LEARNING DELTAS ASIA INITIATIVE (LDAI)

Mission Report-Phase I

July 2017

Report prepared by Institute of Water Modelling (IWM) and Submitted to Bangladesh Water Partnership (BWP)

Table of Contents

List of Figures

List of Tables

Bangladesh Mission Report

1 Background

The Learning Delta Asia Initiative (LDAI) concept was built mainly for awareness raising and acquainting and sharing knowledge among the Delta Countries concerned Institutions and Agencies. The initial LDAI concept was undertaken during a scoping workshop organized during the Singapore Water Week[1] and in the second half of October 2016[2]. Follow up was discussed by GWP at a DC meeting in Marrakech in November 2016. Bilateral meetings with GWP/BWP and IWM as well as CEGIS was held on November/December 2016[3].

2 Overview

Under the broad framework of scoping of Phase-1; Bangladesh and Myanmar is considered as 'learning territories' due to its pronounced leadership in the region with 'Learning champions' (knowledge holders in a position to share) on adaptive delta management (ADM) and Delta issues for resilience. GWP/BWP and IWM, as partner organization, invited concerned Myanmar delegation for anchoring these two countries and to gain and share knowledge on ADM. A representative of PROCASUR was also present to develop the methodology of the learning approach and routes.

The visit program of Myanmar delegation team was held from 23 February to 28 February 2017. The learning program included lectures on Delta issues, Q&A and field visit on nine learning areas:

1. Presentation on Coastal Vulnerability and Resilience Measures in Times of Climate Change, by Mr. Zahirul Haque Khan, Director, Coast, Port and Estuary Management Division, IWM, Dhaka
2. Flood forecasting in Bangladesh and Implementation of Jason-2 Satellite Altimeter based Flood Forecasting System, by Md. Sohel Masud, Director, Flood Management Division, IWM, Dhaka
3. Community Based Flood Early Warning System and Information Dissemination in Bangladesh Delta by Mr. Waji Ullah, Executive Director, CEGIS, Dhaka, Bangladesh
4. Experiences from Ecosystem Services for Poverty Alleviation-ESPA Deltas Project by Prof. Dr. Mashfiqus Salehin, Director, Institute of Water and Flood Management, BUET
5. Climate Change Adaptation and Water Governance in Bangladesh Delta by Dr. Md. Abu Sayed, Senior Fellow, BCAS, Dhaka, Bangladesh
6. Introduction and Salient features of Bangladesh Delta Plan (BDP) 2100 by Mr. Mafidul Islam, Joint Chief, GED, Planning Commission, GOB
7. Tidal River Management by Prof. Dr. Monowar Hossain, Executive Director, IWM, Dhaka, Bangladesh
8. Mangroves in Bangladesh by Prof. Dr. Monowar Hossain, Executive Director, IWM, Bangladesh

[1] July 2016
[2] Manilla, October 2016.
[3] November/December 2016

9. Field Visit to Land reclamation activities in Bangladesh, by BWDB

The delegation of Myanmar was composed of four people and was active and take decision regarding i. Selection of priority learning areas, ii. Setting the objectives and planning the upcoming mission to Myanmar by the Bangladeshi delegation, iii. Initial discussion on the key institutions and organization and considering invitation to participate in the Learning Route.

3 Learning Route in Bangladesh

The BWP and IWM played a significant role in organizing a menu on Bangladesh´s best practices as did MWP in leading the further exploration on particular learning areas and real experiences of interest for Myanmar. This exchange conducted and discussion held based on presentations provided clarifications to definitions of some Delta Management Concepts for a common understanding. The definitions and areas identified will be refined as process goes on through in country consultations, led by the CWPs and finalized during the upcoming mission to Myanmar.

4 Comprehensive introduction to the three learning areas prioritized in Bangladesh

The presentations, discussion and field visit give food for thought to the Myanmar Delegation for selecting on particular learning areas and real experiences and prioritizing them. The exchange mission to Myanmar will further assist through in country consultations in Myanmar led by the CWPs.

Among many issues of Delta Management the team (Bangladesh & Myanmar) has selected the following three learning areas in Phase-II in Bangladesh:

1. Tidal river management
2. Polder management
3. Management of water resources project

Myanmar delegation comprising of 15 to 20 participants will visit the learning areas in Bangladesh and conduct field training, meeting, discussion with the proper institutions, organizations, community and public & private stakeholders. The duration of the mission program may be 10 days in post monsoon preferably starting in last week of September or in October 2017.

There is a need for concentration as well as a desire to incorporate some exemplary ‘hot spots’ for learning approach. Myanmar Delegation has selected 2 ‘hot spots’ areas for focusing with extra emphasis. The probable 2 ‘hot spots’ areas area:

1. Coastal area
2. Barind Project Area

Especial emphasis would be given in learning directly from the public and private stakeholders from their experiences, in particular to understand the challenges, good practices and lessons learned throughout the inception/conception, design, implementation and M&E of the Intervention/Program.

