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Flood Plan Coordination Organisation,
Ministry of Irrigation, Water Development and Flood Control

BANGLADESH FLOOD ACTION PLAN

FAP 12
FCD/I AGRICULTURAL STUDY

RAPID RURAL APPRAISAL OF KONAPARA EMBANKMENT PROJECT

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Hunting Technical Services Limited

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The present report is one of a series being produced by Flood Action Plan components 12, the FCD/I Agricultural Study and 13, the Operation and Maintenance Study.

The full series is expected to comprise the following reports:

FAP 12

Inception Report (joint with FAP 13)
Methodology Report (2 Volumes)
Rapid Rural Appraisals Overview (2 Volumes)

Project Impact Evaluation studies of:

* Chalan Beel Polder D
* Kurigram South
* Meghna Dhonagoda Irrigation Project
* Zilkar Haor
* Kolabashukhali Project

Rapid Rural Appraisal Studies of:

Protappur Irrigation Project
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Improvement of Sakunia Beel
Silimpur-Karatia Bridge cum Regulators
Khatakhali Khal
Halir Haor
Kahua Muhuri Embankment
Konapara Embankment [1]
Polder 17/2
BRE Kamarjani Reach [1]
BRE Kazipur Reach [1]

Draft Final Report (3 Volumes)
* Final Report (3 Volumes)

FAP 13

Methodology Report
Appraisal of Operation and Maintenance in FCD/I Projects (2 volumes)
Draft Final Report (2 Volumes)
* Final Report

Note: * Report not yet available

[1] Revised versions of these reports were issued in December 1991.

KONAPARA EMBANKMENT PROJECT

Project Summary Sheet

Project Name	: Konapara Embankment Project
Project Type	: Flood Control and Drainage
Location	
FAP Region	: North-East
District	: Mymensingh
Area (ha.)	: uncertain, several different estimates made: 13.4 sq miles or 3,480 ha (gross), 4251 ha or 3,116 ha (net)
Funding Agency	: Netherlands (EIP)
Implementing Agency	: BWDB
Construction started	: 1980/81
Scheduled Completion	: ?
Actual Completion	: 1983/84
Original Cost Estimate	: ? million
Final Cost Estimate	: ? million
Major Flood Damage:	: 1988
Repair/rehabilitation in	: 1989

Major works still required for completion/rehabilitation:

Despite complete resectioning in 1989 much of the embankment is in poor shape and still requires extensive work.

SUMMARY

The Konapara Embankment Project lies along the left bank of the Kangsa River under Haluaghat Upazila in the district of Mymensingh. This is an `early implementation project' (EIP) of the BWDB, financed by the Netherlands Technical Assistance Program. Its objective was to protect standing crops like Aus and jute from early flooding, and T.Aman from monsoon floods. Although the overall economic impact of the project has been positive, mainly through greater protection afforded to T.Aman, it suffers from poor project design and resulting social problems.

Project Area

The project area consists of four unions, namely Amtail, Swadweshi, Bildora, and Sakuai. According to project documents, the gross benefitted area is 8,600 acres and the net area is 7,700 acres. The project essentially consists of an embankment of 21.54 km in length along the Kangsa River, stretching from Bahirshimul in the west to Phutkai in the east. In other words, it is open on three sides, making it difficult to delineate the boundaries of the project area. It is however the view of the RRA team that the benefitted area is actually much more than suggested by the project documents.

Structures

According to the Project Completion Report, there are supposed to be 11 drainage inlets or irrigation outlets built into the embankment. The XEN reported a much higher figure, with 21 drainage outlets and 5 irrigation inlets. The entire length of the embankment was resectioned in 1989, following the 1988 floods.

Pre-Project Agriculture

Three crops were grown: Aus, jute and T.Aman. About 26 percent of the area was devoted to Aus and 10 percent to jute. In the Aman season, the entire project area was used for T.Aman. Yields were very poor, ranging from 10-15 mds per acre for paddy and 15 mds per acre for jute, and the cropping intensity was 135.7 percent (see Project Report). Our field interviews however suggest much higher yields: 20-25 mds per acre for paddy (local) and 30 mds for HYV.

Post-Project Agriculture

The current cropping practice has evolved in response to a number of changes in the crop environment, not all of which are project related. The hydrological regime has altered, making it safe for Aus, jute and Aman cultivation. At the same time, and quite independently, irrigation has expanded rapidly, leading to a rapid expansion in the area under HYV Boro. Thus despite greater protection afforded to Aus, its acreage has declined as Boro cultivation expanded under irrigation. This has reduced project impact, with the Aman crop gaining the most, mainly through a switch from local to HYV varieties. Current cropping intensity is around 200 percent. The increase in cropping intensity would appear to be largely related to acreage expansion in Boro, and cannot be attributed to the project.

Other Impacts

Apart from agriculture, the project has had significant (positive) impact on a number of other areas:

1. Communication has improved, facilitating haulage to markets and access to schools;

2. More local employment has been generated reducing out-migration;

3. Incomes and nutritional status have improved;

4. Protection from floods has led to more fruit trees in the area;

5. Small stock and poultry have increased;

6. Pond fish culture has increased significantly.

Negative impacts have also been recorded:

1. Capture fisheries have declined as migratory routes have been blocked;

2. Grazing land has decreased but fodder availability has increased with expanded Aman production. The former is probably due to more intensive cultivation under irrigation, and cannot therefore be attributed to the project. The latter is a project effect. The net effect has been a reduction in the livestock population.

3. Adjacent areas have been strongly disbenefitted, leading to acute social tensions.

4. There are areas of drainage congestion and sand deposition, causing environmental damage.

Economic Performance

The Project has been highly successful economically, with an EIRR of 37 per cent, NPV of Tk.43 million and BCR of 7.5. The success of the Project is attributable to its sound basic concept and simple and low-cost nature, coupled with the relatively short time taken for its construction. The economic performance takes account of substantial capture fishery losses, and of the probable need for major repairs/rehabilitation at intervals during the Project's remaining life.

Recommendations/Observations

1. The project is incomplete in design. This needs closer examination. At present it is just an embankment that does not seem to begin or end in any logical place.

2. The embankment is in very poor shape although completely resectioned in 1989. Complete lack of O&M is evident.

3. Inappropriate placing of drainage outlets has been reported. These need to be lowered to facilitate their function.

4. There is huge potential in the field of social forestry on the embankment, which has gone largely unnoticed. Similarly, there is considerable scope for fish cultivation in flood-free water bodies, but this is constrained by legal tangles about ownership rights.

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ABBREVIATIONS AND LOCAL TERMINOLOGY

BBS	Bangladesh Bureau of Statistics
BRDB	Bangladesh Rural Development Board
CARE	Cooperatives for American Relief Everywhere
EIP	Early Implementation Project
FAP	Flood Action Plan
FCD	Flood Control and Drainage
FCD/I	Flood Control, Drainage and/or Irrigation
FPCO	Flood Plan Coordination Office
HYV	High Yielding Varieties
LV	Local Varieties
NGO	Non-Government Organisation
NTAP	Netherlands Technical Assistance Programme
O&M	Operation and Maintenance
RCS	
RRA	Rapid Rural Appraisal
UCCA	Upazila Central Cooperative Association

Aman	The major paddy crop harvested in November-December.
Aus	Paddy crop harvested inJuly-August.
Boro	Winter paddy crop grown under irrigation.
Maund (md)	Local unit of weight (1 md= 37.27 kg)
Samity	Society
Taka (Tk.)	Local currency (US $1= Tk. 35)

1 INTRODUCTION

1.1 THE FAP 12 STUDY

The FAP 12 Study is one of the 26 numbered component studies of the Bangladesh National Flood Action Plan, and is jointly supported by the United Kingdom Overseas Development Administration (ODA) and the Japan International Cooperation Agency (JICA). It is led by a group of Bangladeshi and international consulting organisations, involving Hunting Technical Services Limited of the United Kingdom, Sanyu Consultants Inc. of Japan, the Bangladesh Institute of Development Studies (BIDS), the Flood Hazard Research Centre of Middlesex Polytechnic, UK, Hunting Fishtech of UK, and Technoconsult International Limited of Bangladesh.

The objective of FAP 12 is to conduct post-evaluations of a total of 17 projects, representative in type and location, of the FCDI projects so far executed in Bangladesh (see figure 1.1). The results of these evaluations will be passed to other FAP components for guidance in developing strategies for improved flood control and management for the future.

Of the 17 projects for study, 5 will be assessed mainly by Project Impact Evaluation (PIE) methods, using a formal questionnaire approach and probability sampling. The remainder will be assessed by Rapid Rural Appraisal (RRA) methods, and RRA has also been used for preliminary reconnaissance of the 5 PIE projects. The present report describes the findings of the RRA of the Konapara Embankment Project.

1.2 RAPID RURAL APPRAISAL

RRA is a technique of project assessment intended to produce results more quickly than formal interview surveys, while avoiding biases in the data collected. RRA consists of selective direct observation and interviews of informed respondents from representative areas of the project by a small team of well -qualified and experienced specialists who can reach informed judgements quickly in the field. Maximum use is made of documentary sources to minimise the amount of data which have to be collected by interview and to obtain guidance on the location and content of interviews.

In well-conducted RRAs great care is taken to avoid both locational biases (for example observing and interviewing only in easily accessible areas) and socio-economic biases (for example, omitting coverage of women, landless people, and other groups which are difficult to identify, locate or obtain access to).

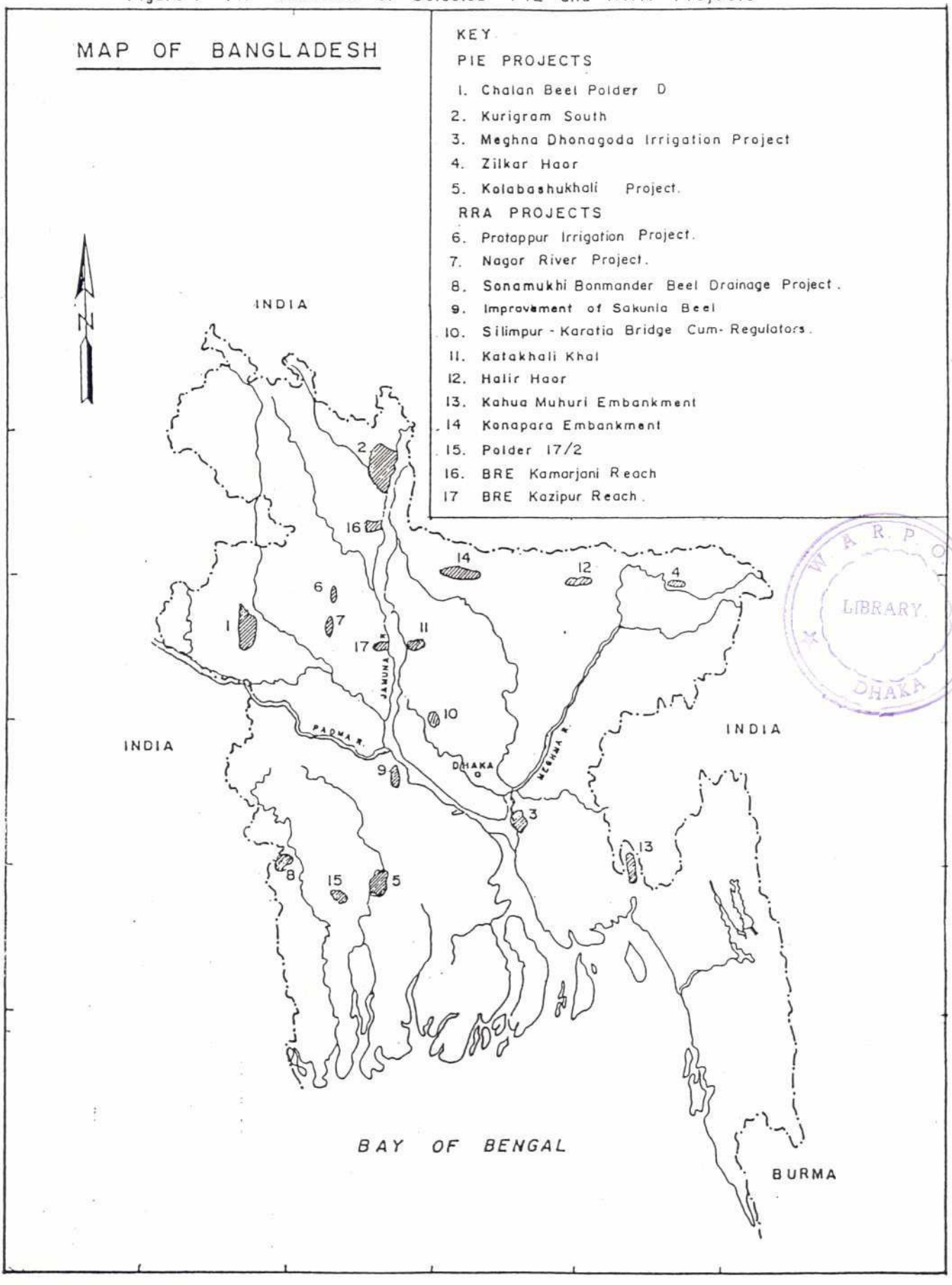
By its nature RRA is better at obtaining quaitative data rather than quantitative data, though it is generally possible to obtain fairly good quantitative data on key agricultural parameters for the selected locations. What RRA cannot do (in contrast to PIE methods using probality sampling) is provide statistical validation of how far observations can be generalised over the project area, or of differences between areas and time-periods. Its findings must therefore always be interpreted as informed judgements, not as precise statements with known margins of error. Further background to RRA will be found in the FAP 12 Methodology Report.

