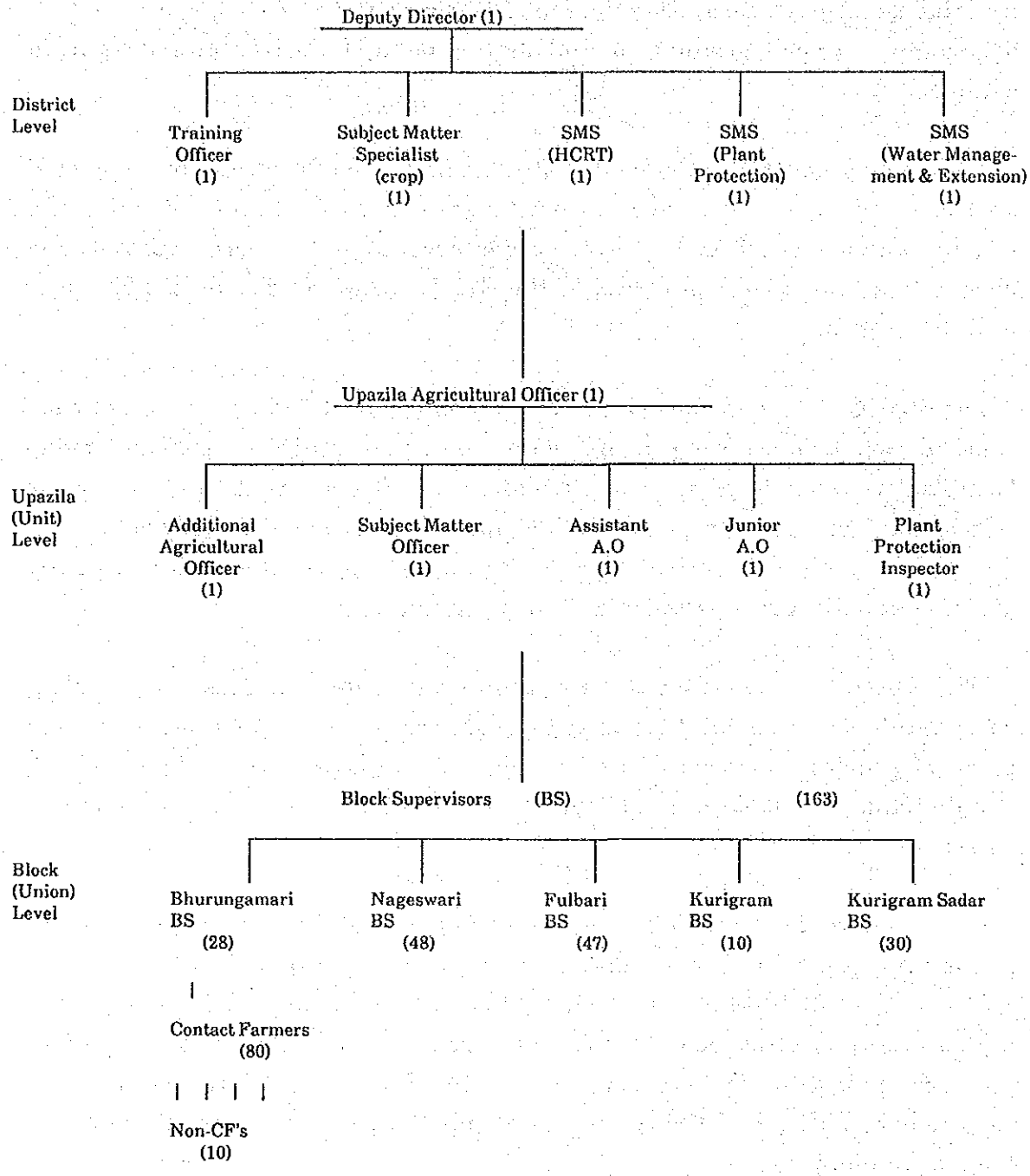
Improved seed (MV) is provided at the BADC seed farms and by registered seed growers as well and then is distributed to farmers through district and upazila offices of the BADC. In the case of sugarcane, however, improved and disease-free cane seed is produced at the BSRTI farm and distributed by sugar mills to the growers.

The BADC is the monopoly agent of chemical fertilizers, viz , urea, triple super phosphate, murate of potash and some others. Fertilizers are distributed to local dealers (including the UCCA/KSS/BSS/MBSS system) at the PMP or the TSC through district offices of the BADC under a government subsidy policy. As for pesticides, however, private companies import and sell them through their dealers located in upazilas and other important markets.