4.1 Coastal Hot Spot area

Out of 64 districts, 19 districts in the south-west to south-east and eastern-hill zone of Bangladesh is defined as coastal area which are mainly influenced by two natural phenomena: tidal influence and salinity intrusion. Cyclones and storm surges are very common natural calamities for coastal area. The coastal land area covers over 32% of the country and about 26% population of the country live there (Figure 1). It covers an area of 47,150 km^2 with a population of 38.5 million (BBS 2011) resulting in an average population density of 817 persons per km^2.

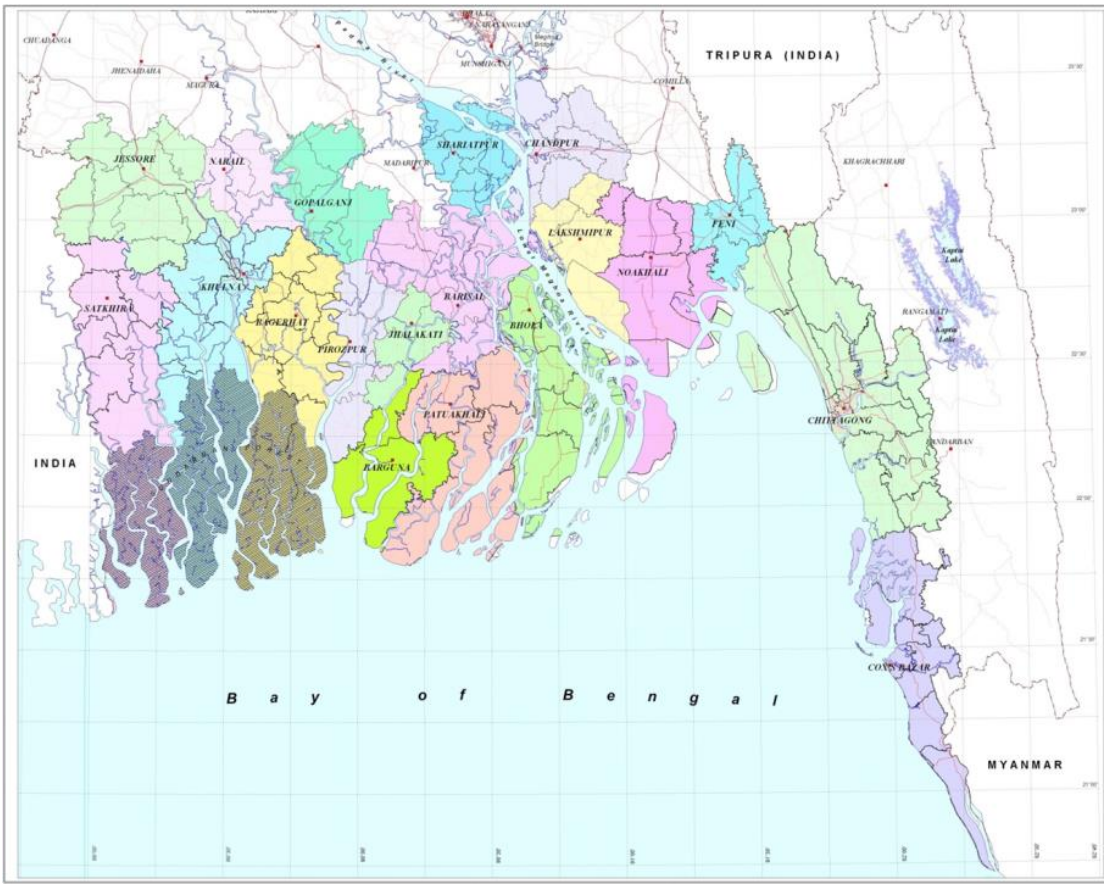


Figure 1: Coastal area of Bangladesh (Source: ICZMP, WARPO 2005)

Polder management and tidal river management is best practices in coastal areas to overcome the problems & challenges in Coastal area. The major problems in Coastal area are:

1. Due to siltation in the tidal rivers water logging and drainage problem is very serious in the southwest (Satkhira, Jessore, Khulna and Bagerhat) and south east (Noakhali, Feni) coastal zones.
2. Cyclones hit almost every year in the coastal area mainly in the early summer (April–May) or late rainy season (October–November). During the period 1960-2009, 19 severe cyclones have hit the coast of Bangladesh, the most recent one and most devastating is the Cyclone Aila in 2009 (Source: BMD website).
3. Salinity intrusion in the river system depends on the volume of freshwater flow from the upstream, the salinity level of the Bay of Bengal near the coast and the coastal currents. The salinity in the river system is high is dry season and severe in

the south-west and eastern-hilly coastal zone. In the south east and south central zone the salinity problem is low.

