CHAPTER 4

RESOURCE UTILIZATION

4.1 Land Use

Out of the total area of the southern region, 26 percent are used for settlements, water bodies, reserved forest etc, about one percent is used for salt farming (along the Chittagong-Cox's Bazar coast) and 73 percent is the net cropped area (CEGIS estimation). The region lags behind the country in terms of the intensity of agricultural (crop) land use. Land is predominantly single (50%) and double (40%) cropped, the cropping intensity being 159 percent, compared to 176 percent in Bangladesh (Figure 4.1, Table 4.1) (BBS, 2010).

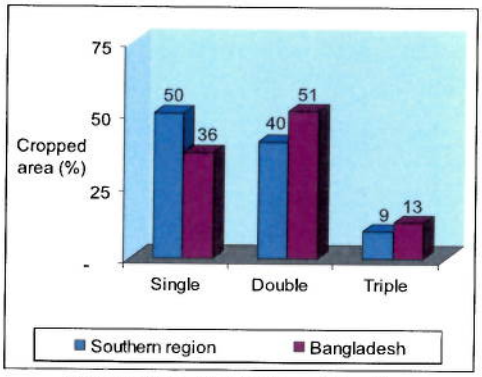


Figure 4.1: Agricultural land use

Table 4.1: Land use (000 ha)

Region/ greater district	Cultivable waste	Current fallow	Single	Double	Triple	Net Cropped Area (NCA) [4]	Total Cropped Area (TCA) [5]
Chittagong	20	27	101	132	32	264	460
Noakhali	13	4	92	145	47	284	522
Barisal	24	40	195	178	46	418	688
Patuakhali	6	49	155	112	16	283	427
Khulna	12	47	284	98	16	397	526
SR total	75	169	826	664	156	1,646	2,622
Bangladesh	257	614	2,844	3,975	978	7,797	13,728
SR (%)	5	10	50	40	9	100	159
BD (%)	3	8	36	51	13	100	176

Major cropping patterns are Fallow-T.Aman-Fallow (38.5% of NCA), B.Aus-T.Aman-Rabi (24.1% of NCA) and T.Aus-T.Aman-Fallow (14.1% of NCA) (Table 4.2, Figure 4.2).

Table 4.2: Cropping pattern

Current cropping pattern			% of net cropped area
Kharif-I	Kharif-II	Rabi	
Fallow	Fallow	Boro	1.01
Fallow	T.Aman	Boro	13.7
B.Aman	B.Aman	Fallow	2.1
B.Aus	T.Aman	Fallow	1.6
Fallow	T.Aman	Fallow	38.5
Mixed B.Aus & Aman	Mixed B.Aus & Aman	Fallow	1.4
T.Aus	T.Aman	Fallow	14.1
B.Aus	Fallow	Rabi	0.5
B.Aus	T.Aman	Rabi	24.1
Mixed B.Aus & Aman	Mixed B.Aus & Aman	Rabi	2.9
Total			**100.0**

[4] Net Cropped Area (NCA) is the total land area of the country minus land used for non-crop purposes (including wasteland).
[5] Total Cropped Area (TCA) = NCA x Cropping Intensity