1.3 GENERAL LOCATION

The project area lies along the left bank of the Kangsa River for a length of about 21.6 km, from Bahirshimul to Phutkai ferry ghat, in Haluaghat Upazila, Mymensingh district. The area is situated 40.2 km north of Mymensingh town and 16.1 km south of Haluaghat upazila headquarters. The area is accessible by road.

There are two rivers, namely the Kangsa and the Darsa in the area. The Kangsa flows parallel to the project area. It originates in the Garo Hills in India and drains into the Dhanu River. The river almost dries up in the winter. The Darsa also originates in the Garo Hills and drains into the Kangsa, after passing through the haors. This river also virtually dries up in winter and appears to be in need of excavation.

Figure : 1.1 Location of Selected PIE and RRA Projects



Source: Consultants

2 DESCRIPTION OF THE PROJECT AREA

2.1 LOCATION

The project area lies along the left bank of the Kangsa River for a length of about 13.4 miles, from Bahirshimul to Phutkai ferry ghat, in Haluaghat Upazila, Mymensingh district. The area is situated 25 miles north of Mymensingh town and 10 miles south of Haluaghat upazila headquarters. The area is accessible by road.

2.2 RELIEF AND DRAINAGE

The ground elevation of the project area is quite flat, with homesteads and roads being situated on relatively higher ground. Almost the entire project area used to be submerged by flood water, to a depth of 1-5 feet, during the monsoon.

There are two rivers, namely the Kangsa and the Darsa in the area. The Kangsa flows parallel to the project area. It originates in the Garo Hills in India and drains into the Dhanu River. The river almost dries up in the winter. The Darsa also originates in the Garo Hills and drains into the Kangsa, after passing through the haors. This river also virtually dries up in winter and appears to be in need of excavation.

2.3 ECOLOGY, SOILS AND CLIMATE

The soil type is generally non-calcarious, and reddish in colour. Fertility is good. Average summer temperatures range from 81.0°f to 85.0°f while winter temperatures range from 66°f to 72.0°f. The mean annual rainfall is 2630.42 mm.

2.4 TYPE OF FLOODING

The pre-project flooding situation was characterised by flash floods in July - August and gradual monsoon floods later on in September - October.

2.5 1987/88 FLOODS

The embankment was badly damaged at several points, and a number of public cuts were made. The most important of these is the public cut at Kodalia, near Bahirshimul, made by the people in the adjacent area. This has been a festering issue, leading to sporadic violence and even murder. People outside the project area complain bitterly about the increased water level and consequent flooding of homesteads during the flood season.

2.6 LOCAL AGRICULTURE (PRE-PROJECT)

Three crops were grown: Aus, T.Aman and jute. About 26 percent of the area was devoted to Aus and ten percent to jute. During the Aman season, the entire cultivable area was put under T.Aman. Yields were very poor, ranging from 10-15 mds per acre for paddy and 15 mds per acre for jute. The cropping intensity was 135.7 percent (Project report,

undated). According to Naqi (1980), however, the pre-project cropping intensity in the project area was 188.34 percent.

The field interviews however, point to somewhat higher yields. Pre-project paddy yields for Aus and local Aman are reported to have been around 20-25 mds per acre and for HYV Aman, 30 mds per acre.

2.7 SOCIO-ECONOMIC CONDITION

Around 55 percent of households were reported to be owner farmers, 12 percent were owner cum sharecroppers and 27 percent were labour households. The remainder were engaged in `business' or `service'. 73 percent of households had no secondary occupation. Land ownership appears to be skewed (in comparison with eg. the national average), with 61 percent of households owning only 14 percent of the land, while 15 percent owned 61 percent of the land.

3 ENGINEERING

3.1 PRE-PROJECT SITUATION

3.1.1 Location

The Konapara Embankment project area is situated along the left bank of the Kangsa river in the upazila Haluaghat of Mymensingh covering a fictitious gross and net area of 3,480 ha (8,600 acres) and 3,116 ha (7,700 acres) respectively. This area was assumed to be a strip of 1.609 km (1 mile) from the embankment as was reported in the project related documents. It was ascertained by the RRA team and through the interviews from the local people that the benefitted area is not limited within the marked boundary on the project map. The length of the embankment from Bahirshimul to Phutkai is 21.56 km and is located at about 40.23 km north of Mymensingh town and about 16.09 km south of Haluaghat upazila headquarters. The project area is approachable by road.

3.1.2 Drainage and Flood Control

The general topography of the project area is moderately gentle with slope of 1:6000 from West to East. Homesteads and roads are situated at higher elevations. During the pre-project period almost the entire project area was submerged in flood to a depth varying from 30 cm to 150 cm during the monsoon. The project area in the pre-project period remained subject to pre-monsoon flooding due to heavy rain water coming from the Garo Hills through the Bhugai Kangsa. The Kangsa and Darsa rivers originating from the Garo Hills in Indian territory were the main drainage channels during the pre-project period to drain out water accumulated from the beels and other low lying areas.

3.1.3 Irrigation

Irrigation in the Konapara embankment project area during the pre-project period was not significant, and was limited mostly to surface irrigation. A significant number of both Deep Tube Wells and Shallow Tube Wells are currently in operation in addition to Low Lift Pumps, providing irrigation facility extensively in this area.

3.2 PROJECT OBJECTIVES

The Konapara embankment was constructed to provide protection to the standing crops from early ingress of flood water from the Kangsa river by overtopping the banks. The long term goals of the project was to increase agricultural production, create employment opportunities and improve living conditions of the farmers.

3.3. PLANNED SOLUTION

To solve the problem a 22.33 km long embankment was constructed/resectioned by the Bangladesh Water Development Board from Bahirsimul to Phutkai Ferryghat with a crest level of .91 metres (3 ft) above the high flood level. The crest width was 4.3 metres (14 ft), slope 1:2 and freeboard was .91 metres (3 ft). Based on erosion a set back distance of 100-150 feet was set according to the location.

The project has fulfilled its primary aim of contributing to a significant increase in crop production through greater flood damage control and dissemination of HYVs. There are nevertheless certain problems that have led to aggravated social tensions and large crop losses. First, the project cannot be treated as complete, because downstream, where the Godaria (Darsha) river meets with the Kangsa, the water level rises during high flood, causing inflow of water into the project area by overtopping the bank of the Godaria. This damages crops in the lower part of the project area every year. Secondly, the embankment ends at Bahirshimul, upstream without taking into consideration the fact that there are lots of villages in the area that would be adversely affected. There was a cross-dam at Kodallia which is outside the embankment. During the severe floods of 1988, the people outside the embankment cut the cross-dam hoping this would ameliorate their condition somewhat. This resulted in serious damage to crops in the project area. This led to social conflicts between the people of the project area and the people of Kodallia and the conflict came to an extreme form when two persons were killed. The public cut at Kodallia has now been open for the last three years, and remains a bone of contention in the area.

It would be ideal if the embankment could be extended from Bahirshimul to Dorail via Bishumpur, Amtail, and Kodallia (8 km). This could solve the problems of both parties.

3.4 SOURCES OF DATA

The following sources of data and information were consulted for this section:

- Draft Project Proforma (PP) of Konapara Embankment (June 1980, BWDB)
- Completion Report of Konapara Embankment (Construction & Reconstruction of Embankment from Bahirshimul to Phutkai Ferryghat) in PIB Form Number 04
- Recommendation for Projects of the 1980-1981 Programme (EIP - Cell, June 1980)
- Socio - Economic Study of Konapara Embankment Project

Interviews were conducted with Union Parishad Chairmen and Members, local farmers and leading members of the community.

3.5 PROJECT STRUCTURES

The Konapara embankment project comprises a small number of minor structures such as irrigation inlets, drainage outlets and massive earthen embankment. The structures along with their present conditions are described in this sub-section.

a) Embankment

The length of the embankment as per the original project proforma was 21.56 km and it was constructed fully up to 1982-83 in keeping with the design criteria set forth in the detailed design of the project.

i) Cuts and Breaches

In 1988, there was a catastrophic flood throughout the whole country and the Konapara embankment was submerged under flood water in that year. During this flood the river stage at the gauge stations Nalitabari, Sarchapur and Jariaghanjail in the river Kangsa exceeded the highest stage considered in 1:20 years flood levels where the observations were within the 95% confidence limits of the Gumbel-I distribution. It was reported to the RRA team by the local people and also by concerned BWDB staff that many natural breaches occurred along the entire embankment. The biggest breach (of about 91.44 meter or 300 ft) occurred at a weak section due to huge hydraulic pressure imposed against that portion of the embankment situated in between Gazipur and Nasullah.

ii) Condition of the Embankment

As the whole embankment was partly damaged during the flood of 1988, it was repaired and resectioned in the year 1988/89 under the EIP Flood Damage Restoration (FDR) programme at a cost of Tk. 33.86 lakh. Discussion with BWDB staff, interviews with local people and on site observations indicated that the entire embankment is still severely damaged at several points. The embankment at Bahirsimul, Gazipur and Nasullah needs urgent repair otherwise it will be badly damaged in the ensuing wet season, and is certain to cause damage to crops and other infrastructure. Moreover, the entire embankment (except 6km which has been reconstructed by LGEB for use as road cum embankment) needs resectioning for its stability as it was damaged by raincut only two years after rehabilitation in 1988/89. The present condition of the embankment is such that its ability to survive the next onslaught of rain and flood is questionable, if no preventive maintenance programme is undertaken immediately.

b) Irrigation Inlet/Drainage Outlet

Five irrigation inlets and twenty one (21) drainage outlets were constructed. These were presumably constructed to fulfill design requirements, although there was no way for the RRA team to verify this independently, as no as built drawings were made available. One irrigation inlet at Gazipur needs protective work on the river side as the supporting soil is eroded beneath and around it. Two drainage outlets at Gazipur and Nasullah respectively need to be provided with protective works on the river side as the supporting soil has eroded.

Irrigation in the pre-project period was based on surface water sources using indigenous technology (doon, sewty). During the post-project period, the system of irrigation technology is shown in table below.

It may be noted that the farmers also use treadle/rower pumps, the present coverages of which are 250 acres, 575 acres, 108 acres and 475 acres in Shakoi, Bildora, Swadeshi and Amtail unions respectively. The expansion in irrigation was largely an autonomous effect and had little relationship with the project being reviewed.

Table 3.1: Irrigation Equipment Installed by Union

Name of Unions	DTW	STW	LLP	Total
Shakoi	19	187	11	217
Bildora	16	19	12	47
Swadeshi	23	35	18	76
Amtail	23	131	21	175
Total:	81	372	62	515

Source: Upazila Agricultural Extension Office, Haluaghat

3.6 PROJECT SUCCESS IN ACHIEVING OBJECTIVES

Positive Aspects

- The flood embankment seems to be strong enough to withstand the normal yearly floods caused by the rivers Kangsa and Darsa;
- The design crest width of the embankment at 14 ft appears to be adequate for road traffic from Bahirshimul to Phutkai, increasing the transport facilities of the project area;
- The road traffic system over the embankment will facilitate continued compaction of the embankment;
- The design side slopes of 1:2 both in the R/S and C/S seem to be enough for the slope stability which provides better flood prevention, unless it is cut;
- The crest width of the embankment can be used for shelter by inundated people during flood periods;

Negative Aspects

- The embankment has been constructed without any compaction which makes it easier for natural breaches and cuts to occur;
- Local drainage congestion problems created by roads constructed under the FFW programme damage crops;
- At Phutkai, at the confluence of the Kangsa and Darsa rivers, crop damage occurs due to the back flow of water into the project area during the peak flow period;
- Due to improper placing of the drainage outlets (too high above ground level), the drainage problem is being aggravated.