4. About 0.1 Million ha area in 2009 in the coastal zone is effected by soil salinity (Source: SRDI, 2014).
5. In the coastal area, the shallow (from 50 to 100m from ground) and the main (250-350m from ground) aquifer to be used for domestic or irrigation purpose. The knowledge and data on the deeper aquifer is very limited.
6. Due to over exploitation, the groundwater quality is often affected by arsenic, iron and/or manganese, which make the water unsafe or unsuitable for domestic uses. Arsenic contamination is detected up to 150m depth aquifer (SDP, 2011).
7. The huge amount of sediment load with water flow are responsible for coastal bank erosion in some islands (Sandwip, Hatia, Bhola and Ramgati island) as well as formation of new lands.
8. Mangrove forest, estuary and marine diversified ecosystem are in threat due to some human activities and salinity.

The main challenges to overcome the difficulties in Coastal area are:

1. Coastal area of Bangladesh is under threat of climate change and sea level rise. According to IPCC (IPCC, AR5 2014) the mean sea level rise may be 0.3m in 2050 and 0.63 in 2100 (in RCP 8.5 scenario).
2. In the coastal zone the land subsidence rate vary from 2 mm/year to 6 mm/year (Brammer, 2013).
3. Water diversion through Farrakka barrage and upstream dams in Ganges and Brahmaputra river basin lead to changes the freshwater flow pattern in the coastal rivers which will aggravate the water resources, agriculture and domestic water supply, fisheries, forestry, navigation, industry, biodiversity, and socio-economy development in the coastal regions.
4. Increasing over population and unplanned urbanization put pressure on land and water resources.
5. Cooperation among the agencies is a big challenge for integrated water resource management (IWRM) in coastal area.

4.1.1 Tidal river management

Tidal River Management (TRM) is a very effective measure to improve the drainage capacity of the tidal rivers by natural dredging the river at downstream of the basin. It allows the sediment to deposit inside the TRM basin. TRM allows natural movement of tidal flows from the river to an embanked low lying area (beel) through a link channel. During flood tide, water with huge sediment load enters to the low-lying area where the sediments are deposited due to reduction of flow velocity and storage for long duration. During ebb tide water from the low-lying basin flows out with reduced sediment load which erodes the river bank and bed at the downstream. Thus, drainage capacity/conveyance of the river increases which also maintains the river navigability. Over time the low-lying area is raised considerably due to deposition of silt. The average life of TRM basin is 5-6 years. The TRM process is a good example to mitigate water logging, river sedimentation and subsidence using natural water hydraulic.

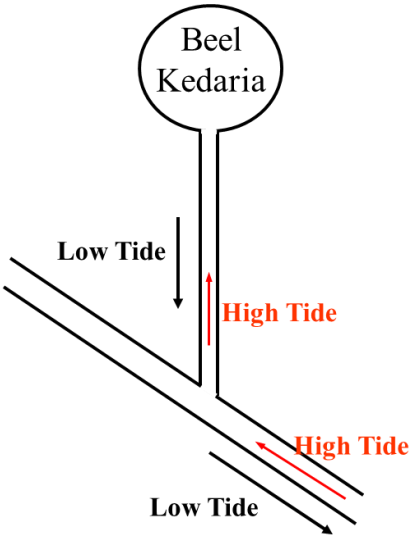


Figure 2: Conceptual Flow Diagram of TRM (Source: IWM)

Tidal River Management (TRM) in Khulna-Jessore Drainage Rehabilitation Project (KJDRP)

The Khulna-Jessore Drainage Rehabilitation Project (KJDRP) of BWDB was initiated in the year 1994 by the Government of Bangladesh to reduce the water logging problem inside the two polders under Jessore and Khulna districts. In the early 90s agricultural land in these area remained submerged for a long period in wet season which caused sufferings of the people and economic loss of the communities due to siltation of the rivers. In the post monsoon huge sediment is brought into the river system naturally by tidal pumping and deposits at the dead end of the river but ebb tide can't erode this deposited sediment. This process results river siltation.