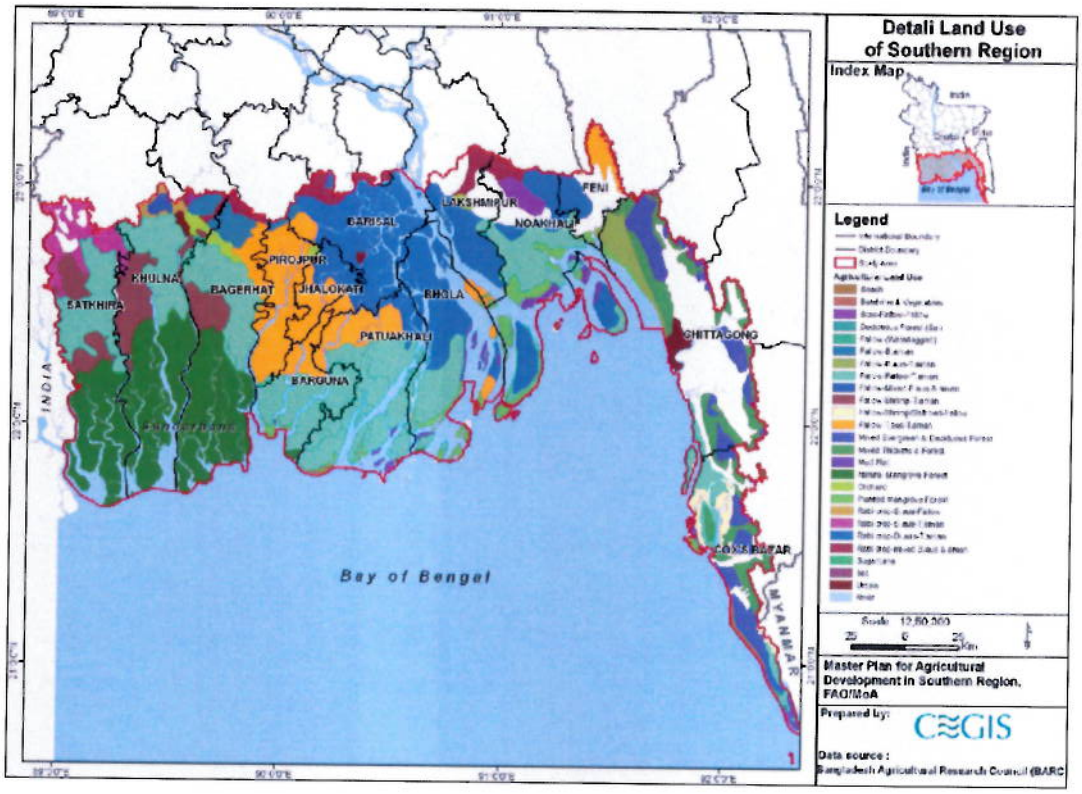


Figure: 4.2: Current cropping pattern

In the southern region, 15 percent of total cultivable land is either fallow and/or not under productive use. Major physical factors responsible for land being not used intensively are soil salinity, water salinity, subsidence and water logging.

4.2 Water Resources Management in Polder Areas

4.2.1 Polders

Polders are major interventions in the southern region with protective structures that provide benefits to the production systems and livelihoods. 'Polder' is a Dutch term, meaning a reclaimed landmass with engineering interventions to grow more food by protecting coastal land from saline intrusion caused by tidal flooding. Over the period of time, rice production has increased significantly as a result of empoldering.

The Bangladesh Water Development Board (BWDB) has constructed 139 polders since the 1960s (Figure 4.3). While these have contributed significantly in enhancing food production in the initial decades, they are now gripped in second generation problems, both social and environmental. The current state of the polders has been addressed in a recent International Food Policy Research Institute (IFPRI) study on institutional aspects of polder management in the coastal areas. Problems are mainly manifested through the following phenomena (IFPRI, 2012).