The BADC also distributes irrigation equipment for deep tube wells , shallow tube wells and low lift pumps through medium term loans of institutional credit of which resources are provided by the Bangladesh Krishi Bank (BKB), Sonali Bank, Bangladesh Samabaya Bank and other nationalized commercial banks.

The Bangladesh Rural Development Board (BRDB) is responsible for encouraging rural development by organizing farmers through the UCCA/KSS/BSS/MBSS systems, which promotes economic activities regarding agricultural production as well as various types of off-farm activities. The BRDB provides the institutional credit for the UCCA/KSS/BSS/MBSS to meet farmers' requirement for their activities through the BKB, Sonali Bank, Bangladesh Samabaya Bank, etc.

Fig. 3-11 Kurigram District Agricultural Extension Organization



4) Interview Survey with Sampled Farmers

① The Methods Employed for the Survey

Considering the survey period and the numbers of field investigators ,the total and the per village numbers of interviewed farmers for the interview survey were determined to be about 200 and 15 farmers respectively. Accordingly, the number of villages where the farmers' interview survey was conducted was about 12 or 13. Taking into account the respective number of unions, villages and farm house-holds of the four upazilas in the Study area, the distribution of sample villages to the four upazilas were determinded as follows;

Table 3-24 Upazila-Wise Distribution of Intervewed Farmers

Upazila	Number of unions	Number of villages	Number of farmers
1. Kurigram	3	3	50 H.H.
2. Nageswari	6	6	101
3. Bhurungamari	1	1	15
4. Fulbari	2	3	34
Total	12	13	200

The economist from the Dte. of Planning Scheme-1, BWDB, and the team leader of the 10 field investigators and who is the associate professor, Department of economics at Carmichael University College, Rangpur held discussions with the four upazila chairmen and the relevant union chairmen about the selection of survey villages so that they represent the situations of the whole villages in the Study area as impartially as possible, considering the following conditions:

- socio-economic status
- topography
- cropping pattern
- irrigation
- probable cooperation of the local people
- accessibility to the village

As a result, the following 13 villages and the numbers of interviewed farmers in their respective villages were selected;

Table 3-25 Village-Wise Distribution of Interviewed Farmers

Zila	Upazila	Union	Village	Number of farmers
Kurigram	Kurigwam Sadar (North)	1.Ghogadaha	Rowlia	15 H.H.
		2.Panchgachi	Gobindapur	15
		3.Jatrapur	Ghanashyampur	20
	Nageswari	1.Noonkhawa	Maguarvita	20
		2.Berubari	Char-Berubari	16
		3.Bamandaga	Maliani	15
		4.Nageswari	Ballavpur	15
		5.Ramkhana	Askarnagar	20
		6.Royganj	Damalgram	15
	Bhurungamari	1.Andarirjhar	Baraitari	15
	Fulbari	1.Shimulbari	Shorai Karji	7
			Kabirmamud	8
		2.Baravita	Purba Dhaniram	19
			Paschim Dhaniram	

For the choosing of actual households to be surveyed, first hand information from each of the above selected villages was collected, which was the name of the head, of the family operated area, type of crops produced, irrigated area and the like of the farm-households. On the basis of the above, 200 farmers were interviewed at random, taking into account their farm size and its distribution, from the selected 13 villages.

② Results

In order to assess the present farmers' socio-economic situation, data on family characteristics, agricultural and agro-economic situations along with living and cultural situation in the Study area were collected through the interviewed farmers.

a) Farm Household Income and Expenditures

Farm-household income and expenditures are shown in Table 3-26. The average farm-household net income for large farmers is Taka 130,656, whereas that of medium farmers is Taka 52,052 and that of small farmers is Taka 23,290. The large farmers get about Taka 50,000 of the average farm-household economic surplus, whereas the medium farmers get barely about Taka 1,400, and the small farmers run a deficit of about Taka 700. The average farm-household net income and average consumption expenditures per capita of family of large farmers are about Taka 13,000 and Taka 8,100, whereas those of medium farmers and small farmers are about Taka 4,700 and Taka 3,900, and about Taka 4,600 and Taka 4,000 respectively.

According to the Bangladesh Household Expenditure Survey 985/86 (BBS), the average income and average consumption expenditures per capita of rural area Bangladesh are Taka 4,992 and Taka 4,463,respectively. So that those of medium farmers in the Study area are barely level with rural area Bangladesh, but small farmers are in distress being below. It is said that the large farmers in the Study area are at a remarkably high level compared with the small and medium farmers, either in the household net income and in consumption expenditures.