3.7 CONCLUSIONS/OBSERVATIONS

- In a number of places, the embankment needs urgent repair and rehabilitation;
- The borrow pits at Bahirsimul, Gazipur and Nasullah have silted up. During the flood season, water flows through these borrow pits at high speed, causing the river side to erode;
- Effective functioning of a flood control project like Konapara embankment needs detailed operation and maintenance guidelines; the earthen structures and hydraulic structures by their nature demand regular maintenance works;
- Drainage control facilities need to be improved by re-excavating the existing drainage channels and other water bodies;
- Maintenance of the physical components is intimately connected with the achievement of project goals in terms of substantial increase in agricultural production.

3.8 RECOMMENDATIONS

The project has fulfilled its primary aim of contributing to a significant increase in crop production through greater flood damage control and dissemination of HYVs. There are nevertheless certain problems that have led to aggravated social tensions and large crop losses. First, the project cannot be treated as complete, because downstream, where the Godaria (Darsha) river meets with the Kangsa, the water level rises during high flood, causing inflow of water into the project area by overtopping the bank of the Godaria. This damages crops in the lower part of the project area every year. Secondly, the embankment ends at Bahirshimul, upstream without taking into consideration the fact that there are lots of villages in the area that would be adversely affected. There was a cross-dam at Kodallia which is outside the embankment. During the severe floods of 1988, the people outside the embankment cut the cross-dam hoping this would ameliorate their condition somewhat. This resulted in serious damage to crops in the project area. This led to social conflicts between the people of the project area and the people of Kodallia and the conflict came to an extreme form when two persons were killed. The public cut at Kodallia has now been open for the last three years, and remains a bone of contention in the area.

It would be ideal if the embankment could be extended from Bahirshimul to Dorail via Bishumpur, Amtail, and Kodallia (8 km). This could solve the problems of both parties.

The Phutkai area can be protected from back flow of the Darsa and Kangsa rivers by installing a regulator at the junction point of these rivers. However, a thorough investigation will need to be conducted to decide on the desirability of a regulator by constructing embankments on both sides of the Darsa river to confine the flow of water. Installation of such a regulator will help in draining out water during the peak flow period and will also serve to store water in the lean period for LLP irrigation. It can also serve as a bridge to facilitate local communication.

In addition the following suggestions may be made:

- Proper coordination and consultation with BWDB must be maintained by other agencies while constructing roads within project areas;

- Proper compaction must be applied to obtain the required durability for such massive earthen structures as embankments;

- The embankment must be realigned at some places to remove social conflict and unhappiness;

Project beneficiaries should be motivated to actively participate in operation and maintenance works.

Figure 3.1: Konapara Embankment Project showing locations visited and key features

LEGEND:—

- Embankment
- Project Boundary BWDB
- Remaining Project Boundary
- Brick Soiling Road
- River / Khal
- Beel
- Irrigation Inlet
- Drainage Outlet

0 1 2 3 Miles

0 1 2 3 4 5 Km.

KONAPARA EMBANKMENT
MYMENSINGH.

4 AGRICULTURE

4.1 PRE-PROJECT SITUATION

4.1.1 General Agricultural Conditions

The project area is situated on the left bank of Bhugai-Kangsa river. Both Kangsa and Bhugai originates in the Garo hills on the north. Kangsa is a seasonal river and receives water from the Darsa river which passes through several haors.[1] The northern side of Haluaghat Upazilla is higher in elevation and drains water from the hills towards the south through Darsanadi, Gumiranadi and Bhuraghatnadi. All these rivers pour into the Darsa, and from there flows into the Kangsa. The catchment area is very large. The left bank of the Kangsa river is somewhat elevated at Bahirsimul (Fig 3.1), so that overtopping of the banks only occurred during exceptional flood years, probably once in ten years. The right bank of the Kangsa river is very low. Severe flooding occurred every year on both the banks, downstream from Bahirsimul. As the left bank is higher, there is a localised tendency for water to drain northwards towards the haor area, and eventually drains back into the Kangsa via the Darsa (see Figure 3.1). The run off from the northern hills also accumulates in the haors (Baluaghata, Podo, Barbilla, Chilka and Kailati beels).

The ground elevation of the project area is fairly even. The entire project area used to be submerged in flood water to a depth varying from one feet to five feet during the monsoon. The soil is old Brahmaputra piedmont alluvial soil, somewhat silty to clayey in nature. The soil is fertile.

Agriculture was the mainstay of the economy of the project area. Most of the people of the project area were farmers and they mainly depended on farming for their livelihood. Almost fifty percent of the landless labourers were engaged in agriculture. The large farmers were few in number and had a maximum of 40 acres of land whereas 30 per cent of the farmers had up to 2 acres of land. Share cropping was on a 50:50 basis. Most of the people of the area were poor.

The net cultivable land was estimated to be 7700 acres, which was about 90 per cent of the gross project area. Broadcast Aus, Transplanted Aman and Jute were the three principal crops grown in the project area (Table 4.1). Boro (HYV & LV) and rabi crops were also cultivated.

The present land areas under each land level, the crops cultivated at different land levels, yields and productions in the pre-project situation (according to the farmers) are given in Tables 4.3, 4.5 and 4.6. Crop losses due to flood, drought and insect pests were high.

4.1.2. Problems in the Pre- Project Situation

During the early monsoon, heavy rainfall in the Garo hills caused a huge amount of water to drain into the Kangsa river. The inflow of water overtopped both banks of the river and damaged standing B. Aus and Jute crops cultivated in the higher reaches of the project area, almost every year. Damage restricted the acreage and reduced yields.

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1 The haors are saucer-shaped water bodies, which are elevated along the periphery and depressed in the center.

The embankment constructed by the Union Parishad was lower than the flood level. During monsoon (September - October) flood water overtopped the embankment and damaged the T. Aman seedlings, sometimes even resulting in complete crop failure.

Table 4.1: Pre-Project Cropping Patterns

Crops	Acreage	% area Covered	Period Broadcasted/Trans planted	Period Harvested	Yield md/acr	Cropping intensity
B.Aus	2000	25.97	March-April	June-July	10	135.71
Jute	750	3.25	March-April	July -August	15	
Aman	7700	100.00	September -Oct.	Dec -Jan	15	

Source: Project Proforma, BWDB 1980.

4.2. OBJECTIVES

The main objective of the project was to protect standing crops from early ingress of flood water which flows in from the Kangsa river after overtopping the embankment. It was implied that if the standing crops are protected, yield, production and employment would increase.

4.3. EXPECTED BENEFITS

- Reduction of flood damage to crops
- increase in tields and production
- risk reduction
- improved drainage
- increased irrigation

The expected acreages, yield and cropping intensity are given in Table 4.2 below for each crop:

Table 4.2: Planned Acreage, Yields and Cropping Intensity

Crops	Acreage (ac)	% area Covered	Yield (md/ac)	Cropping intensity
B.Aus	2500	32.47	15	145.45
Jute	1000	12.99	20	
T.Aman	7700	100.00	20	

Source: Project Proforma

4.4 PRESENT SITUATION

The RRA found the actual benefited area to be much more than the 7700 acres stated in the project report by BWDB. While the true extent of the benefited area is still unclear, it cannot be less than the 10,674 acres cropped in the Aman season in the surveyed villages. In calculating pre-project area and output, the data from BWDB (1980) have therefore been scaled up in line with a net cultivated area of 10,674 acres (Table 4.6).

The acreages under HYV Boro, B Aus, and HYV T Aman have increased substantially, which in turn has increased production (Table 4.6). The acreage and yield impacts have exceeded the expected figures. A large increase in irrigation facilities in the area has served to boost Boro HYV output, but it is doubtful whether this can be claimed as a Project impact.

Local T Aman acreage has been reduced as a result of the growth of HYV T Aman, but yields have increased due to reduced flood damage. The public cut at Kodalia and the backflow of water at the end point of the project downstream, however, still cause serious damage to T Aman. In addition, silting up of the river bed also aggravates early monsoon flooding in some years (Table 4.4).

Reduced flood risk has increased B. Aus acreage a little, but resulted in a major reduction in Jute acreage. Introduction of T. Aus and potato is also an indicator of the project success.

Cropping intensity (Table 4.6) has increased from an estimated 159 per cent pre-Project to 220 per cent post-project, but this includes the impact of increased Boro cultivation which is not a Project effect. Aman season intensity has not increased, since all available land was already cultivated pre-Project. There has been some increase in the Aus area, attributable to the greater security the Project provides from flood damage, but this has been at the expense of jute, and overall there has been a slight decrease in monsoon (Aus plus Aman) season intensity.

Table 4.3: Percent area under different land levels in different villages.

Villages	Percent area under different land levels		
	High	Medium	Low
Bahirsimul	80		20
Amtail	50		50
Konapara Jogania	20		80
Sarchapur	50		50
Nasullah	30		70
South Itakhola	25	25	50
Batta Nayapara	80		20
Sakuai	25	37.5	37.5
Kailati	20		80

Source : Farmers group interview

Table 4.4: Crop damage due to flood in 1989.

	Aus		Jute		T. Aman Seed bed		Crop	
	Area	%	Area	%	Area	%	Area	%
Total area under cultivation (ac)	5444		304		1759		14641	
Submerged area (ac)	1540	28.28	129	42.43	550	31.27	1750	11.95
Fully damaged area (ac)	180	3.31			29	5.27	157	1.07
Partially damaged area (ac)	499	9.17			48	8.72	538	3.67

Source : Upazila Agriculture Officer, Haluaghat.

4.4.1 Positive impacts

- New tree and crop varieties have been introduced as a result of increased security against flood water. These varieties are mango, jackfruit and coconut.
- Crop yields have increased due to a change from local to high yielding varieties (Table 4.6);
- HYV boro area has increased.

4.4.2 Negative impacts

- Cropping patterns did not change (Table 4.5) but the acreage under certain crops (Aus and Jute) has decreased;
- Flood control in four Unions (Amtail, Swadeshi, Shakuai and Bildora) changed these into triple cropped areas, increasing the incidence of insect infestation.

Table 4.5 : Crops Cultivated by Land Level

Land level	PRE PROJECT			POST PROJECT		
	Rabi	Kharif I	Kharif II	Rabi	Kharif I	Kharif II
High	Pulse Wheat	B. Aus Jute	T. Aman HYV	Boro LV Boro HYV Mustard S. Potato Pulse		T. Aman HYV
Medium	Boro LV	B. Aus	B. Aman	Boro HYV Boro LV	T. Aus	T. Aman LV T. Aman HYV
Low	Boro LV	B. Aus	B. Aman T. Aman LV	Boro HYV S. Potato Ground nut		T. Aman LV

Source: Farmer interviews

Table 4.6 Crop Acreage, Yield and Production Pre- and Post-Project

Crops	Pre-Project (Feasibility estimates)			Pre-Project (Adjusted estimates) 1/			Post-Project (RRA estimates)		
	Area (ac.)	Yield (md./ac)	Prodn. (mt.)	Area (ac.)	Yield (md./ac)	Prodn. (mt.)	Area (ac.)	Yield (md./ac)	Prodn. (mt.)
Boro LV	210	30	235	291	30	326	1647	35	2150
Boro HYV	924	40	1379	1281	40	1911	6847	60	15324
B Aus	2000	25	1865	2772	25	2585	3167	15	1772
T Aus				0			463	37	639
T Aman LV	7700	20	5744	10674	20	7963	6267	20	4675
T Aman HYV				0			4407	45	7397
B Aman	481	18	323	667	18	448			0
Jute	750	10	280	1040	10	388	202	10	75
Mustard	77	5	14	107	5	20	206	9	69
Pulses	77	5	14	107	5	20	145	7	38
Potato				0			100	200	746
Total	12219			16938			23451		
Intensity %				159			220		

Source: BWDB 1980, Consultants' estimates.

Notes: 1/ BWDB pre-project estimates adjusted to a net cultivable area of 10,674 ac..

5 THE IMPACT ON LIVESTOCK

5.1 PRE PROJECT SITUATION

There is no information about the pre-project situation in the relevant project documents and reports. Therefore, information presented here on the pre-project situation is based on interviews and discussions with farmers, local leaders and relevant officials.

Most of the households in the project area kept some livestock to meet draught power requirements and as a source of supplementary income. There was sufficient grazing land where animals used to graze freely. The fields which could not be used for T. Aman cultivation due to annual floods and the fallow lands during boro season provided good scope for grazing cattle. Besides, various types of grasses were grown in the low lying areas and the farmers used these grasses as cattle feed. Paddy straw, in addition to grass, was also an important feedstuff for cattle. Cows were raised mainly for milk, although their use as draught animals was not unknown, particularly during periods of acute draught power shortages. Goats were next in importance, and all types of farmers used to keep at least a few goats. Almost all the households reared poultry birds. Milk production was relatively good due to adequate availability of green fodder.