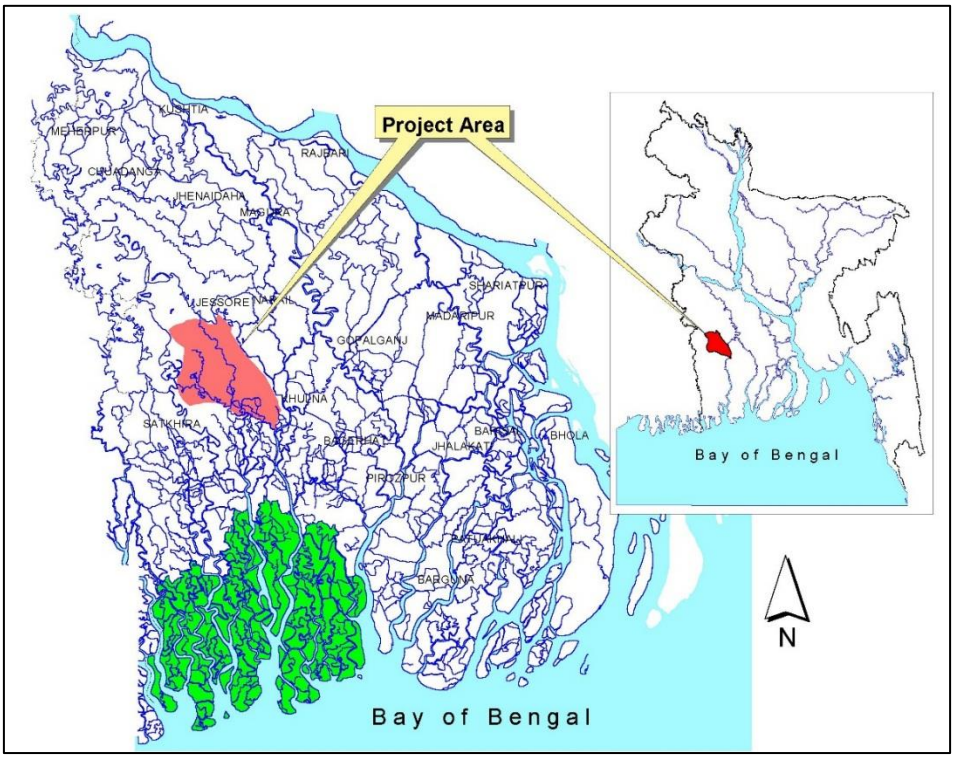


Figure 3: KJDRP Project area (Source: IWM)

Engineering solution with re-orientation and re-excavation of the drainage network and constructing additional sluices where necessary was given initially. The solution worked well to remove the water-logging from beel Dakatia of polder 25. But this structural solution could not be implemented in polder-24 of Jessore area due to strong opposition from local communities, LGI and NGOs as they thought construction of Bhabadaha sluice across the Hari River was the main cause of water-logging in that area.

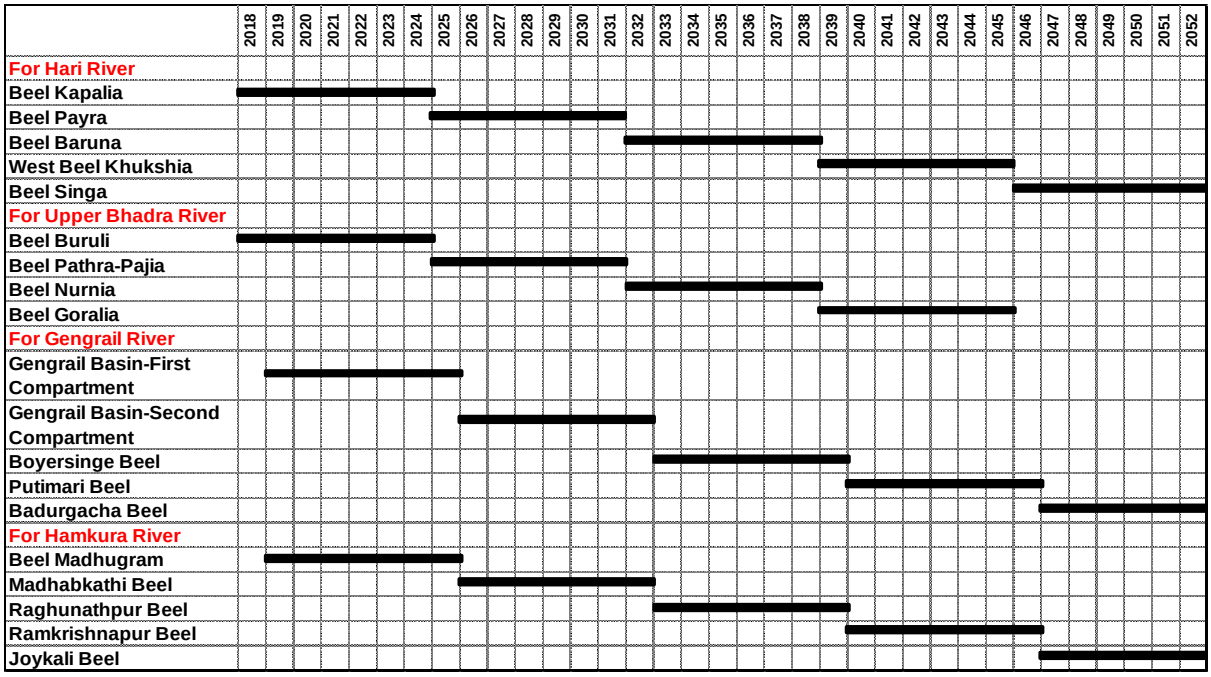
After the devastating flood in 1997 and in 1998 flood (monsoon) season the local people, LGI and local NGO's drew attention of the donor agency to apply Tidal River Management in all the beels adjacent to Hari River sequentially as a tool to remove water-logging from the inundated beels. BWDB adopted the technique of TRM for increasing tidal prism and raising low-lying beels.

Initially the people of beel Kedaria were very much in favour of operation of TRM and there was no water logging in the area during 2002 to 2004. But the land owners lost their interest to operate TRM by submerging their own land without getting any yield at least for three years. This created a negative impact on TRM and ultimately BWDB could not find any new beel to operate TRM in the year 2005. As a result the Hari River again became silted-up in the dry season and water-logging take place in the area during the monsoon of 2005.