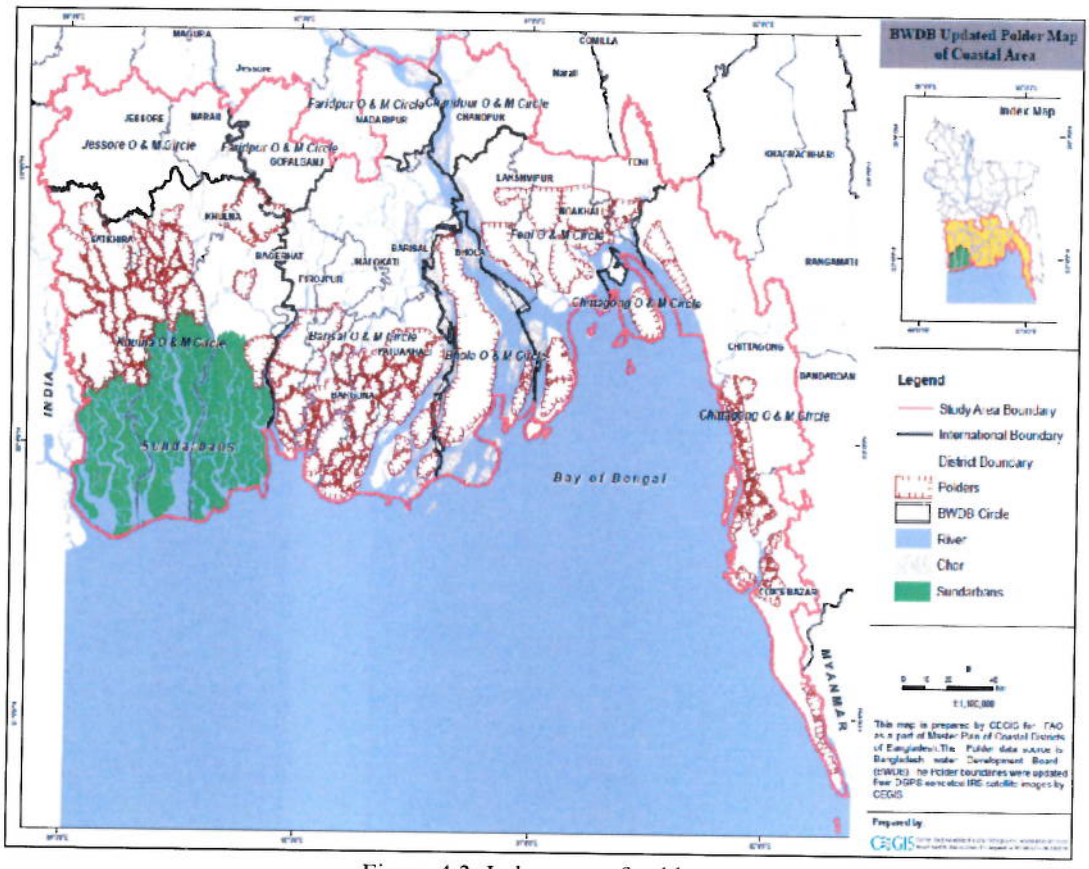


Figure 4.3: Index map of polders

- ***Siltation:*** Due to empoldering, natural inundation outside the polders has been obstructed by embankments resulting in higher elevation of land outside the polder and no siltation inside.
- ***Drainage:*** Because of siltation of outfall channels, channels within polders have significantly lost drainage capability resulting in water logging. The problem has been compounded by siltation of internal drainage channels.
- ***Water logging:*** Because of land accretion, particularly in the Meghna estuary, many rivers and *khals* (drainage canals) have been silted up. Onrush of upstream flow and prolonged rainfall often cause water logging. This problem has been aggravated by empoldering.
- ***Salinity:*** Though soil salinity declines in the long run because of empoldering, problem recurs because of erosion and embankment failure (breaches or overtopping by storm surge).
- ***Land use conflict:*** Shrimp farmers bring saline water inside the polder by cutting embankment or using LLP. This affects salinity balance inside the polder and causes damage to crops in surrounding fields. Competing land use often results in confrontation and violence and thereby affects the social fabric. Polders have not been designed for the multi-functional land use and the BWDB has no mechanism how to deal with land use conflicts.

4.2.2 Operation and maintenance

The state of water management is generally poor in those polders that are not covered by a specific project with an institutional component. Poor operation of sluice gates often harms farmers in low lying areas who are vulnerable to unwanted inundation. *Khals* are hardly maintained (IFPRI, 2012).