5.2 OBJECTIVES

There is no reference to any livestock related objective in the project documents. However, given the importance of livestock in the rural economy, such an objective should perhaps have been explicitly incorporated. In particular, FCD/I projects are expected to have an impact on the feed and fodder situation through increased cropping intensity and more crop production. Given the widely reported draught power constraint, this aspect should not be glossed over.

5.3 SOURCES OF DATA

During the period of RRA study, data on livestock were collected from farmers, local leaders and elites.

Interviews were conducted individually and in groups. The information collected were cross checked and verified with other persons or groups. Attempts were made to collect information from different relevant officials through a series of interviews. Upazila level information was also collected from the Upazila Livestock Officer. These were supplemented by detailed field observations. The data collected on livestock from the concerned Upazila Officer are listed in Table 5.1 and livestock price data are shown in Table 5.2.

5.4 POSITIVE EFFECTS

- Due to flood protection the transplanted Aman cultivation has become much more secure to the farmers than before, as a result of which its area and production have been increased significantly.

The increased area of transplanted Aman crop has created a positive impact on rice straw production. The quality and quantity of straw has improved, by about 30-35% after the project. Due to the increase in rice production, rice bran as a by-product is now more plentiful.

- Poultry and egg production have gone up by about 30-35% after the project. These increases are probably associated with the increased output of rice and its by products.

- The farmers reported that the goat population within the project area has also increased by 20-30%. The farmers graze them mostly on roadsides, embankment slopes, and fallow land.

5.5 NEGATIVE EFFECTS

The project has also created negative effects on livestock. Considering their importance a few of them are listed below.

- The most important negative effect of the project is on the availability of the area under grazing land. The area under grazing land has decreased by about 70-80% due to increase in rice cultivation. Protection from monsoon floods has created great scope for cultivation of different crops. Now most of the project area remains under rice cultivation in different seasons of the year. Thus the project has greatly limited the area of grazing land for use by livestock.

- After the project the cattle population has decreased by 15-20% due to the decrease in the area of grazing land. The poverty of small and marginal farmers is also responsible to some extent for this decrease in cattle population. These farmers face an acute problem in keeping their cattle, specially during the boro and transplanted aman season, due to lack of grazing area. Some of them, therefore, are compelled to sell out at least a few head. Besides, some of the farmers also sell out some cattle during the boro and transplanted aman seasons to meet their costs of cultivation. Comparative data on the livestock population for the year 1982-83 and 1990-91 collected from the Haluaghat Upazila Livestock Officer has been presented in Table 5.1. This table however, shows an increasing trend in the livestock population in the Upazila, which is at variance with our findings based on field interviews.

- Shortages of green grass and grazing land have left adverse effects on cows' milk producing capacity. After the project, milk production has decreased by about 15-20%.

- As a result of the decrease in the cattle population and increase in the area under rice cultivation, an acute draught power shortage has developed. The draught power requirement has increased by about 30-40%, depending upon the farm size. However, the farmers are meeting this requirement by hiring power tillers.

- The health condition of the animals observed in the project area was not good. The decrease in grazing area and reduced availability of green fodder by the sides of beels have caused deterioration in the health condition of the animals.

5.6 RECOMMENDATIONS

The following measures can be taken to mitigate the negative effects on livestock due to the project:

- Though production of rice straw increased both qualitatively and quantitatively after the project, the straw alone can not meet the total food requirement of the animals, because, straw contains less food value as compared to other concentrates. Available fallow land, roadsides and embankment slopes could be used to grow food crops (cow pea, khesari and maize) and forage crops (napier grass and para grass) to mitigate the green fodder shortage to a significant extent. This would not only help minimise food shortage, but will also greatly help in reducing erosion of embankments and roads.

- The farmers of the project area incur great loss of livestock every year due to the out break of diseases like ranikhet, foul fox and cattle diarrhoea. To prevent the poultry and cattle from being infected, routine vaccination programmes should be undertaken by the livestock extension officers within the project.

- To improve bullock power and the milk producing capacity of the cow population, a regular insemination programme should also be under taken within the project area. This would help mitigate the shortage of draft power and reduce the animal protein deficiency of rural people.

Table 5.1: Information on Livestock for the Upazila, Haluaghat .

i) Comparative study on livestock population and price of average size livestock between 1982-83 and 1990-91				
Type of Live-stock	No. of Livestock		Price of Livestock (Tk/animal)	
	1982-83	1990-91	1982-83	1990-91
Cattle	62,356	77,440	3500-4000	5000-6000
Buffalo	2,051	3,456	7000-8000	12000-14000
Goat	9,197	12,252	800-1000	1200-1500
Sheep	15	24	500-600	700-800
Chicken	2,08,132	3,25,356	40-50	70-90
Duck	45,312	57,432	30-40	60-70
ii) Other related information (changes taken place since 1983)				
a) Green feeds decreased by 40-50%				
b) Crop by-product increased by 15-20%				
c) Straw production increased by 10-15%				
d) Areas of grazing land and khas land decreased				
e) Milk production increased from 2 kg to 4 kg /cow				
f) Egg production increased from 150 egg to 200 egg/hen				
g) Egg production increased from 150 egg to 175 egg/duck				
h) Health condition of cattle is not good				
i) Draft power shortage is about 20% and this shortage is met by using cows.				

Source : Information collected from the Haluaghat Upazila Livestock Officer.

Table 5.2: Prices of Livestock in the Project Area

Animal/Bird	Price (Tk/kg)
Cattle (meat)	50 - 55
Goat (meat)	65 - 70
Chicken	50 - 60
Duck	30 - 40
Milk	10 - 12

Source : From interview and discussion held with farmers during RRA study (May 1991).

6 FISHERIES

6.1 PRE-PROJECT SITUATION

To know the pre-project situation efforts were made to collect necessary documents related to the project. However the BWDB failed to supply the Feasibility Study Report and there is hardly any information about the fisheries situation of the project in the relevant documents so far consulted. However, according to the Socio-Economic Study Report there were 5 beels namely Balughata Beel, Podo Beel, Chilka Beel, Barbhita Beel and Koi Beel within the project area[1]. Every year these beels were flooded over.

During the RRA study the fishermen and farmers reported that the beels and khals of the local area were rich in different species of fish before the project. After the project, the embankment along the bank of the Kangsa river blocked the khals which were previously used as the migration routes of fish from the Kangsa river to the water bodies inside the project. Thus the project started affecting the fisheries resources within the project after its completion.

6.2 OBJECTIVES

No definite planned objective for improving fisheries resources was set by the planners. Since fish was one of the main sources of income, at least for some groups of people, and an important source of animal protein to the project inhabitants as a whole, planners should have taken explicit account of the impact on fisheries at the planning stage.

6.3 SOURCES OF DATA

The main sources of data were fishermen, farmers, fish traders and local leaders. Information was also collected from relevant officials. Attempts were made to collect background information from relevant documents and reports. During the period of RRA study, farmers, pond fish culturists, fishermen and fish traders of different categories were interviewed individually and in groups.

6.4 POSITIVE EFFECTS

The flood protection embankment along the river Kangsa has protected about 30-40% of the existing ponds from annual flooding. This encourages the pond owners to stock their ponds with fingerlings of quality fish. After rearing them for a certain period the farmers catch the marketable size fish for their consumption and for sale. The well to do farmers keep almost half of the catch for home consumption and sell the rest of the catch, whereas the poorer farmers sell the major portion of the catch, keeping only a small fraction for their own consumption. Almost all the ponds free from floods are now stocked with fish by the farmers.

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1 Socio-Economic Study of Konapara Embankment Project by NTAP, 1980.

The decrease of fish production in open water bodies and increased protection of ponds from annual flooding have encouraged many farmers to construct new ponds for fish culture. In South Itakhola village alone 10 new ponds were constructed for fish culture. About 20-25% of all ponds now in use have been constructed after the project.

Increased pond fish culture has created at least some employment for a few fishermen. The professional fishermen catch fish from the ponds on an output sharing basis. The fishermen get ¼ of the catch or ¼ of the value of the total catch as payment. In addition, the fishermen receive one fish of average size free of cost from the pond owner.

Income and animal protein consumption of pond fish farmers have significantly increased due to increase in pond fish culture.

6.5 NEGATIVE IMPACT

Though the project possesses a relatively small area of capture fisheries, its affect on fish production is very large. Some of the adverse impacts of the project on fisheries are given below :

The protection of the project area from monsoon floods has greatly decreased the area of capture fisheries, as a result of which almost all the beels and khals within the project area dry up during the annual dry season.

The flood protection embankment has blocked several khals and canals that connected the beels of the project with adjacent rivers. Through these khals and canals the fish used to enter the project area during the monsoon floods to graze. As a result of this blockage, fish production has decreased by about 70-75% and significant changes have occurred in species composition. In particular, the major carps and other important commercial species have already disappeared. Only the small forage fish species, snake heads, shing, koi and boal are now available. in small quantities.

Due to flood protection, the water bodies inside the project now dry up every year, and farmers catch whatever they can. The increased use of water from khals and beels for irrigating high yielding rice varieties, also causes them to dry up early. In addition, the breaching of the embankment near Nasulla Bazar during 1988, has resulted in sand and silt deposition inside the project area. Due to these reasons water bodies dry up early, causing heavy damage to fish stock.

The project has severely affected the livelihood of the professional fishermen, by limiting the fishing area and fishing period drastically. Before the project, the fishermen used to catch fish from the beels and khals in addition to fishing from adjacent rivers. Now fishermen are not allowed to catch fish from the water bodies inside the project by the farmers as the farmers do it for themselves. As a result, fishermen have to depend solely on the river for fishing.

Due to decrease of fish in the project water bodies and the adjacent rivers, the income of fishermen has also gone down about 40-50%. Consequently, a good number of fishermen have been forced to adopt subsidiary occupations, such as daily labour, petty trade and crop production.

Due to lack of scope for fishing in the water bodies inside the project the fishermen have increased their fishing pressure on rivers, as a result of which fish stock in rivers are decreasing very rapidly. Before the project the fishermen used to catch about 2.5 to 3 kg/day and now their catch has decreased to 1-1.50 kg/day. The trend of decrease in fish production of riverine fisheries of Mymensingh district is shown in Table 6.1. Major carps, live fish, hilsa and large shrimps were found to have decreased suddenly after 1985.

Fish traders have also been adversely affected due to reduction of fish in the water bodies, both inside and outside the project. The quantity of fish handled by them has decreased by about 40-50%.

6.6 MEASURES TO CORRECT NEGATIVE IMPACTS

The project was completed in 1983, and there has since been no rehabilitation programme on fisheries resources as result of which all these resources have now deteriorated greatly. It is therefore, not possible to bring them back to original state. However, some measures can be taken to mitigate the losses to a significant extent.

To mitigate the loss of fish due to the project, emphasis must be given to pond fish culture. For this purpose the pond owners should be motivated to adopt improved fish culture practices by strengthening the extension activities within the project area. Though the ponds are stocked with fish by the farmers, they do not follow any improved fish culture methods. Only very few of them use rice bran as fish food.

Farmers should be motivated to introduce improved fish culture in the water bodies such as beels and khals within the project on a co-operative basis. For this purpose the water bodies need to be reclaimed first so that they can hold water round the year. Then by stocking these water bodies with quality fish seeds the farmers will be able to harvest a good catch at the end of each year.

6.7 LESSONS LEARNED

Undoubtedly fisheries should be an important component in all the FCD/FCDI projects. It is sad to note that in this project the fisheries component was totally ignored. Similarly to other projects, this project has also severely affected the fisheries resources, income of fishermen and total animal protein consumption of the local population. Therefore, from the outset, care should be taken so that fisheries resources are protected. Structures such as sluices and drainage outlets should be designed in a way so that the fish can get easy entrance through them. There should definitely be a planned programme for the development of fisheries resources within the project to mitigate the probable losses due to it.

Concerned officials such as the Fisheries, Livestock and Agriculture Officers should be involved during future project planning in order to have clear picture of the pre-project situation on different aspects. This will help greatly to undertake future development programmes within the project more effectively.

Table 6.1 : Fisheries Information for Haluaghata Upazila

a) Number of water bodies with area and yield			
Name of items	Number	Area/Length	Fish Yield (MT)
Total ponds	1291	394 acres	70
Rivers	4	45 miles	20
Other seasonal fishable water bodies	-	50 acres	7.5
Total			97.5
b) Total production per year = 97.5 MT			
c) No. of Fishermen Co-operative = 1			
d) No. of Co-operative member = 256			
e) Price of major carp = TK. 40-60/kg (depending on size and type)			
f) Small fishes = Tk. 7-10/kg			

Sources : (a) and (b) from Upazila Fisheries Officer and (c) to (f) from interviews and discussion with pond fish culturists, fishermen and fish traders.