Table 3-26 Farm-Household Income and Expenditures Unit; Taka

Items		Small Farmers (0.7ha)	Medium Farmers (1.6ha)	Large Farmers (4.3ha)
Agricultural Gross Return	(A)	14,800	32,614	116,788
Non-agricultural Receipt	(B)	13,704	33,625	48,760
Farm Household Gross Income	(A)+(B)	28,504	66,239	165,548
Agricultural Net Income	(A)	9,931	18,427	81,896
Non-agricultural Net Income	(B)	13,359	33,625	48,760
Farm Household Net Income	(A)+(B)	23,290	52,052	130,656
Tax etc		12	20	50
Disposable Income		23,278	52,032	130,606
Household Expenditure		23,952	50,622	80,711
Farm Household Economic Surplus		-674	1,410	49,895
Per Capita				
Average farm Size (persons)		6	11	10
Farm Household Gross Income		4,751	6,022	16,555
Farm Household Net Income		3,882	4,732	13,066
Disposable Income		3,880	4,730	13,061
Farm Household Expenditures		3,992	4,602	8,071
Economic Surplus		-112	128	4,990

Source : Feasibility Study

(Reference)*1

Per Capita Rural Household Income(Net)	Taka	4,992
Per Capita Rural Household Expenditures	Taka	4,463

Source *1 : Report of The Bangladesh Household Expenditure Survey 1985-86,BBS.

b) The Farmers' Hopes and Their Impressions

1. The Farmers' Hopes for Agricultural Improvements

(1) Land Improvement Work

All the interviewed farmers had hopes for land improvement work in the following order, i.e., improvement of irrigation, improvement of drainage, reclamation of land and the improvement of farm roads.

It is noticed that farmers in high land areas had strong wants for the reclamation of land, and that landless farmers in medium high land areas and large farmers in medium low land and high land areas had wanted the improvement of farm roads.

(2) Agricultural Development Promotion Scheme

All the interviewed farmers were most eager about the expectation for seed multiplications. And then they were eager about post harvest improvements, livestock and agricultural extension services.

Medium and large farmers had their expectation on the increase of land and land reforms. Especially medium farmers on medium land gave first rank to those.

2. Farm-lot Distribution Conditions

(1) Number of Farm-lots

According to the interviewed farmers , the frequency of farmers with operated area distributed into 7 or more lots are very high and this tends to be remarkably high as their operated area is larger. On the other hand, the frequencies of farmers whose operated area has been distributed into 3 or 4 lots are rather high also with small farmers.

(2) Distance

All the interviewed farmers stated that on average the distance from their house to their farm-lots is about 550 m and some on smaller lots is 90 m. A phenomenon is the fact that, as an operated area gets larger, the distance to their far farm-lots is longer, and that those near their farm-lots has been shorter than others, by contraries.

(3) Size

Interviewed farmers stated that on average the size of one farm-lot is about 0.3 ha for large ones and 0.05 ha for small ones.

3. Social Conditions

(1) Literacy Ratio

According to the farmers, the literacy ratio is 31 % which is much higher compared with that of this area at 16 % in the 1961 census and which means that the number of families reading and writing per farm-household is 2.1 persons. And as the operated farm is larger, the literacy ratio is higher. Moreover, the enumeration ratio of primary school children reached 67 %.

(2) Drinking Water

Tube-wells for drinking water are popular in the Project area, that is 89 % of the interviewed farmers and 95 % of large Scale farmers also. But not all are satisfied with these supplied facilities, that is, they want more and shorter drinking water transportation distances.

As for landless farmers, they still depend much on rivers as their source of drinking water.

63 % of the interviewed farmers and 75 % of large scale farmers think that the quality of their drinking water is good.

(3) Sanitary Facilities

77 % of all interviewed farmers and especially 100 % of the landless farmers have their sanitary facilities in open spaces. As the operated farm size increases, open space sanitary facilities decreases, that is, for large scale farmers, the decrease was to 44 %.

(4) Electricity

This area has not been supplied with electricity except for the head quarters of upajila parishads. Accordingly, none of the interviewed farmers has electricity.

(5) Fuel

Of the surveyed farmers, 51 % use fire-wood, 30 % c ow dung cakes and 15 % kerosene as their fuel. As for fire-wood, the lowest case is 40 % for the landless farmers, and as the operated form size is larger, it is more used, that is, for large scale farmers, its consumptions reaches 72 %. On the contrary, for cow dung cakes, only 9 % of large farmers use it and as much as 40 % of the landless farmers use it.

(6) Farm Land sales

33 farmers which are 16 % of the 200 interviewed farmers have sold their land in the last 3 years, of which 19 farmers are small, 12 are medium and 2 are large scale farmers. The sizes of land sold are almost (94 %) less than 0.5 ha.