Total value of all BWDB investments in the country is estimated at BDT 200 billion. O&M costs are three percent of investment costs as a general rule of thumb. This means, BDT six billion is annually needed for O&M. However, it has not been possible to provide the required allocation to the BWDB. Expenditures are often lower than allocations because of non-availability of cash funds, delay in tendering, adverse weather condition, lack of field staff and more attention for new projects (Pearbolte and Zubair, 2011). Thus proper maintenance is hampered, affecting the quality and functionality of structures.

Local Government and Engineering Department (LGED), through its small scale water resources development (SSWRD) project also works for water management in the polders with the consent of the BWDB.

4.2.3 Conflict

Polders are areas of contention and conflicts that develop around economic interests of groups with different types of land endowment and conflicting land use. The conflict between shrimp growers and rice farmers is age-old. While polders are designed to protect land from saline water intrusion, shrimp growers bring saline water inside the polder. This affects the salinity balance inside the polder and causes damage to crops in surrounding fields. Competing land use often results in confrontation and violence and thereby affects the social fabric. Polders were not designed for multi-functional land use and the BWDB has no mechanism to deal with land use conflicts.

Land elevation in polders is not uniform. There are high lands, as well as low lands with different demand-supply regimes for water. Those who control the sluice gate also control the water according to their own convenience and benefit. When high lands are irrigated, low lands are submerged under deep water and crops are damaged. When water is drained out for the benefit of low lands, high lands suffer. In many villages, farmers of low-lying areas have to make their own internal dikes to protect their crops from inundation, while the high land farmers do the same to retain water. The problem is resolved sometimes by the Water Management Group (WMG) through discussion. In polders, where there is no functional WMG, the powerful people dictate terms.

Some people occupy *khals*. They construct *bundh* (earthen cross-dam) on the *khal* for aquaculture. As a result, the *khals* lose much of their drainage function. On the other hand, farmers in adjacent areas lose access to water of the *khals* for irrigation.

4.2.4 Current institutional setting

The BWDB is a public agency under the Ministry of Water Resources which constructs and anchors coastal polders. The Ministry formulated the National Water Policy (NWP) on 30 January 1999. To implement the NWP, Guidelines for Participatory Water Management (GPWM) was prepared and endorsed by the Ministry of Water Resources in April 2001. Following this, the

BWDB started to develop its own implementation manual. According to the GPWM, Water Management Organizations (WMOs) representing local stakeholders are driving forces in water resources management. Among these are the Water Management Group (WMG), Water Management Association (WMA) and Water Management Federation (WMF). These are meant to be independent organizations with decision making power at all stages of local water resources management. WMOs are responsible for planning, implementation, operation and maintenance of local water resource schemes in a sustainable way. Management responsibilities of schemes/projects are dependent on the size of the project (polder) as follows:

- Schemes/projects over 5,000 ha: Private management through leasing, or management contract or joint management by BWDB along with local government institutions (LGIs) and WMOs, but keeping the ownership with BWDB;
- Schemes / projects over 1,000 ha but not above 5,000 ha: Management by WMOs keeping ownership with the BWDB; and
- Schemes / projects up to 1,000 ha: Management to be transferred gradually to the LGIs, which are being satisfactorily managed by WMOs (Abedin, 2004).

Although BWDB is legitimately concerned about water management, it is also important and relevant for other agencies that deal with public welfare and development. Inter-agency relationship does not flow automatically. The people in a polder need services from a host of agencies. Except in the Char Development and Settlement Project (CDSP) in Noakhali, a multi-agency approach is conspicuously absent. If farmers and fishers in a polder need extension service from the Department of Agricultural Extension, Department of Fisheries or Department of Livestock Services, extension staff of that agency are needed to operate within the framework of her/his parent organization. Unless inter-agency partnership is clearly spelled out in administrative arrangements or statutory frameworks, such services hardly trickle down to polders where they are needed.