Table 6.2 : Fish Production Trends in Mymensingh District

i) Riverine Fisheries :					
Major Group of Fish	Year-wise Catch (MT)				
	1983/84	1984/85	1985/86	1986/87	1987/88
Major Carps	1,394	3,034	172	126	100
Other Carps	609	1,339	433	344	309
Catfish	1,004	2,191	670	576	433
Live fish	272	589	1	26	0
Hilsa	484	708	299	31	2
Big Shrimp	142	240	25	31	11
Small Shrimp	0	304	1,118	451	215
Other Species	4,474	9,188	7,132	8,843	11,062
Total	8,379	17,593	9,850	10,428	12,132
ii) Beel Fisheries :					
a) Area (Acre)	29,406	29,406	29,406	29,406	29,406
b) Catch (MT)	13,233	13,734	12,811	13,152	13,479
iii) Floodland :					
a) Catch	7,374	6,731	11,030	12,434	12,437
iv) Pond Fisheries :					
a) Area (Acre)	21,841	21,841	21,841	21,841	21,841
b) Catch (MT)	8,435	7,450	7,227	7,769	9,551

Source : Department of Fisheries, Fish Catch Statistics of Bangladesh.

7 NUTRITION

7.1 PRE PROJECT SITUATION

The pre-project nutritional situation was marked by very low levels of nutritional standards associated with poorly developed health, sanitation and water supply infrastructure. The area was in food deficit, and highly susceptible to seasonal floods that would cause substantial damage to the aus and aman crops.

7.2 OBJECTIVES

No nutritional objectives were stated, although it was implied that the per capita income and employment would increase with crop production, serving to raise living standards and improve the nutritional status.

7.3 ACTUAL BENEFITS

- People now have 3 meals/day
- They are eating more rice.
- Fish and milk are scarce in the project area but can be readily purchased from the market;
- Children are suffering less from disease and malnutrition;
- Disease incidence is low;
- They are now using tubewell water for drinking.

7.4 RECOMMENDATION

- As the project area is a food surplus area, more attention needs to be given to fish farming and dairy production;
- More fodder crops should be cultivated in the project area (see section on livestock).
- The potential for crop diversification, particularly to grow more pulses and fruits and vegetables, needs to be explored.

8 WOMEN IN DEVELOPMENT

8.1 PRE-PROJECT SITUATION

The people in the area were very poor. Women were not generally engaged in activities outside the house. Even men found it difficult to obtain employment. Muslim ladies were mostly restricted inside the house. Female literacy was very low. Early marriage was widely practised.

8.2 OBJECTIVES

There was no stated objective relating to women. It was nevertheless implied that work would be created for women in both agricultural and non-agricultural areas as a result of the project, even if indirectly.

8.3 ACTUAL BENEFITS

More women are now involved in different activities (Table 8.1). They are more motivated than before to work for money. More women are found in farm work, particularly amongst the tribal Garos. They are mostly converted christians and are more liberated. The women work in groups of 12-15. They transplant rice, do weeding, carry harvested rice to the threshing yard and also thresh rice.

Increase in crop production increased in-house off-farm activities such as boiling, drying and storing rice. The housewives need helpers and are found to hire female labour to assist them. Female labourers were also found to process rice in the house and in the rice mills.

Housewives also engage themselves in homestead gardening. They collect seeds, prepare land, sow seed, prepare platforms for the crawling vegetable vines, apply fertilizer, water plants and harvest crops. If they can grow good crops then they sell those. Usually the head of the family or son takes these to the village market for sale.

In the project area groups of women were found working in road construction and maintenance, in CARE sponsored projects. Women who do not like to work outside the house weave fish nets, bamboo baskets and kula. Their husbands sell these in the market. Women tend to be involved in raising chicken, ducks and goats, for sale. Women were found to help with house construction. Local women are also engaged in small business, petty trading and sale of old clothes, stationeries, fish and other household articles. Female garment workers are also seen in the project area.

Female education is available up to the secondary school certificate level. The percentage of matriculates is much higher than in the pre-project situation. There are no girls schools or colleges in the project area. Girls have to go to the same school as the boys. The college is far from the project area. Parents do not like to send their girls to college. Most girls are married off between the ages of 16 and 20.

There are local NGOs who give loans on interest to women's groups for rice processing, chira-muri preparation, cattle, goat and poultry raising and small business. Women are faring better than men in these types of cooperative activities.

The wage rates for different activities are given in Table 8.2. Women receive a lower salary than men, in their specialised activities. But employers all accept the fact that women are more sincere than men in their jobs.

8.4 OBSERVATIONS

The impact on women is somewhat indirect and diffiult to isolate from the many independent factors in operation that have served to improve the economic and motivational status of women. To start with, the presence of the Garo community with their hard working women engaged in all kinds of farm work, combined with the work of NGOs, has probably created a more conducive environment for women to expand their role as economic beings than is usual in Bangladesh. The intervention in the form of the embankment and its implications for women needs to be seen within this perspective. It is neither possible nor particularly meaningful in such a case to try to identify the pure effect of the project. It should suffice at this stage to merely point out that the project has indeed made everyone's lives slightly better off, including those of women.

Table 8.1: Professions where women were/are engaged in pre and post project situation

Profe-ssions	Activities	Pre-project situation		Post-project situation				
		In house	Out side house	In house	Out side house	Status		
						In-creased	De-creased	Same
On-farm Agri-culture	Sowing	X	X	X	✓			
	Transplanting	X	X	X	✓			
	Weeding	X	X	X	✓			
Off-farm Agri-culture	Rice boiling	✓	X	✓	✓	✓		
	Drying	✓	X	✓	✓	✓		
	Husking	✓	X	✓	✓	✓		
Home-stead Garde-ning	Land preparation	✓	X	✓	X	✓		
	Seed collection	✓	X	✓	X	✓		
	Sowing	✓	X	✓	X	✓		
	Weeding	✓	X	✓	X	✓		
	Watering	✓	X	✓	X	✓		
	Harvest	✓	X	✓	X	✓		
Others	Road construction	X	X	X	✓			
	House construction	X	X	X	✓			
Cottage indus-try	Net preparation	✓	X	✓	X	✓		
	Bamboo craft	✓	X	✓	X	✓		
Live-stock raising	Chicken, duck	✓	X	✓	X	✓		
	Goat raising	✓	X	✓	X	✓		
Service	Family plan-ning worker	X	X	X	✓			
	Garment labour	X	X	X	✓			
Busi-ness	Vender	X	X	X	✓			
	Fish trader	X	X	X	✓			

Source: Group Interview

Key X Does not participate
_/ Participates

Table 8.2 Wage rate of women for different professions.

Profession	Wage rate (Tk/day)	
	Inside house	Outside house
On-farm Agriculture		15+1kg rice+1 meal
Off-farm Agriculture	1 kg rice + 1meal Return 20kg rice for husking 1 maund paddy.	11.20
Road Construction	32	
House Construction	15+one meal	

Source : Group interview

9 SOCIAL INSTITUTIONS

9.1 PRE PROJECT SITUATION

Social

(i) The total population of the area was about 10,000.[1]

(ii) Most of the inhabitants of the project area were farmers. About 55% of the family heads were primarily owner farmers, and 12% were owner-cum-share croppers.

(iii) 27% reported their primary occupation as daily wage labour, while 3% were businessman and 2% were employed in service. The day labourers were mainly landless, marginal farmers and share-croppers;

(iv) 36% of the households were poor;

(v) The land ownership pattern was skewed. 28% of the households were landless (possessing no cultivable land), about 9% owned less than 1.00 acre and 15% owned 7.00 acres or more.

(vi) The wage rate of the daily labourers was very low i.e. Tk.3-6 with food and Tk. 8-12 without food. During the harvesting period the corresponding figures were somewhat higher, at Tk.5-12 and Tk 10-20 respectively;

(vii) Share-cropping has been practised in the area a on 50-50 basis for inputs (seeds, fertilizers) and outputs.

(viii) There was no industry of any kind in and around the project area.

Institutional

(i) During the pre-project period, there were no activities of the BRDB/RCS cooperatives in the project area.

(ii) NGO activity in the project area was also absent.

(iii) The project area was relatively backward, with a low literacy rate (about 10%);

(iv) There were only 5 High Schools, 1 Junior High School and 9 Primary Schools in the project area. There were also a few informal institutions such as mosques and maktabs in different villages.

(v) No irrigation system other than indigenous technology (Sewty, Doon) existed in the pre-project period.

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1 According to figures available from the Upazila office.

9.2 PROJECT OBJECTIVES

There was no explicit project objective for initiating and accelerating institutional facilities towards social and economic development. However, there was an expectation that communication infrastructure, educational institutions, farmers organisations, cooperatives and other developmental organisations would emerge, an autonomous tendency that would be strengthened by the project.

9.3 IMPACT OF THE PROJECT

The project has generated both positive and negative social impacts.

9.3.1 Positive Impact

i) Employment opportunities have been created in the project area which could be ascertained from the increasing number of rickshaw pullers and push-carts for carrying passengers and goods.

ii) There has been a decreasing rate of outmigration of wage-labourers from the project area to outside districts such as Sylhet, Narayangonj, Dhaka, Sherpur. This outmigration has been continuing for generations. But in recent years, the rate of this outmigration has been reduced to a great extent. It may be noted that during the pre-project period, outmigration was high (72% - 75%) at Itakhola, but presently there is no outmigration from this village.

iv) There has been an increase in land prices throughout the project area. The highest price is Tk. 100,000 and the lowest Tk.60,000. The adjacent area land price varies from Tk. 40,000 to Tk.50,000.

9.3.2 Negative Impact

(i) The villagers whose lands were acquired for borrow pits/ embankments, were partly compensated in terms of money. The final instalment has not been paid and this has created dissatisfaction among the landowners.

(ii) There is also a legal problem over payment of land revenue. The landowners who have lost their land due to acquisition continue to pay land revenue because the BWDB has not yet transferred ownership of the land away from them, even a decade after acquisition.

(iii) The section of the embankment at Bhatta was not constructed as per original plan, because of the intervention of Mr. Abdur Rahim Khan, Ex-Chairman of Shakoi Union, and thus about 1500 families with about 4,000 acres of land (about 10 mauzas) remained unprotected. The area was strongly disbenefitted in terms of damage to houses and livestock from annual flooding. Before the embankment, homesteads were not inundated, but these are now. During the 1987 floods, a baby fell from its bed into the water and died. Villagers grew angry and cut the embankment at Bhatta Nayapara. The people cut the same spot successively for several years after this incident.

(iv) The public cut at Kodallia cross-dam (outside the embankment) has already been discussed. This created acute social conflicts, resulting in the death of two persons.

(v) In many areas, the fishermen turned into landless wage labour as fishing grounds dwindled. In the Boro Beel, for example, the fishermen are not allowed to catch fish. Ownership of the water body lies with the farmers, who no longer need the services of professional fishermen. As the water level falls and the Beel dries up (a project effect), the farmers are able to catch fish without additional help.

(vi) Though the RRA Team has the impression that the overall living condition of the people within the project area has improved, income inequalities appear to have been exacerbated.

9.4 ADDITIONAL OBSERVATIONS

During the post project period, the number of formal cooperative societies organised by BRDB was almost nil. At present, there are 79 cooperative societies (KSS + MSS) in the concerned unions of the project area. Out of 79 cooperative societies, 40 are DTW groups.

Table 9.1 : Cooperative Societies Operating in the Project Area

Name of Unions	No. of Cooperative Societies
Shakoi	30
Bildora	15
Swadeshi	20
Amtail	14
Total	79

Source : UCCA Office, Haluaghat

i) There were no NGOs in the project area during the pre-project period. A local NGO, called "Mymensingh Pally Unnayan Prayash" has been working at Amtail since 1989. Its target group is the landless poor people. At Amtail union, it has formed 12 men and 12 women groups with 303 members. Their total group savings are Tk.10,195. The organisation is mainly concerned with conscientization, group savings and income generating activities.

ii) A Christian Mission, named, "Seventh Day Adventist" is working in the project area (Itakhola) with the Garos. It is mainly concerned with child education in the project area.

iii) Many informal cooperative societies have emerged in the project area (i.e. these cooperatives have no formal registration with BRDB/RCS) The societies provide loans to the group members with interest rates ranging between 15 and 20%.

9.5 RECOMMENDATIONS

(i) Social and institutional concerns should be reflected in the project planning process to maximise gains.