(7) Owned Furnitures

Of the 200 surveyed farmers, 82 farmers own bicycles, 3 own motorcycles, 39 own radios including radios with tape recorders and 3 own television sets. Converting them into numbers per 1000 farm-households based on the above, 410 farmers own bicycles, 15 own motorcycles, 195 own radios and 15 own television sets in this area. And according to this same conversion, for large scale farmers, 933 own bicycles, 133 own motorcycles, 534 own radios and 133 own television sets per 1000 farm-households respectively.

(8) Goods, Properties and Farmers' Requests

All the surveyed farmers requested the following ; land, irrigation machines (tools) and bullocks (including livestock). 84% of them requested to build and/or repair their houses. Also, their requests for business facilities were deep-rooted.

Large scale farmers requested irrigation machines (tools). Then they requested other goods which in order are houses, land, business facilities and bullocks.

4. Measures for the Improvement of Living Conditions

Farmers have many opinions on how to improve their living conditions. According to surveyed farmers, the measures to be taken in order are as follows; flood control (including irrigation, drainage and barrage), financial aid, education, agricultural development and extension, building and improvement of roads, and the increment of farm-land (including land reform).

Small and medium scale farmers show almost the same views as the above. But large scale farmers put priority on education institutions first, building and improvement of roads secondly and electricity, flood control (including irrigation, drainage and barrage) and the increment of farm-land third. Landless farmers attach importance to land reform (including increment of farm-land).

5. Requested Items to the Government

These are also divided into many varieties; at first, farmers request services for their health, such as hospitals and family planning clinics.The following requests are ranked in order of flood control (including irrigation, drainage and barrage), financial aid, building and the improvement of roads, education and electricity. Excluding landless farmers, almost the same requests were made in spite of differences in farm operation sizes.

Landless farmers strongly desire the improvement of their sanitary facilities.

(g) Farmers Organization

Bangladesh has an established tradition in cooperatives, dating back as far as the early fifties. But the key positions in these cooperatives were held by well to do farmers, therefore a widespread loss confidence from less well of farmers are a consequence. In the beginning of the sixties, after cooperatives were formed following the successful Comilla experiment which was carried out under the responsibility of the Bangladesh Academy for Rural Development, giving cooperatives a versatile and comprehensive character, the movement gained strength. In the early seventies, after the establishment of Integrated Rural Development Program (IRDP), the Comilla Experiment gained wider recognition when its model began to be used for nationwide implementation. IRDP advocated the use of a two tired cooperative system that federated primary cooperatives KSS which were operated at village levels under the Thana Central Cooperative Association TCCA at the Thana level. The traditional KSS in villages which had already been organized have rapidly reorganized to KSS under the IRDP. But the IRDP did not initially undertake the establishment of cooperatives (BSS/MBSS) for the landless poor. However, in response to criticism that the KSS (farmers'cooperatives) served only rich farmers, the IRDP tried to organize groups for the landless, and advocated the use of a two tired cooperative system the same as that of the TCCA/KSS. In 1982 Sept., the name of the IRDP was changed to the Bangladesh Rural Development Board (BRDB).

According to the modified Cooperative Society Rules(1987), a ASS/BSS must be comprised with a minimum of 10 members of 18 years old or more in age under an equal rights, act, and must be registered as per provisions in the Bangladesh Cooperative Law. A KSS/BSS is managed by managing committee comprised of a minimum of 6(village level) to a maximum of 12 (upazila level) elected members as may be fixed in the by-law of a KSS or a UCCA. They prepare plans for operation and budgets, arrange funds, maintain accounts, obtain books of audited accounts, maintain reserve funds, distribute profits to the members/shareholders, arrange for the settlement of disputes and collect operation and maintenance costs for irrigation.

A UCCA is an organization at the upazila level, which federates all KSS's, BSS's and MSS's in the villages.

This UCCA/KSS/BSS/MBSS system has been playing an important role for rural people to carry out economic activities such as crop production, marketing, small scale irrigation as well as off-farm activities including rice husking, bamboo and cane works,hand looms, silk and jute crafts. It supplies the funds for the above economic activities. It can act as a private wholesaler of fertilizers, which is given credit by the BRDC for a bank guarantee. Besides, in areas under the BRDB Project or Program, the forming of an irrigation management committee is done when necessary.