Community participation in water management is a key issue and is being attempted in selected polders. The BWDB and the WMA have entered into a contract regarding O&M of the polder. Respective tasks have been delineated. BWDB is responsible for periodic and emergency maintenance, while the WMA is responsible for regular maintenance of physical infrastructures. Delineation of responsibility between the two has been clearly spelled out in the GPWM (BWDB, 2008). In CDSP and IPSWAM polders, the arrangement works. The WMG engages one or two of its members to look after the sluice gate within its jurisdiction.

In polders covered by CDSP and IPSWAM, the project staff of the TA team (consultant) took special efforts to organize the people in the WMGs in line with the GPWM. The WMGs are registered with the Department of Cooperatives (DoC) through its local office. While the WMGs are organized for each village/sub-polder, an apex body of the WMA is formed at the polder level. WMG is more of a 'social unit' representing a neighborhood, and the WMA is an institution that represents a water management system. The WMA is not yet a statutory entity, as it does not fit in the conventional structure of the DoC. However, the WMAs are acknowledged as representative of

water users by the BWDB, which offers them with some *de facto* role and authority. The WMF is formed representing a larger catchment incorporating several WMAs.

4.2.5 Coordination

With increasing population, urbanization and industrialization of the country, patterns of interaction between different types of water users are changing rapidly. This interaction is also diverse and this diversity is a determining feature of life (Local Govt. Division, 2006).

It is widely perceived that the BWDB is the lead agency for water management, and other agencies like Department of Agricultural Extension (DAE), Department of Fisheries (DoF), Forest Department (FD) or DoC have less concern for water management, and O&M of infrastructures. NGOs are virtually exogenous entities that are generally brought into the picture as an extended arm of project technical assistance. In the absence of such funding, NGOs would not be in place or would be more inclined to support activities like savings and credit schemes.

Yet, some 35 public agencies are connected with water as a basic resource to fulfill their organizational mandates. Lack of a coherent policy and planning on the use of water has driven the situation to such a pass that some of the agencies are found to have been working at cross-purposes. Now that the relevant ministries have declared their sub-sector policies and these have generally been found to be compatible with each other, they should start working towards harmonizing the remaining inconsistencies (Local Government Division, 2006).

4.3 Water Management

4.3.1: Surface water

As noted above, the southern region has an extensive network of rivers, *khals* and water bodies. Surface water is widely available due to existence of some large and medium perennial river systems flowing through this region.

In the monsoon, most of the *khals* are navigable. But in the dry season, water is used for irrigation and some of these khals contain very little water. Many internal rivers and khals in the network have been silted up and water is not available in the dry season at the place of use in time of extreme need.

Many households in the rural areas possess ponds adjoining respective homesteads. Some of these are used for fish culture, some for domestic purposes and some are derelict. Pond water is also used for irrigating selected Rabi crops, fruits and vegetable gardens in close proximity to the homestead.