(ii) Discontent is not conducive to efficiency, and can reduce project benefits. The legal issues pertaining to land revenue should be settled immediately and compensation money should be promptly settled.

(iii) There is very little popular participation at any level. Ways and means of incorporating and encouraging such participation for better maintenance and operation need to be devised.

(iv) Social forestry in the embankment plays a vital role not only in preventing environmental degradation by releasing more oxygen to the atmosphere, but it also creates an additional source of income. Thus there is a need to involve NGOs/ government agencies to fully explore the potential of the embankment as a forestry resource and as a source of employment/income.There are many informal cooperative societies in the project area. Their activity is limited to providing credit only. A provision should be made to involve NGO/BRDB/RCS or any other development agency to work in this area to activate these informal groups and build up more formal groups for social and economic development in the project area.

(v) It is important to undertake thorough socio-economic studies before going ahead with implementation of a project, in order to identify potential social conflicts that can arise to thwart project success.

(vi) An effective operation and maintenance (O&M) organisation is a prerequisite for realisation of optimum benefit from the project and therefore, a practical and effective O&M system for the embankment should be be developed. Generally where there is no (major) structure, O&M is absent. Embankment type projects (with no structures) could be handed over to the union parishad representatives, who would be better situated to involve local people in O&M.

(vii) A coordination committee for the project should be formed with upazila level concerned officials along with BWDB to get more effective results from the project.

9.6 LESSONS LEARNED

The social cost of the project was not taken into consideration at the time of planning (i.e. impact on prevailing social structure, social conflicts, sharing of benefits and disbenefits of the project). In many cases, social conflicts arise and become acute. Any such future project should take this factor into consideration.

It should also be noted that to reach the desired rate of success, continuous monitoring is required. Thus, completion of an embankment should be taken as the "beginning" not as the "end" of the project by the concerned authority.

10 ENVIRONMENTAL EVALUATION

10.1 PRE-PROJECT SITUATION

The Konapara embankment project area is entirely within agro-ecological subregion 22b, the northern and eastern plains of the Northern and Eastern Piedmont Plains Agro-ecological Region (FAO, 1988).

There is a slight west to east gradient across the project area, and slight waterlogging occurs in the east when the river flow is high. The RRA findings suggest that the flooding was mainly due to rainfall run off from the Garo Hills in India through the Kangsa and Darsa Rivers. Most of the project area used to be submerged by flood water, to a depth of 0.3-1.5 m. (1-5 ft.), during the monsoon.

The area concerned is occupied by a single soil association, Pn 374. This typically comprises Medium Highland and with a small area of Medium Lowland. Most of the higher land occurs along the north-west margin of the Kangsa river.

The region comprises merging alluvial fans which slope gently outward from the foot of the northern and eastern hills into smooth, low lying basins. Large parts of the region (22b) are subject to shallow flash floods in the rainy season and rain water is retained on the surface within field bunds. This region has complex soil patterns due to irregular deposition of sediments of different textures during successive flash floods. Deposits range from sand to clays, though the greater part of the area is occupied by soils with sandy loam to silty clay texture. Local people reported that during the monsoon heavy rain water flow through the Kangsa River flooded the area. Broadcast or transplanted Aus followed by T. Aman were the main crops. The major agricultural problem was that the river dried up in the winter, and therefore the scope for using surface water for irrigation was very small.

Many years ago wild life and especially birdlife in the Borobila beel was quite common. At present this has been displaced by the sheer pressure of population, and even the fish population would have been considerably reduced. By the time of Project construction (1980/81) little of the natural flora and fauna remained. Natural vegetation had long been largely replaced by rice fields.

10.2 PROJECT OBJECTIVES

The Project Proforma (PP) (BWDB 1979) did not address environmental issues. No attempt at pre-project environmental assessment was proposed.

10.3 SOURCES OF INFORMATION

The PP and Feasibility Report include some data of relevance to physical and human aspects of the environment but contain no biological data. Information on agroecological zonation and characteristics are available in the comprehensive FAO (1988) work which covers all of Bangladesh.

All other data used in this Chapter were acquired by the RRA approach of interviews with villagers and government officials and by direct field observation. Equally important for

the environmental evaluation have been the findings of the other disciplines within the RRA team.

10.4 PHYSICAL ENVIRONMENTAL IMPACTS

Physical issues have been sub-divided into water related and land related issues; other physical issues such as climate and atmosphere have not been affected by the project.

10.4.1 Physical Impacts (Water)

(a) River Flow

There are no active rivers within the project area. The duration, timing and velocity of the Kangsa River seem not to have been significantly affected by the Konapara Project. Immediately adjacent to the project area, the lower reaches of the Kangsa river combines with the Darsa river, where a severe negative impact on river flow was noted. This is because the level of water in the Kangsa is higher than in the Darsa.

A small increase in volume and velocity have resulted from the embankment containing the river flood water that previously entered the north of the project area. Timing and also duration of high river flows have possibly been slightly increased during the monsoon period. None of these, however, are likely to be sufficient to cause significant external impacts, either adjacent to the project area or downstream. More efficient operation of the regulators on the drainage inlets and outlets might allow more significant amounts of water into the Kangsa River. Overall the Project impact on river flow is positive but minor.

(b) River quality

Important key quality factors are sewage, presence of agrochemicals, sediment load (reflected by turbidity) and salinity.

Any pollution of the Kangsa River water by agrochemicals or sewage is diluted by the strong monsoon flow through the Dhurail area, upstream of the project. Sediment from erosion, and salinity, are not factors in Konapara. Downstream near the confluence of the Kangsa and Darsa, the upstream current in the Darsa may carry some fine sand, which could cause slight problems when it is deposited on agricultural land. Overall, Project external impacts on river quality are negligible.

(c) River Morphology

River morphology changes mainly as a result of bank erosion, bed scour or siltation. The upstream current in the Darsa River from the confluence of the Kangsa causes slight siltation. The Project will not significantly have affected bank erosion and scour in the Kangsa.

(d) Flooding

The Project was designed to provide early monsoon flood control and drainage. A modest degree of success has been achieved, but flooding is generally very similar to the preproject level due to public cuts in the upstream section of the project near Dhurail and also due to the upstream flow (section (c) above) in the Darsa. Outside the project area flooding

increases during the monsoon period. The external impact on flooding is rated as moderately negative.

(e) Drainage

Localised drainage congestion has been reported, affecting around 40 ha.. This is a result of inappropriate siting of drainage outlets. Unplanned or poorly planned earthworks (roads) in the project area have aggravated the drainage problem further. Overall impact is negative but minor.

(f) Groundwater levels

The level of ground water is very important issue, because of the rapid spread of shallow tubewell and deep tubewell irrigation in the project area, especially for HYV Boro. Since this is a long term phenomenon, it is difficult to evaluate any immediate trends.

Local people reported the decline of water levels in their wells. There is a slight decrease in the volume and duration of flooding, which may have reduced recharge, leading to a minor negative impact within the project area.

Externally, the area must benefit from ground water recharge due to increased flooding. The impact is positive but minor.

(g) Groundwater Quality

The use of agrochemicals, particularly fertilisers and pesticides for HYV paddy, has increased. The rapid expansion of HYV Boro cultivation is related to the increased availability of irrigation facilities for ground water irrigation (Chapter 4) rather than to the project. Since the volume and duration of flooding has decreased, there is a minor danger of pollution from fertiliser use. However, this requires measurement and monitoring and no water quality data exist to evaluate such impact.

(h) Wetland and Waterbodies Extent and Recharge

There were a number of beels in the project area which were flooded every year. Since construction of the project, the beels within the project area dry up during the annual dry season. The increased use of water from khals and beels for irrigating high yielding rice varieties also causes them to dry up early. There is a moderate negative impact within the project area, which would be even greater if the project functioned properly (Chapter 3).

(i) Quality of Wetlands and Waterbodies

There is accumulation of sewage and leached fertilisers in the water bodies due to rainwater transport. The poor drainage (section (e) above) which prevents flushing out of these pollutants must cause an increasing concentration in the beels and lowlying areas. However, hard data are required to evaluate this parameter with any accuracy. A minor negative impact is therefore assessed within the project area.

Outside the project, the volume and also duration of flooding, and hence the efficiency of flushing, have increased, and no impact is therefore noted.

10.4.2 Physical Impacts (Land)

(a) Soil Fertility

Soil fertility has been affected slightly. The main influence of the project on decreasing soil fertility has resulted from decrease of flooding. Aquatic weeds on which blue green algae would grow are now unable to flourish, and therefore the supply of nitrogen to the soil from this source does not occur. Annual deposition of silt also does not occur now. A minor negative impact is assumed.

Outside the project, the extended flood area should have a minor positive impact.

(b) Soil Physical Characteristics

The beels and lowlying areas that were previously wetland now dry out seasonally. Supply of organic matter from aquatic weeds (section (a) above) has decreased and as a result of limited flooding silt deposition is lacking. In addition, the breaching of the embankment near Nasulla Bazar during the flood of 1988 has resulted in sand deposition inside the project area. The overall impact is negative but minor. Outside and downstream there is no impact.

(c) Soil moisture

This has suffered a slight negative impact in the high land and slight positive impact in the low land due to lack of proper drainage (Section 10.4.1 (e)). On balance the impact is negligible.

In the external areas flooding has increased which means a slight increase in soil waterlogging. A slight positive impact is assumed.

(d) Soil Erosion

Soil erosion is negligible. Only slight erosion was noted in Gazipur and Nasrullah. Here the borrowpits have been silted up, and during the flood season, water flows through these borrow pits at high speed, causing the river side to erode.

(e) Land capability

Land capability has increased from expanded irrigation capacity and also due to reduced flooding. This improved land capability has allowed the switch from local to HYV paddy varieties.

(f) Land availability

The drying up of beels (section 10.4.1) has increased significantly the land availability within the project area and so constitutes a moderate positive impact.

In downstream areas the increased flooding would also have slightly diminished the extent of available land, and the impact is assumed to be minor negative.

10.5 BIOLOGICAL ENVIRONMENTAL IMPACTS

Biological environmental issues affected by the Konapara embankment project can be divided into fauna and flora issues (Table 10.2). Most biological issues have suffered no significant impacts but they are briefly examined here because of the popular awareness of them as issues.

10.5.1 Biological Impacts (Fauna)

(a) Bird Communities/Habitats

The decline in bird communities and deterioration of their habitats is a function of human population density rather than an impact of the project.

(b) Fish Communities and Habitats

The fish ecology in the beels has deteriorated because the beels are seasonally dry (10.4.1 (h)). In addition, the embankment has blocked several khals and canals and the beels are cut off from the rivers and from each other. Fish migration from the rivers to the beels during the monsoon floods has stopped which has decreased fish production by about 70-75 per cent.

The embankment has protected fish ponds from annual flooding and has thus increased confidence in fish pond construction. This has helped to accelerate the considerable growth of culture fisheries within the project area.

On balance a minor positive impact is assumed.

(c) Other Macro-fauna Communities/Habitats

The same comments apply as for (a) above: already by 1983 the intensive occupation and utilisation of the land had reduced mammals, reptiles, amphibians, etc., to almost the very low populations found today. The continued imperceptible decline during the project's life has not been significantly accelerated by the project, in part because it started from too low a base level.

The lack of historical data for this and most other biological issues in Bangladesh is unfortunate, as it prevents any attempt to plot the decline of the country's wildlife and habitats. This would have enabled the project's impact on these issues to be shown in a true perspective.

(d) Micro-fauna Communities/Habitats

This issue has already been touched in Section 10.4.2 (a) where negative changes are noted with respect to the incidence of blue-green algae, one of the major microbiota elements in Bangladesh. In the total absence of data, it is assumed that other microbiota are also affected by the project.

10.5.2 Biological Impacts (Flora)

(a) Trees

The project has helped the introduction of economically useful trees such as mango, jackfruit, coconut and betel nut. In addition, the embankment provides an excellent opportunity for afforestation. Hence, introduction of new tree species and their growth is assessed as a minor positive impact.

(b) Other Terrestrial Vegetation

The same comments apply as to (a) and (c) in Section 10.5.1.

(c) Aquatic Vegetation

Due to the reduction in the extent of permanent water, the Project has had a moderate negative impact on the communities and habitats of aquatic vegetation within the project area. Externally, the impact is assumed to be negligible.

10.6 HUMAN ENVIRONMENTAL IMPACTS

Some of the most important environmental impacts of the Konapara embankment project are those affecting the human environment. However, many of these are covered in other Chapters of this report. Here they are represented in Table 10.3 and are briefly summarised below.

Human impacts can be conveniently grouped into five sub-categories: human use, social, economic, institutional and cultural.