According to the data of the BRDB, Kurigram district, the total number of cooperatives under the BRDB in the four upazilas related to the Study area is 950, of which 606 are KSS's, 207 are BSS's and 132 are MBSS's. The total number of members are 32,523, of which 22,163 are of KSS's, 7,052 BSS's and 3,308 MBSS's. The number of members per cooperative is 34 (37 KSS's, 34 BSS's and 25 MBSS's). The farmers who have joined the cooperatives account for 44% of the total farmers. Besides, there are 38 UCMPS's, 25 fishermen cooperatives, 2 weaver cooperatives and 59 others which are not under the BRDB.

3-4. Irrigation and Drainage

(a) Irrigation

1) Present Condition

Three types of small scale irrigation fscilities which are commonly found in Bangladesh are also in use mainly for crop cultivation during the dry period in the project area.

① Deep tube well (DTW)

A well of which the depth is 180 - 200 feet on average, and of which the capacity is more than 2.0 cusec is called a deep tube-well. The tube well diameters are 6 or 8 inches. The engine power is 22 - 32 HP. According to the Team's field investigations and the BADC, there are 114 deep tube wells and the irrigable area per well is 20.7 hectares on average in the project area.

② Shallow tube Well (STW)

A well, of which the depth is within 60 - 80 feet on average, and of which the capacity is about 0.5 cusec is called a shallow tube well. Tube well diameters are 4 inches. The irrigable area per well is 4.0 hectares on average. According to the BADC there are 1,046 s hallow tube Wells in the project area.

③ Low lift pump (LLP)

The low lift pump is a portable vertical fugal pump with 10 feet of total head for lifting surface water from creeks and bills. The command area per LLP is found to be about 11.7 hectares. According to the BADC, there are 151 low lift pumps in the project area.

The location of the existing small irrigation facilities in the project area are shown in Appendix Fig.VI-1.

A spot interview survey on some currently-operating small irrigation schemes was conducted and the output of this survey is summarized in Appendix Table VI-1 and VI-2. According to this survey, a DTW irrigates 20.7 hectares of land on

average, a STW 4.0 hectares and a LLP 11.7 hectares. The estimated area currently irrigated by these small schemes in the project area is approximately 8,300 hectares.

The problems encountered by the farmers with the existing irrigation systems are summarized below:

- It is difficult to get good quality fuel.
- Scarcity in the supply of engine spare parts.
- Water loss due to unlined canals.
- Credit system is not satisfactory and not available on a timely manner.
- Coverage area is smaller than expected.

2) Actual Water Consumption

An investigation to measure the actual water consumption in the field was conducted at the two DTW irrigation schemes, which are situated in Nageswari and Bhurangamari. The results are summarized as follows:

Station	Nageswari	Bhurungamari
Duration of measurement	10 days (from Fed.15)	10 days (from Fed.15)
Actual irrigated area	27.10 ha.	29.10 ha
Irrigated crops	Paddy	Paddy
Actual discharge (measured by a weir)	0.065 cumec/s (2.30 cusec)	0.0588 cumec/s (2.07 cusec)
10-day average operation hours	12 hrs./day	14 hrs./day
Actual water consumption in depth	10.40 mm/day	10.20 mm/day

3) Costs for Investment, Operation and Maintenance

According to field survey results, it appears that the Bangladesh Government through the BADC supplied and installed DTWs among the farmers fixing total investment cost of Tk. 500 thousands per DTW keeping a subsidy of Tk. 325 thousands between 1978 and 1983. The average yearly operation and

maintenance cost per DTW comes out at Tk. 58,000, of which 12% goes to repairs and labor.

Regarding STW irrigation schemes, it is found that comparatively rich farmers bought STW pumping sets with their own money. The average investment cost per scheme comes out on an average at Tk. 33,000 and the average yearly operation and maintenance cost is Tk. 14,000 of which 33% goes to repairs and labor. The average investment cost for a LLP pumping set is Tk. 22,250 and its operation and maintenance cost is Tk. 23,000 of which 29% goes to repairs and labor costs.

From these data, the irrigation cost per farmer become Tk.670, Tk.740 and Tk.1,000 for DTW's, STW's and LLP's respectively.