TRM in East Beel Khuksia: The challenges of TRM operation are mainly social and institutional. Though people realized that TRM is the best solution for reducing submergence problem, People are unwilling to provide their land for TRM operation since they cannot cultivate the land during TRM operation. To overcome this challenge a compensation mechanism for crop and fisheries has been established. However, the process of providing compensation is very complex and needs further improvement. Having no other alternate solution, TRM in beel Khuksia was started in November 2006. About 2.5 meter depth of water was removed from 18100 hector of land of 193 villages, 21 unions and 2 municipalities. The area was brought under Boro cultivation at the end of year 2008. The Hari River was restored and the land of the beel also was raised about 2 to 4 feet.

Road Map for Long Term Solution by TRM: According to the long term planning prepared by IWM, the next beel for TRM is Beel Kapalia which would started in 2018 with consultation with land owners for obtaining land on compensation basis.

Table 1: Possible sequence of the Tidal Basins or the TRM in Bhabodah area



TRM in Kobadak River Basin (Source: IWM 2017)

The drainage congestion and sedimentation suddenly aggravated after the year 2000 in the Kobadak River basin. In order to relieve local people from this suffering, the Kobadak river was re-excavation from 2003-05. But river was silted up again after 2008 dry period due to lack of maintenance dredging and due to non- implementation of Tidal River Management (TRM), which had been recommended as follow up activities of capital dredging. For improving the situation BWDB started TRM operation at Pakhimara Beel from July 2015 and monitoring activities is going on. For sustainable drainage and flood management of Kobadak River Basin TRM is one of the most important tools. There are 5 (five) potential beels identified near Kobadak River for TRM basin.

Table 2: Sequence of Beels for TRM in Kobadak river basin in present & future

Beels	Gross Area (ha)	Year				
		2015-2021	2022-2028	2029-2035	2036-2042	2043-2049
Pakhimara	1273					
Hariharnagar & Raruli	1758					
Rajapur Harinkhola	1320					
Delua	1020					
Jalalpur	1126					

4.1.2 Polder management

Bangladesh Water Development Board completed 139 polders for intensification of agriculture by protecting the land from saline water intrusion and flood protection. By polderization about 1.2 million hectares of land is under permanent agriculture. Recent devastating cyclones damaged the embankments which causes intrusion of saline water

inside the polder and threatened the functionality of the polders. Siltation of peripheral rivers surrounding the embankments, poor maintenance and inadequate management of the polders caused the inside polder areas suffering from water logging, which lead to environmental, social and economic degradation. The water logging and salinity intrusion decline the soil fertility and good agriculture production in some polder areas.

Coastal Embankment Improvement Project (CEIP)

Cyclones SIDR (in 2007) and AILA (in 2009) hit the coastal zone causing severe damage to the infrastructure, life and property which have led the Government to re-thinking its strategy that the polder should protect the land from regular high tide as well as from frequent storm surges. In 2007, the Government of Bangladesh (GOB) obtained an IDA/credit for Emergency Cyclone Recovery and Restoration Project (ECRRP) and carry out the Feasibility Study to support Bangladesh Water Development Board (BWDB) in preparation of The Coastal Embankment Improvement programme (CEIP) and implementation of first phase project CEIP-1. Under the first phase, 17 coastal polders in 6 districts has been selected to upgrade and rehabilitate with the financial support from the World Bank (USD 400 millions).

Main objectives of the CEIP project are as follows:

- Increase the coverage of protection area from tidal flooding and frequent storm surges, which are expected to worsen due to climate change
- Improve agricultural production by reducing saline water intrusion inside the polders
- Improve the capacity of GoB to respond sharply and effectively during any disaster or emergency.