10.6.1 Human Use Impacts

(a) Crop cultivation

Chapter 4 shows that due to reduced flood damage, agricultural production has increased. The increased output may be regarded as a minor positive impact. External impacts are minor negative since, because of the embankment, both volume and duration of flooding have increased.

(b) Livestock

Some increase in small stock is reported (Chapter 5) in case of poultry (30-35%) and goats (20-30%), along with benefits from use of the embankment for grazing of goats. Cattle population has decreased (15-20%) due to the reduction of grazing land.

Overall a minor positive impact is assumed.

(c) Fisheries

A slight positive impact is assumed, because the embankment has provided a degree of protection and confidence from overtopping the ponds within the area, although decrease of capture fisheries was noted.

(d) Afforestation

No impact, but an opportunity to plant the embankment is being missed.

(e) Agro-industrial Activities

Slight positive impact; this is mainly due to the project's impact on agricultural production, which has helped establishment of some rice mills in the project area.

(f) Transport and Communications

Road transport has improved, but boats have declined in importance. The impact is therefore minor positive.

(g) Infrastructure

The control of floods may have had small benefits. However, as a result of public cuts, floods damage houses and property.

In adjacent areas, flood water damages homesteads causing physical damage, discomfort and dislocation; the impact is therefore assessed as minor negative.

(h) Domestic Water Supply

The discussion in 10.4.1 (f) showed a minor negative impact in maintaining ground water levels. This may have a minor negative impact on domestic water supplies from shallow drinking water tubewells.

(i) Sanitation

The main fear is that the embankment prevents the previous flushing action of monsoon floods therefore that sewage may accumulate. This would create a minor negative impact.

(j) Recreation

Not affected.

(k) Energy

There may be a slight negative impact. This is from the increased use of energy by the rice mills encouraged by the project.

10.6.2. Social Impacts.

(a) Human Carrying Capacity

The Project has helped to increase land capability and availability which has increased the population capacity (see section 10.4.2(e) and (f)).

(b) Demography

The Project itself has probably not significantly influenced demographic structure and trends except as in (a) above.

(c) Gender

A minor positive impact on the role of women, by creating greater employment opportunities in farm work.

(d) Age

No real impact.

(e) Health and Nutrition

Minor positive impact due to project related increases in crop and fish production (Chapters 4 and 11) and to the maintenance of a clean drinking water supply from the tube wells (Chapter 7).

(f) Disruption, Safety and Survival

The partial control of flooding has given the population greater security for their belongings in the Project area and the impact is minor positive. Outside the Project, there has been increased damage of homesteads causing physical damage and dislocation and the impact is minor negative.

(g) Land ownership

Not affected.

(h) Equity

A slight negative impact, because those who could afford to take advantage of improved input opportunities, particularly tubewell irrigation and culture fishery in protected areas, have flourished. The losers are mainly traditional fishermen and poor farmers.

(i) Social cohesion

Social cohesion has beeen subject to a minor negative impact, in consequence of the impact on equity noted at (h) above. There is much resentment amongst the losers, particularly the traditional fishermen.

(j) Social attitude

There are public discontents, because the embankment was not constructed according to the original plan, particularly at Bhatta where the section of the embankment was not constructed. Public participation both before and after Project construction was lacking. Public cuts at Kodallia cross-dam created acute social conflicts and resulted death of people. The impact is seriously negative both inside and outside the project.

10.6.3. Economic Impacts

The three main potential impacts on the people are incomes, employment and land values. All these have received at least minor positive impacts (Chapter 11). In all the three cases, the impacts are mainly from the increased cultivation, fish culture and production.

In the downstream areas, substantial economic losses occur in wet years. Rural credit has not benefited from the Project as perhaps it could have done, if better provision had been made for it.

10.6.4 Institutional Impacts

Institutional effectiveness does not seem to have improved as a result of the project. In lowlying areas and external areas, the project has created problems for some people (notably the capture fishermen within the area and excessive flooding outside and downstream areas). Institutional roles and public participation show minor negative impacts, both outside the area and within it.

10.6.5. Cultural Impacts

It is difficult to see that project has influenced cultural heritage and continuity or scenic qualities in the project area. There are no particular historical, archaeological or more recent cultural sites.

Cultural continuity is threatened in the beel areas, especially, because of the impending demise of the traditional capture fishermen's community. Usually they are Hindu and add to social and cultural diversity. Many of them work now as labourers.

However , overall the Project has improved the quality of life in the Project area to a limited degree, through increased agricultural production, health, improved roads and tubewell irrigation.

10.7 ENVIRONMENTAL SCREENING

The primary Project activities were flood control. The scoping exercise in Section 10.4 - 10.6 shows that this has been only partially achieved, and in fact the threat of catastrophic flooding remains due to cuts. Drainage systems are suffering because of unplanned road construction within the Project Area.

The environmental screening of the Project activities implicated in section 10.4 - 10.6 shows that the component responsible for most environmental impacts is flood protection.

10.8 CONCLUSIONS AND RECOMMENDATIONS

10.8.1 Conclusions on Project Environmental Impacts

There have been no major positive net impacts, and all the positive impacts are minor in the Project Area. This may be related to the frequency of public cuts of the embankment and natural breaches due to poor design and construction.

The main negative impacts are:

- the decrease in wetlands and consequent decline in the communities and habitats of fish and aquatic micro-biota;
- the resulting decline in capture fisheries;
- the failure to achieve institutional effectiveness and to encourage public participation;
- the threat to the cultural traditions of the largely Hindu capture fishermen;

The major positive impacts seem to have been :

- improved land capability and land availability ;
- increased crop production;

10.8.2 Recommendations

a) Rehabilitation of the embankment cuts and of the drainage systems, improvement of structures and improved maintenance at points liable to breach.

b) Establishment of monitoring programmes for certain critical environmental parameters, including ground water levels and wetland extents including micro-biota.

c) Introduction of an afforestation programme on the embankment.

Table 10.1 : Physical Environmental Impacts.

Physical Issues	Degree of Environmental Impact	
	Project Area Impacts	External Impacts
WATER		
a. River Flow	0	+1
b. River Quality	0	0
c. River Morphology	0	0
d. Flooding	+1	-2
e. Drainage	-1	0
f. Groundwater Levels/Recharge	-1	+1
g. Groundwater Quality	0	0
h. Wetlands and Waterbodies Extent/Recharge	-2	0
i. Wetlands and Waterbodies Quality	-1	0
LAND		
a. Soil Fertility	-1	+1
b. Soil Physical Characteristics	-1	0
c. Soil Moisture Status	0	+1
d. Soil Erosion	0	0
e. Land Capability	+1	0
f. Land Availability	+1	-1

Table 10.2 : Biological Environmental Impacts

Biological Issues	Degree of Environmental Impact	
	Project Area Impacts	External Impacts
FAUNA		
a. Bird Communities/Habitats	0	0
b. Fish Communities/Habitats	+1	0
c. Other Macro-Fauna Communities/Habitats	0	0
d. Micro-Fauna Communities/Habitats	-1	0
FLORA		
a. Trees	+1	0
b. Other Terrestrial Vegetation	0	0
c. Aquatic Vegetation	-1	0

Table 10.3 : Human Environmental Impacts

Human Issues	Degree of Environmental Impact	
	Project Area Impacts	External Impacts
HUMAN USE		
a. Crop Cultivation	+1	-1
b. Livestock	+1	0
c. Fisheries	+1	0
d. Afforestation	0	0
e. Agroindustrial	+1	0
f. Transport Communications	+1	0
g. Infrastructure	+1	-1
h. Domestic Water Supply	-1	0
i. Sanitation	-1	0
k. Recreation	0	0
k. Energy	-1	0
SOCIAL		
a. Human Carrying Capacity	+1	0
b. Demography	0	0
c. Gender	+1	0
d. Age	0	0
e. Health and Nutrition	+1	0
f. Disruption, Safety and Survival	+1	-1
g. Land Ownership	0	0
h. Equity	-1	0
i. Social Cohesion	-1	0
j. Social Attitudes	-3	-3
ECONOMIC		
a. Incomes	+1	-1
b. Employment	+1	-1
c. Land Values	+1	0
d. Credit Availability	0	0
INSTITUTIONAL		
a. Institutional Activity/Effectiveness	-1	-1
b. Public Participation	-1	-1
CULTURAL		
a. Historical/Archaeological Sites	0	0
b. Cultural Continuity	0	0
c. Aesthetics	0	0
d. Lifestyle (Quality of life)	+1	-1

11 OVERALL ECONOMIC IMPACT

11.1 INTRODUCTION

The Konapara Embankment Project commands a relatively small area, and consists of a stretch of earthworks. It is entirely devoid of structures, and appears to suffer from poor design or implementation. This has resulted in heightened social tensions in the area. There is also some ambiguity about the extent of the project area, which is not enclosed. The field investigation suggests that the benefited area has been seriously underestimated. While an exact figure cannot be quoted, it appears that the actual benefitted area is at least 39 per cent greater than the figure used in the Project Proforma.

The project has had a significant impact on a number of areas. As expected, the major impact has been on agriculture. Although these effects have already been reported in the relevant sections, an attempt is made here to present an integrated appreciation. An attempt was made to quantify the agricultural impact, while effects on other sectors/areas have been treated in a qualitatative manner.

11.2 PROJECT COSTS

The Konapara Embankment Project is devoid of structures, and the cost components consist of earthwork and grass turfing, apart from the usual overheads and contingencies. Excluding land acquisition costs, the Project involved a cost of Tk.4.45 million.[1] To arrive at the economic value of the Project, the FPCO conversion factor for unskilled labour was used (.71). This was then converted to the 1987/88 level by inflating by the agricultural wage rate index obtained from BBS (1990), to permit comparison with estimated agricultural benefits calculated with 1987/88 prices (given by FPCO 1991) shown below. The economic cost of the project was estimated on this basis at Tk. 5.95 million, excluding the opportunity cost of the land used. The latter was taken into account by assessing the pre-project net value of output on the area including the land used for the embankment, while the post-project value was assessed on the area net of land used.

Major resectioning of the Project was necessitated following the damage caused by the floods in 1988. It was assumed that the expenditure incurred was 50 percent of total construction cost. In the absence of O&M costs (or any allocation in lieu), it was further assumed that major resectioning would be required once in every 10 years, equivalent to the 1989 level. The total economic cost of the Project at 1987/88 prices therefore stands at Tk. 7.87 million.

11.3 AGRICULTURE

The pre-project agricultural situation was dismal, and the agricultural benefits to the project have been considerable. The Aus, jute and Aman crops were very risky, and irrigated Boro was not popular. The project therefore made a significant difference to agricultural output and employment. Isolated negative impacts, in the form of drainage congestion and adjacent

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1 The construction period was from 1980-81 to 1983-84. Information on phasing of construction costs was not available, so that we assumed that costs are at 1982/83 prices.

area problems have reduced benefits slightly.

The original benefit-cost analysis justifying the project rests on the following assumptions: per acre yields were 10 and 15 maunds for Aus and Aman paddy respectively, and 15 maunds for jute in the without project situation.[2] This was projected to rise by 5 maunds per acre, for each crop. Acreages were 2000, 750 and 7700 acres for Aus, jute and T. Aman, assumed to rise to 2500, 1000 and 7700 respectively. The total increase in production was estimated at 8750 maunds for jute and 56,500 mds for paddy (increases of 78 per cent and 42 per cent respectively)[3].

The socio-economic feasibility study (Naqi, 1980) differs substantially with the base yield figures. The yield data generated by the RRA are closer to Naqi's figures, and have accordingly been used to recalculate the economic performance of the Project. Further, the RRA revealed that the benefitted area has been seriously underestimated in Project documents (eg in the Project Proforma). In recalculating Project benefits and costs, revised acreage figures have been used along with the yield data to arrive at production.

Tables 11.1 and 11.2 provide data on acreage, production and the economic value (in 1987/88 prices) of production and costs by crops. Net benefits pre-Project were found to be Tk. 36.8 million compared to Tk 52.4 million in the post-Project situation - a very significant increase.

Despite the very positive impact on crop output, the Project has had secondary and external effects, mostly negative, that need to be reviewed. The RRA was only able to point to the direction of impact on other relevant sectors, including fisheries, livestock, social and environmental issues etc., so these could not be explicitly included in the formal economic appraisal. It will be clear however, that if one were able to do so, Project benefits would be significantly reduced.

11.4 FISHERIES

Non-agricultural impacts are not normally taken into account at the planning stage, although these may be quite significant. An important area for FCD/I projects is fisheries. The Konapara Embankment has adversely affected open water fisheries but boosted pond fish cultivation. The net effect on fish availability has been negative. There remains considerable potential for further development. This has resulted in reduced employment (of professional fishermen) and greater inequity. For assessment of the economic value of lost fishery output, a loss in volume of 37 kg per hectare (following MPO 1987) of the Project area has been assumed, on a revised area of 4,321 ha. (10,647 ac.), and at an economic price of Tk.27/kg.