4) Organizations

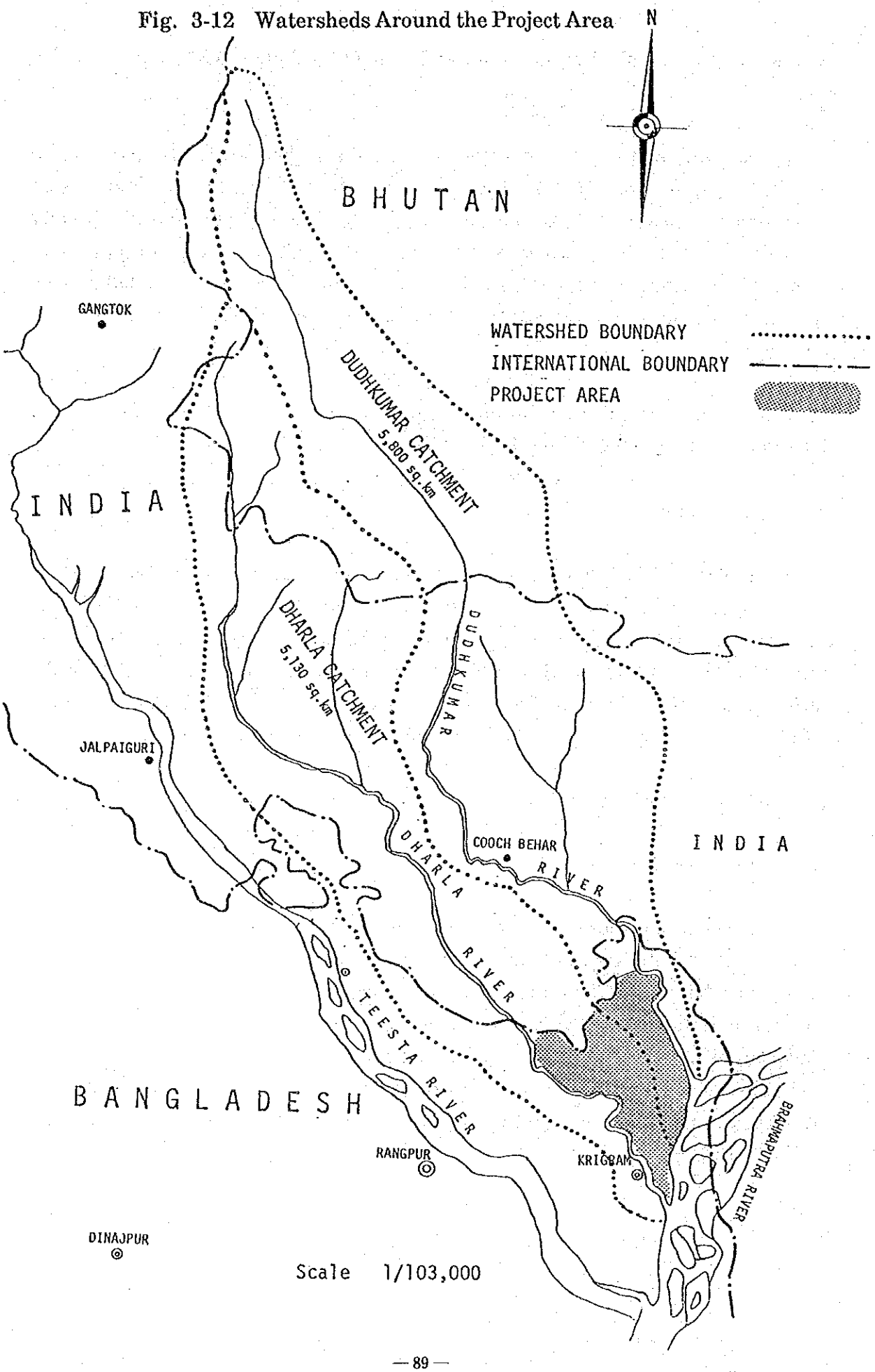
Most of the DTW schemes are being managed by some cooperative societies, whose average number of members are found to be 87. Almost all the STW and LLP schemes are being managed by individual farmers (comparatively rich in number). They are distributing irrigation water among the farmers and fixed a unit price/cost for irrigation. The average farm household numbers covered by the STW scheme and by the LLP scheme are found to be 19 and 23 respectively.

(b) Drainage and Flood Control

1) Drainage Area

The project area is located in the Dharla and Dudhkumar catchments as shown in Fig. 3-12. The drainage area of the study area is as large as 678.1 sq.km and extends its boundary deep into Indian territory consisting of 213.4 sq.km (31%) therein as indicated in Table 3-27. There are three major river systems in the study area; i.e. the Phulkumar river, the Nilkamal river and the Girai river occupying about 80% of the whole drainage area. The total area may be divided into 6 drainage blocks by topography and component drainage systems as shown in Fig. 3-13.