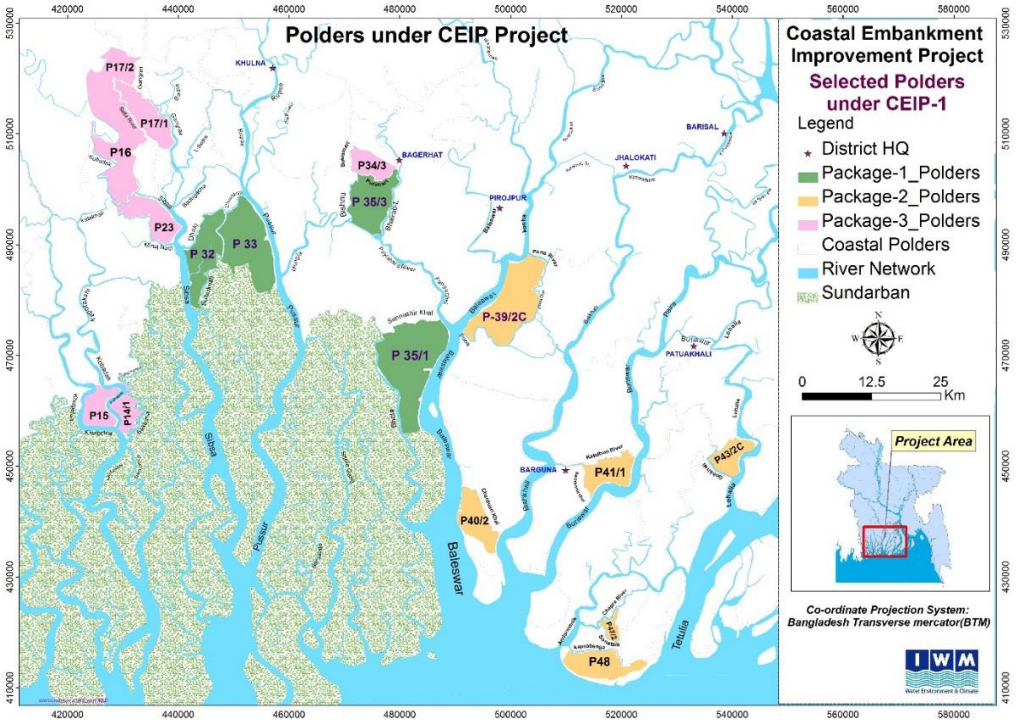


Figure 4: Selected polders under CEIP-1 project

Blue Gold Project

For integrated and sustainable management of water resources in the coastal zone with empowering community organization, the Blue Gold Program has been built which cover 25 polders with a combined area of 160,000 ha and 150,000 household. It is a collaboration project between the Government of Bangladesh and the Government of the Netherlands. The objective of Blue Gold Program is to manage the water resources and drainage and irrigation infrastructures through establishment and empowerment community organizations based on the priorities in the area of agriculture, livestock and fisheries development. The Program aims to create strong cooperation between the public and private organizations that play a important role in the development of the area. Figure 5 shows the project areas under Blue Gold Program. The main challenges identified for the development of this area under this program are: the hydrological dynamics which is influenced by climate change, the production systems (mainly based on paddy cultivation) and an inadequate institutional capacity for provide services to the community.

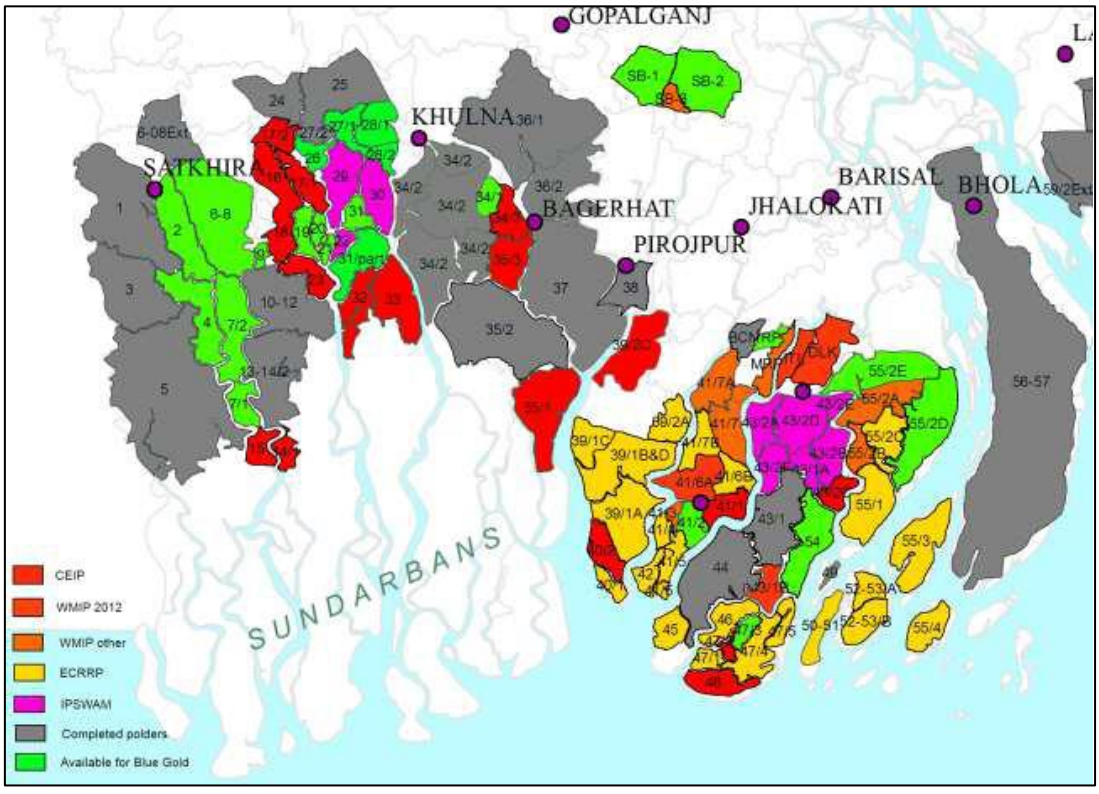


Figure 5: Polders under Blue Gold and other projects (Source: Blue Gold 2012)

The programme consists of 5 components:

- Component 1 - Community Mobilization and Institutional Development.
- Component 2 – Integrated water resources management (six-step approach to participatory water resource management)
- Component 3 - Food Security and Agricultural Development (support to WMGs in responding to existing or potential market demands for the end goal of generating additional income for rural households).