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2 See BWDB (undated)

3 Based on Project Report : Konapara Embankment Project, BWDB.

Table 11.1 Economic Value of Outputs and Costs, Pre-Project (1987/88 economic prices)

Crop	OUTPUTS Volume (mt.)	OUTPUTS Value 1/ (Tk.'000)	COSTS Area (ac.)	COSTS Unit Cost (Tk./ac.)	COSTS Total Cost (Tk'000)	Net Output Value (Tk.'000)
B Aus	2585	14947	2772	2476	6865	8083
T Aus	0	0	0	2770	0	0
T Aman LV	7963	52458	10674	2375	25351	27107
T Aman HYV	0	0	0	2476	0	0
B Aman	448	2949	667	840	560	2389
Jute	388	2079	1040	2726	2834	-755
Total		72434			35610	36824

Source: Output volumes Table 4.6; output and input prices based on FPCO 1991.
Notes: 1/ Including by-products

Table 11.2 Economic Value of Outputs and Costs, Post-Project (1987/88 economic prices)

Crop	OUTPUTS Volume 1/ (mt.)	OUTPUTS Value 2/ (Tk.'000)	COSTS Area (ac.)	COSTS Unit Cost (Tk./ac.)	COSTS Total Cost (Tk'000)	Net Output Value (Tk.'000)
B Aus	1772	10245	3167	2476	7841	2403
T Aus	639	3694	463	2770	1283	2412
T Aman LV	4675	30800	6267	2375	14884	15916
T Aman HYV	7397	42767	4407	2476	10912	31856
B Aman	0	0	0	840	0	0
Jute	75	404	202	2726	551	-147
Total		87910			35471	52439

Source: Output volumes Table 4.6; output and input prices based on FPCO 1991.
Notes: 1/ Including by-products

11.5 LIVESTOCK

FCD/I projects tend to adversely affect the cattle population by reducing grazing land area, although this is slightly redeemed by greater availability of stalk and bran by product of paddy. Konapara is no exception, and a reduction of 15-20 per cent in the cattle population is not unlikely. On the other hand, goats and poultry production has significantly increased. It is difficult to say whether the net benefit is positive or negative. Given the greater importance of cattle in an agricultural economy, perhaps a negative sign should be assigned, reducing project benefits.

11.6 COMMUNICATION

Road transport has improved, but boats have declined in importance. We would definitely attach a positive sign to the benefits column to take this into account.

11.7 OTHER IMPACTS

The impact on the environment and women is small, and need not be explicitly recognised, as far as Konapara is concerned. However, strong dis-benefits have been reported by those in the adjacent areas, sometimes resulting in acute social frictions. There is a very sharp division of opinion about the project between those outside and inside. Those adversely affected worry about flood water entering their homesteads and causing physical damage, discomfort and dislocation. The numbers of households so affected could be as high as 3000 (15 mouzas), compared to perhaps 20,000 households deriving some benefit. This obviously means that net benefits need to be scaled down somewhat. The recurrent public cut at Kodalia (see Chapter 9) and the acute social conflict is a Damocles' sword, and threatens Project success.

11.8 AN OVERALL ASSESSMENT

Table 11.3 indicates, for an assumed Project life of 30 years, an EIRR of 37 per cent, NPV of almost Tk. 43 million, and BCR of 7.5 (the two latter measures at a 12 per cent discount rate). Clearly, the Project has been an outstanding success economically, despite its delapidated condition and the likelihood of further damage similar to that in 1988.

Table 11.4 gives an overview of project impacts in the main areas affected by the Project. Apart from agriculture, livestock, fisheries and social harmony, the Project has impacted on physical infrastructure, roads and communication and social institutions. Damage to housing and katcha (dirt) roads has been reduced inside the project, but adjacent area residents have complained bitterly about their increased distress during the flood season. Communication has improved because of the embankment and deserves to be explicitly recognised.

Table 11.3 Economic Cash Flows and Performance Indicators
(Tk.'000 at 1987/88 economic prices)

	Project Cost	Agric. Net Benefit	Fishery Net Benefit	Total Benefits	Benefits minus Costs
1980/1	-595		-904	-904	-1499
1981/2	-2182		-1808	-1808	-3990
1982/3	-2182		-2712	-2712	-4894
1983/4	-2182		-3617	-3617	-5799
1984/5		7808	-3617	4191	4191
1985/6		11711	-3617	8094	8094
1986/7		15615	-3617	11998	11998
1987/8		15615	-3617	11998	11998
1988/9		15615	-3617	11998	11998
1989/90	-2976	15615	-3617	11998	9022
1990/1		15615	-3617	11998	11998
1991/2		15615	-3617	11998	11998
1992/3		15615	-3617	11998	11998
1993/4		15615	-3617	11998	11998
1994/5		15615	-3617	11998	11998
1995/6		15615	-3617	11998	11998
1996/7		15615	-3617	11998	11998
1997/8		15615	-3617	11998	11998
1998/9		15615	-3617	11998	11998
1999/2000	-2976	15615	-3617	11998	9022
2000/1		15615	-3617	11998	11998
2001/2		15615	-3617	11998	11998
2002/3		15615	-3617	11998	11998
2003/4		15615	-3617	11998	11998
2004/5		15615	-3617	11998	11998
2005/6		15615	-3617	11998	11998
2006/7		15615	-3617	11998	11998
2007/8		15615	-3617	11998	11998
2008/9		15615	-3617	11998	11998
2009/10	-2976	15615	-3617	11998	9022
2010/1		15615	-3617	11998	11998
2011/2		15615	-3617	11998	11998
2012/3		15615	-3617	11998	11998
2013/4		15615	-3617	11998	11998
2014/5		15615	-3617	11998	11998
2015/6		15615	-3617	11998	11998
2016/7		15615	-3617	11998	11998
2017/8		15615	-3617	11998	11998
2018/9		15615	-3617	11998	11998
2019/20	-2976	15615	-3617	11998	9022

EIRR %	37.32
NPV @ 12%:	42972
BCR @ 12%:	7.50

Table 11.4 : Aggregate Impact on Output, Employment and Equity

Sector	Output	Employment	Equity	Potential
Agriculture	+++	++	-	+
Fisheries	-	-	-	++
Livestock	-	-	-	-
Non-farm	N	N	N	N
Social Harmony	-	-	-	+
Environment	+	N	N	++
Women	N	N	N	++

Note : N refers to "No Change", A + sign indicates a small positive change, two pluses shows moderate impact. Similarly with minus signs.

12 RECOMMENDATIONS AND OBSERVATIONS

Engineering

Effective functioning of a flood control project like Konapara embankment needs detailed operation and maintenance quidelines. The borrow pits at Bahirsimul, Gazipur and Nasullah have silted up. During the flood season, water flows through these borrow pits at high speed, causing the river side to erode. Drainage control facilities need to be improved by re-excavating the existing drainage channels and other water bodies.

The embankment should be extended up to Pabajuri to protect the Dhurail area from pre-monsoon flood in order to avoid social conflict. The Phutkai area can be protected from back flow of the Dharsa and Kangsa rivers by installing a regulator at the junction point of these rivers. However, a thorough investigation will need to be conducted to decide on the desirabilty of a regulator. It would additionally include by constructing embankments on both sides of the Dharsa river to confine the flow of water. Installation of such a regulator would help in draining out water during the peak flow period and would also serve to store water in the lean period for LLP irrigation. It could also serve as a bridge to facilitate local communication.

The embankment must be realigned in some places to remove social conflict and unhappiness. Proper compaction must be applied to obtain the required durability for such massive earthen structures as embankments.

Proper coordination and consultation with BWDB must be maintained by other agencies while constructing roads within the project area. Project beneficiaries should be motivated to actively participate in operation and maintenance works.

Agriculture

To avoid the early monsoon flash floods and local drainage congestion, the Boro crop should be sown on time. Necessary arrangements for timely irrigation should be made through mutual understanding between the buyer and the supplier of irrigation water. Agricultural Extension people could help in this respect.

Livestock

The following measures can be taken to mitigate the negative effects on livestock arising from the project:

Though production of rice straw has increased both qualitatively and quantitatively, straw alone can not meet the total food requirement of the animals, as straw contains less food value compared to other concentrates. Therefore available fallow land, roadsides and slopes of the embankment could be used to grow food crops (cow pea, khesari and maize) and forage crops (napier grass and para grass) to mitigate the green fodder shortage to a significant extent. This would not only help minimise food shortages, but would also greatly help in reducing the erosion of the embankments and roads.

The farmers of the project area incur great losses in livestock every year due to out break of diseases like ranikhet, foul fox and cattle diarrhoea. To prevent the poultry and cattle from being infected, routine vaccination programmes should be undertaken by the livestock extension officers within the project area.

In order to improve the bullock power and milk producing capacity of the cattle population, a regular insemination programme should also be undertaken within the project area. This would help mitigate the shortage of draught power and reduce the animal protein deficiency of rural people.

Fisheries

The project was completed in the year 1983, and there has been no subsequent rehabilitation programme for fisheries, as a result of which fish resources have greatly deteriorated. It is not possible to revert back to the original state. However, some measures can be taken to mitigate the losses to a significant extent:

- Emphasis must be given to pond fish culture. For this purpose pond owners should be motivated to adopt improved fish culture practices by strengthening extension activities within the project area. Though the ponds are stocked with fish by the farmers, they do not follow any improved fish culture methods. Only very few of them use rice bran as fish food.

- Farmers should be motivated to introduce improved fish culture in water bodies such as beels and khals within the project on a co-operative basis. For this purpose the water bodies need to be reclaimed first so that they can hold water round the year. Then by stocking these water bodies with quality fish seeds the farmers would be able to harvest a good catch at the end of each year.

- Structures such as sluices and drainage outlets should be designed in a way so that the fish can get easy entrance through these to the project area.

Concerned officials such as the Fisheries, Livestock and Agriculture Officers should be involved during future project planning in order to have a clear picture of the pre-project situation. (Comments only)

Nutrition

- As the project area is a food surplus area, more attention needs to be given to fish farming and dairy production;

- More fodder crops may be cultivated in the project area (see section on livestock).

- The potential for crop diversification, particularly to grow more pulses and fruits and vegetables, needs to be explored.

Women

The impact on women is somewhat indirect and difficult to isolate from the many independent factors in operation that have served to improve the economic and motivational status of women. To start with, the presence of the Garo community with their hard working women engaged in all kinds of farm work, combined with the work of NGOs, has probably created a more conducive environment for women to expand their role as economic beings. The intervention in the form of the embankment and its implications for women needs to be seen within this perspective. It is neither possible nor particularly meaningful in such a case to try to identify the pure effect of the project. It should suffice at this stage to merely point out that the project has indeed made everyone's lives slightly better off, including those of women.

Social and Institutional Issues

Social and institutional concerns should be reflected in the project planning process to maximise gains. Discontent is not conducive to efficiency, and can reduce project benefits. The legal issues pertaining to land revenue should be settled immediately and compensation money should be promptly settled.

There is very little popular participation at any level. Ways and means of incorporating and encouraging such participation for better maintenance and operation need to be devised.

Social forestry in the embankment plays a vital role not only in preventing environmental degradation by releasing more oxygen to the atmosphere, but it also creates an additional source of income. Thus there is a need to involve NGOs/ government agencies to fully explore the potential of the embankment as a forestry resource and as a source of employment/income.

There are many informal cooperative societies in the project area. Their activity is limited to providing credit. A provision should be made to involve NGO/BRDB/RCS or any other development agency to work in this area to activate these informal groups and build up more formal groups for social and economic development in the project area.

It is important to undertake thorough socio-economic studies before going ahead with implementation of a project, in order to identify potential social conflicts that can arise to thwart project success.

An effective operation and maintenance (O&M) organisation is a prerequisite for realisation of optimum benefit from the project and therefore, a practical and effective O&M system for the embankment should be developed. Generally where there is no (major) structure, O&M is absent. Embankment type projects (with no structures) may be handed over to the union parishad representatives, who would be better situated to involve local people in O&M. A coordination committee for the project should be formed with upazila level concerned officials along with BWDB to get more effective results from the project.

The social cost of the project was not taken into consideration at the time of planning (i.e. impact on prevailing social structure, social conflicts, sharing of benefits and disbenefits of the project). In many cases, social conflicts arise and become acute. Future projects should take these factors into consideration.

It should also be noted that to reach the desired rate of success, continuous monitoring is required. Thus, completion of an embankment should be taken as the "beginning" not as the "end".

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