4.3.2 Groundwater

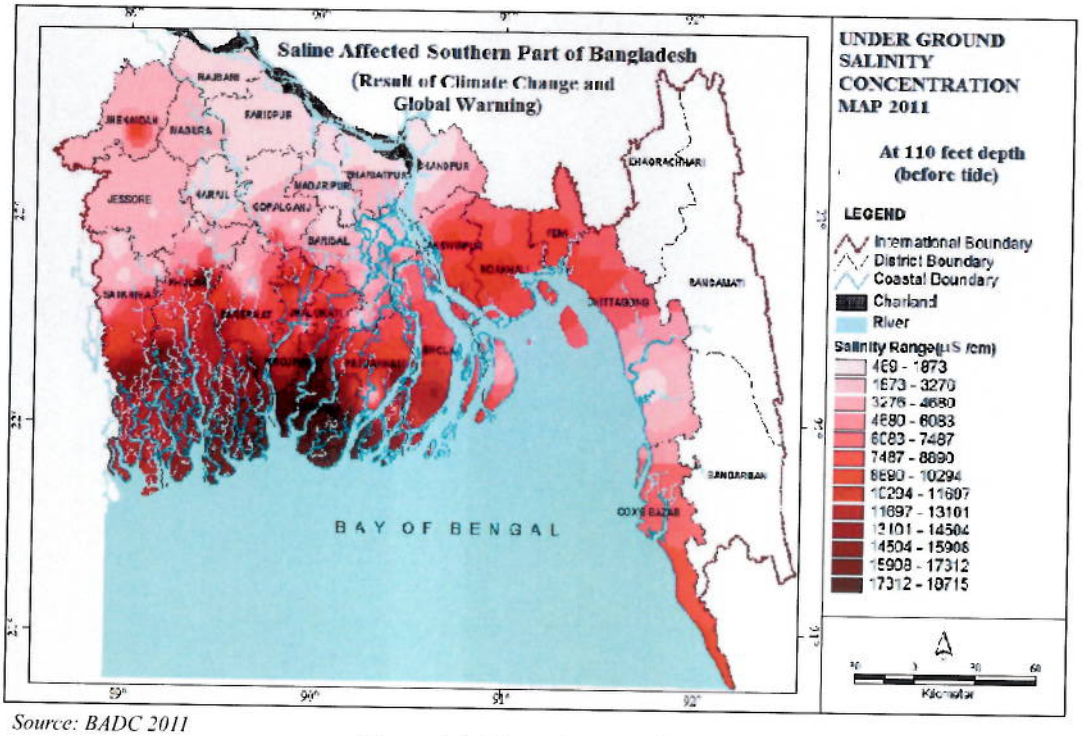
In Barisal region during the monsoon, the groundwater table rises close to the ground level. Groundwater levels fall after mid-October in response to evapo-transpiration and rapid drainage of surface water. The natural rate of fall is the highest in October-November.

Because of high rainfall and widespread water logging in the southern districts and as both the shallow and deep aquifers have good recharge characteristics, they normally remain saturated

almost to the ground level. But under the influence of tidal conditions, the shallow aquifers of Noakhali, Patuakhali, Jhalokati, Pirjopur, Barguna and Bagherhat districts remain saline. For this reason, ground water irrigation area coverage is less in these districts. Moreover, ground water in Noakhali has high concentration of arsenic. In addition, there exists a thin impermeable top clay layer in Noakhali that would hinder installation of Deep Tube-Well (DTW) and Shallow Tube-Well (STW).

Data from the Bangladesh Agricultural Development Corporation (BADC) observation wells reveals that groundwater of coastal belt does not fluctuate too much. Its maximum depth even during the driest period, i.e. April to May, remains within the suction limit of STW. But in terms of quality, it is not suitable for irrigated crop cultivation due to higher salt concentration.

At a depth of 60 to 110 feet below the surface level, salinity concentration varies from 9,347 µS/cm to14,021 µS/cm (Figure 4.4).



Source: BADC 2011

Figure 4.4: Groundwater salinity

4.3.3 Drainage system

Drainage in Barisal Division is served by important river systems, such as, the Meghna, Arial Khan, Kirtankhola, Tetulia, Shandha, etc. Other rivers influence the drainage pattern, such as the distributaries of the Meghna River.

The drainage system in Noakhali region is a complex network of interconnected channels, in which flow directions are often reverse. Flash floods from Tripura Hills carry substantial amount of sediment that cause deterioration of natural drainage system.

There are three principal drainage features: Dakatia River, the WAPDA-Rahmatkhali Khal, the Noakhali Khal and Little Feni River. These are interconnected by a number of *khals* and tributaries. Rahmatkhali/WAPDA Khal forms the principal drainage route in the north of the district. The drainage is provided primarily by WAPDA Khal in Noakhali and the same named as Rahamatkhali Khal in Lakshmipur into the Lower Meghna. This area generally suffers from drainage congestion, and one major feature is the Begumganj depression, which is seasonally water- logged. With land accretion in the south, the primary drainage route from the Noakhali area is now to the west. The BWDB is in the process of diverting the Noakhali Khal to Sandwip channel through the Algir Khal and the Bamni River.