Fig. 3-12 Watersheds Around the Project Area



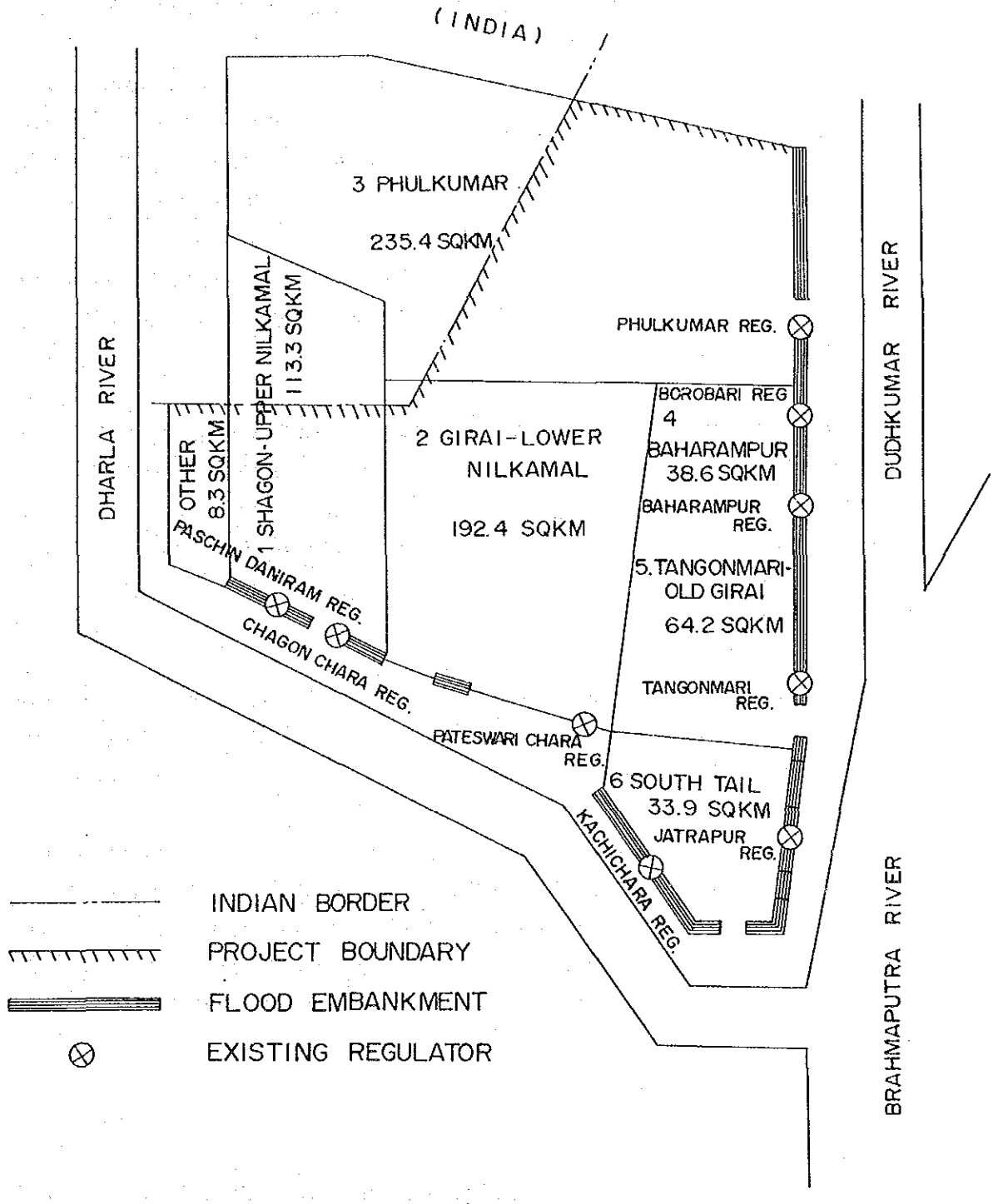


Fig. 3-13 Drainage Blocks of the Project Area

Rivers in and along the study area continuously change their courses in the wet seasons depriving farmers of their land, producing a large number of landless farmers and leaving long reaches of swamps in the old channels instead.

Drainage from the study area is made either to the Dharla river, Dudhkumar river or Brahmaputra river through gaps in the flood embankments and the drainage regulators constructed across them. Major drainage outlets are in three places; at the estury of the Phulkumar river for the northern part, at Shagon Chara Regulator for the western part and at the Pateswari Chara Regulator for the central part. The study area often suffers from floods due mostly to inflow from outer rivers and/or incapable inland drainage caused by high water levels in the outer rivers.

Field investigations of major drainage channels in the project area in the winter season have shown that they are meandering and have shallow and wide cross-sections; seemingly sufficient for flood discharge in most of their courses. Meanders with such cross-sections contribute to much of the delay in flood concentration time and work for water retention to reduce flooding in the downstream reaches.

It shall be stressed that the Shagon river, which is only 40 km long, is playing an important role as a drainage by-pass of the Nilkamal river to short-cut flood water to the Dharla and to reduce flooding in the lower reaches of the Nilkamal.