- Component 4 - Business Development and Private Sector Involvement (market development for the farmers in the polders)
- Component 5 – Livelihood Improvement and Cross Cutting Issues

The plan is to create 600 new co-operatives – to work alongside the 250 that have already been formed – and equipping them with technical, advocacy, communication and project management skills to strengthen water management assets. Furthermore, advice will be given on irrigation, drainage, land and fisheries management techniques to improve agricultural and aquacultural productivity to create more income.

4.2 Barind Hotspot area:

The Barind Tract region is located in the North-West Hydrological Region in Bangladesh and covers most of Dinajpur, Rangpur, Pabna, Rajshahi, Chapai Nawanganj, Bogra, and Naogaon districts of Rajshahi Division and Rangpur Division. It consists of three physiographic sub-divisions: i) the Level Barind Tract, occupying 5,048 km2 or 65% of the whole unit; ii) the High Barind Tract, in the west, covering 1,600 km2 or 21%; and iii) the North-Eastern Barind Tract, covering 1,079 km2 or 14% of the whole unit (Brammer, 1997). The weather of this area is very dry and lesser rainfall occur compare to other parts of the country. . It covers roughly an area of about 7,770 sq km. It has long been recognized as a unit of old alluvium, which differs from the surrounding floodplains. This physiographic unit is bounded by the Karatoya to the east, the Mahanada to the west, and the northern bank of the Ganges to the South. A lower fault scarp marks the eastern edge of the Barind Tract, and the little Jamuna, Atrai and Lower Punarbhaba Rivers occupy fault troughs. The western part of this unit has been tilted up; parts of the western edge are more than 15m higher than the rest of the tract and the adjoining Mahananda floodplain. The southern part of the main eastern block of the Barind Tract is tilted down towards the southwest and passes under lower Atrai basin sediments in the south.

The Barind area is a severely drought prone area. Drought is especially severe in the High Barind (Natore, Bogra, Thakurgoan Districts). Perennial river flows are present in the major regional river systems, but many of the minor rivers lack sufficient environmental flows in the dry period. Since the main source for water use is groundwater, lowering of groundwater levels in aquifers due to rainfall deficit leads to water scarcity for households, industry and agriculture. Due to intensive groundwater use and development of (boro rice) irrigation systems, the groundwater table has gradually declined, particularly in the high Barind tract.