4.3.4 Irrigation

BWDB is the lead agency for implementing large scale water irrigation projects. Among the major irrigation projects in the region are:

- Barisal Irrigation Project (Barisal)
- Muhuri Irrigation Project (Feni)
- Chandpur Irrigation Project (Chandpur, Lakshmipur)

Meanwhile, BADC has been implementing minor irrigation projects facilitating both groundwater and surface water irrigation since 1961 (Table 4.3).

Table 4.3: Minor irrigation in the southern region

District	Equipment used & area irrigated (ha)						Total area (ha)
	DTW		STW		LLP		
	No.	Area	No.	Area	No.	Area	
Bagerhat	0	0	6,349	11,753	12,267	33,212	44,965
Barguna	0	0	0	0	310	1,714	1,714
Barisal	0	0	0	0	5,090	57,156	57,156
Bhola	0	0	0	0	4,146	47,024	47,024
Chittagong	57	1,001	2,924	13,030	5,028	45,266	59,297
Cox's Bazar	2	70	5,140	19,016	2,508	22,391	41,477
Feni	37	1,132	2,927	11,894	1,620	16,987	30,013
Jhalokati	0	0	0	0	1,038	7,868	7,868
Khulna	0	0	13,649	26,508	13,254	24,399	50,907
Lakshmipur	17	617	1,012	2,528	2,843	24,268	27,413
Noakhali	58	2,225	3,100	7,998	6,983	38,875	49,098
Patuakhali	0	0	0	0	940	2,320	2,320
Pirojpur	0	0	0	0	2,509	12,493	12,493
Satkhira	720	11,135	38,445	61,490	2,333	4,415	77,040
Total	32,912	357,595	1,425,136	3,336,652	14,033	128,575	3,822,822

Source: BADC Minor Irrigation Survey Report 2009-10

This minor irrigation programme is overwhelmingly dependent on extraction of groundwater. STW accounts for 88 percent of total irrigated area in the region covered by the BADC (Figure 4.5). The extent of surface water irrigation using the LLP is very small (3% area). Surface water irrigation is particularly low in Jhalokati, Patuakhali, Barguna and Satkhira (BADC, 2010).

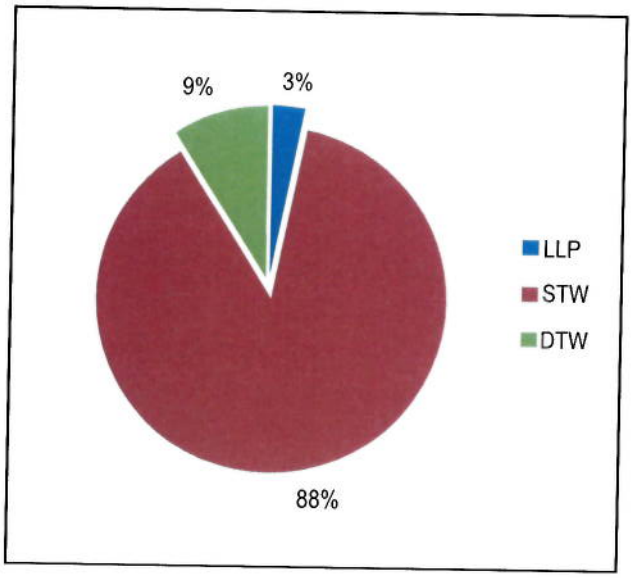


Figure 4.5: Minor irrigation of BADC

The BADC's surface water irrigation program includes double-lifting irrigation using 5-cusec pump in Barisal, Bhola, Lakshmipur and Cox's Bazar. Area covered under this mode using slightly over 13 km of irrigation channels was 10,585 ha in 2010-11.

LGED has 200 small scale water resource development (SSWRD) sub-projects in the southern region covering an area of 135,000 ha.