On the other hand, however, cross-sections of the downstream portion of the Girai at their confluence with the Nilkamal in some lengths seem to be insufficient in meeting with the necessary capacity of regulators at the downstream end. Some 2.0 km from the confluence till the junction with the Old Girai in the Girai (say "Girai-Nilkamal Pass") will be examined for their capacity.

2) Drainage Facilities

Drainage facilities equipped in the study area are quite limited in number and structure type. No drainage measures are taken other than for the construction of culverts across roads and a number of regulators along the flood embankment. Drainage channels are of a natural system and are left almost untouched.

As of date, five drainage regulators have been constructed across the flood embankment, while additional four will be completed by the end of FY1989-90 as shown in Table 3-28. The BWDB still has plans to construct more regulators along the embankment though their implementation has not yet been programmed.

3) Flood Control Facilities

In the previous F/S in 1969, the construction of 70.5 km of flood embankment was proposed. Up to date, due to changes in the river courses and the socio-economic significance in local societies, embankment alignment has been revised in ways to protect productive land from encrochement by the river's flow, to secure a safe distance from the river water, to include newly formed land, etc. A standard cross-section of the embankment is shown in Fig. 3-14 for reference. As of date, the total length of the embankment is planned 83.9 km, and its components by construction status are given in Table 3-29, wherein 18.0 km are left for further construction in the future.

The construction of the embankment started in FY 1980-81 from the southern part of the study area and continued every year by use of not only the government fund but also other funds provided from foreign sources. Earthwork is all manually done so as to provide the local farmers with more employment. No construction machinery, even light ones, are employed even for the distant hauling of embankment materials.

The flood embankment thus constructed has often been damaged by rainfall. It is mostly made of sandy soils and locally of silty ones along the work site. No mechanical compaction is performed. Careful attention is not always paid on soil texture and uniform compaction. Consequently, some parts of the embankment are damaged by sliding, gully erosion and washing at times by intensive rainfall.

The repair of the embankment has also been performed since FY 1983-84 including some improvement works by using the same funds. As of date 58.9 km has been repaired including the length of some 12 km that was repaired twice.

Among the planned 83.9 km of the embankment, there are 13 gaps remaining to be filled and to be connected through. Seven places are waiting for construction, three have been cut by local farmers for local flood drainage, one by

river flow scouring, and the remaining two are existing roads to be upgraded with the flood embankment. See Table 4-11 for reference.

Table 3-27 Drainage Area by Drainage Blocks (sq. km)

Drainage Block	Drainage Area	in the Study Area	out of the Study Area	in Indian teritory
1 Shagon-Upper Nilkamal	113.3	34.0	79.3	79.3
2 Girai-Lower Nilkamal	192.4	191.4	1.0	1.0
3 Phulkumar	236.4	55.0	181.4	133.0
4 Baharampur	38.6	38.6	-	-
5 Tangonmari-Old Girai	64.2	64.2	-	-
6 South Tail	33.9	33.9	-	-
Others	8.3	8.3	-	-
Total	687.1	425.4	261.7	213.3

Table 3-28 Drainage Regulators in the Project Area

Location (km)	Name	Dimension Nos.-B×H(m)	Sill EL (m)	Construc. (FY)
(along the Dudhkumar Right Embankment)				
10+07	Phlkumar Reg.	8-1.52×1.83	23.77	'83-'84
12+95	Borobari Red.	3-1.52×1.83	25.91	'89-'90
21+76	Baharampur Reg.	5-1.52×1.83	23.47	'83-'84
30+72	Tangonmari Reg.	4-1.52×1.83	22.25	'86-'87
38+11	Jatrapur Reg.	2-1.52×1.83	22.25	'88-'90
(along the Dharla left Embankment)				
10+45	Paschin Daniram Reg.	2-1.52×1.83	25.60	'89-'90
12+13	Shagon Chara Reg.	3-1.52×1.83	24.99	'83-'84
29+43	Pateswari Chara Reg.	12-1.52×1.83	22.56	'89-'90
34+09	Kachichara Reg.	3-1.52×1.83	22.56	'83-'84

Table 3-29 Flood Embankment Construction
(as of the end of FY '89-'90) (unit :km)

Construction Status	Dudhkumar R. Embankment	Dharla Left Embankment	Total
1. Constructed	40.06	21.87	61.93
2. To be constructed	1.58	15.03	16.61
3. Exist. roads to be imp'vd as embank.	-	5.40	5.40
Total	41.64	42.30	83.94

Fig. 3-14 Standard Cross - section of Flood Embankment