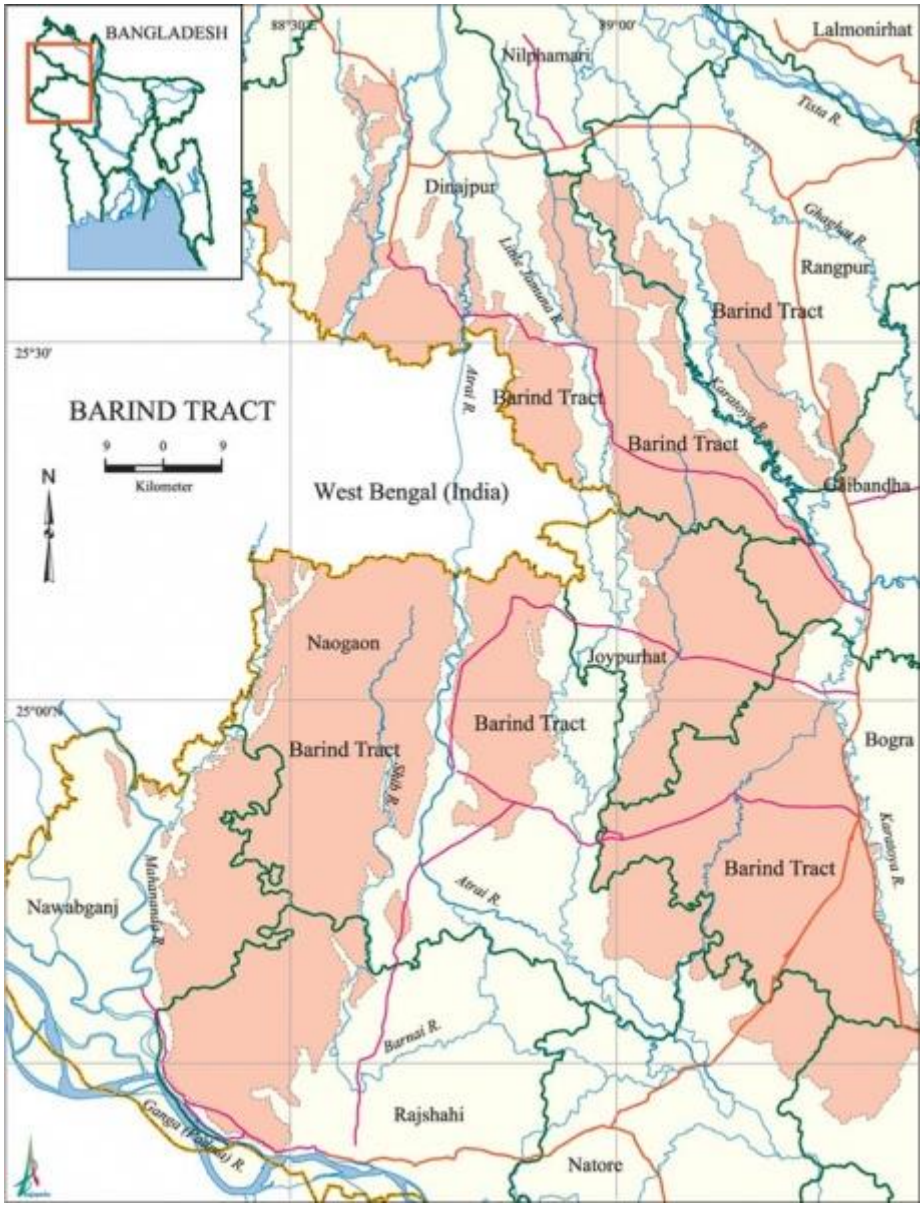


Figure 6: Locations of Barind area (IWM 2006)

Depending on the availability of water, prospective agricultural development and constraints the Barind area can be divided into 3 irrigation zone: Surface water, Mixed Mode (DTW & STW) and purely DTW zone. The ground water quality is suitable for both domestic and agricultural uses. The main issues and challenges in water management are:

- Shortage of water - even during rainy season, sometimes irrigation required
- Shortage of drinking water (December-January and March-May)
- High presence of Iron in some area.
- Due to cold storage problem farmers are unwilling to diversify crop cultivation.
- Lower profit in vegetable cultivation.
- Drinking water layer is low.
- Set up of shallow machine at low ground for water extraction.
- There is no alternative cultivation in “Boro” season because cost of other cultivation is high.

- Lack of knowledge of efficient water irrigation among farmers.
- Irregularities in agricultural inputs.
- River sedimentation
- Sand layer in crop field
- Illegal possession of water bodies hampering fish farmers
- Internal channels disconnected from river
- Low quality of seed
- Insufficient Credit facility
- Marketing system needs to improve
- Storage system needs to improve

To overcome the challenges some strategy can be taken such as:

- Sprinkler irrigation method can be used in crop fields
- Use of Water hyacinth in pond fish farming.
- 'Mulching' method for fruit farming
- Usage of pipe (drip irrigation) in crop fields
- Canal water storage after monsoon season.
- High yield seeds and low water consuming crops for cultivation.
- During monsoon season use roof top water to restore the underground water.

The probable solution given by the community and stakeholders area:

- River and canal (khal) re-excavation and freed from illegal possession
- Water storing during monsoon using "Sluice gate"
- Suitable market price for alternative crops
- Good quality of seed should be supplied
- Farmers training/school
- Diversify crop cultivation (mango, banana, potato, mustard)
- Provide government subsidy
- Alternate Wet and Dry (AWD) irrigation method can be used to save water

5 Concluding Remarks

The problems & challenges in Coastal & Barind area in Bangladesh are different as they are situated in different hydrological regions. Both the areas are very vital for crop production and ensure food security for Bangladesh. Many projects have been taken by the Government of Bangladesh for sustainable and integrated management of water, land and food. Learning from these two diversified regions would be valuable for other Delta countries of the region

6 References

Bangladesh Meteorological Department, www.bmd.gov.bd

BBS (2011). Census of agriculture 2008.Bangladesh Bureau of Statistics.

Blue Gold (2012), Program for Integrated Sustainable Economic Development by improving the Water and Productive Sectors in selected Polders, Program Document, Government of Bangladesh & Government of the Netherlands.

CEIP-1 (2013), Consultancy Services for "Technical Feasibility Studies and Detailed Design for Coastal Embankment Improvement Programme, Final Report, Bangladesh Water Development Board.

Government of Bangladesh, www.warpo.org

ICZMP 2005, Integrated Coastal Zone Management Plan, WARPO.

IWM (2017), Feasibility study & detail Engineering design for long term solution of drainage problem in Bhabodah area (2nd phase), Final report, BWDB.

IWM (2017), Monitoring of sedimentation, salinity, tide and flood in Kobadak system and TRM basin, Final report, BWDB.

IWM (2014), Coastal Embankment Improvement Project (CEIP-1), Technical Report.

IWM (2006), Groundwater Model Study for Deep Tube Well Installation Project in Barind Area, Barind Multipurpose Development Authority, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

NWMP (2001). National Water Management Plan, Annexes, Ministry of Water Resources, Government of the People's Republic of Bangladesh.

SDP (2011), Sector Development Plan (FY 2011-25), Water Supply and Sanitation Sector in Bangladesh, Local Government Division, Ministry of Local Government, Rural Development and Cooperatives, Government of the People's Republic of Bangladesh.

SRDI (2014), Resource Profiles, Extrapolation, Domain and Land Use Pattern, Project Closure Report.