

ENVIRONMENTAL IMPACT ASSESSMENT OF DEVELOPMENT ACTIVITIES IN THE SUNDARBANS



Ph.D. Thesis

Researcher

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A Thesis

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**DEDICATED TO THE MEMORY OF
MY RESPECTED PARENTS
WHO LAID THE FOUNDATION OF MY EDUCATION**

DECLARATION

I do hereby declare that I prepare the dissertation entitled, **Environmental Impact Assessment of Development Activities in the Sundarbans**. This dissertation is an outcome of one-year course work experience and field survey under the auspicious of the study was designed to explore degradation of Sundarbans environment for implementing various development activities and to provide an additional contribution to this very crucial issue. I humbly submit this thesis to the Institute of Environmental Science, University of Rajshahi, Rajshahi. No part of it in any form has been submitted to any other University or Institute for any degree or diploma or for other similar purposes.

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CERTIFICATE

It is our pleasure to certify that the dissertation entitled, **Environmental Impact Assessment of Development Activities in the Sundarbans** was prepared by Md. Abdul Mannan, Ph.D. Research Fellow, Session:2007-2008, ID No:07201, Institute of Environmental Science, University of Rajshahi under our direct supervision. The dissertation is an original research work done by Md. Abdul Mannan for the degree of Doctor of Philosophy.

He has tried to explore the experiences and indigenous knowledge of the Sundarbans of various statuses along with the scientific investigations of the consequences of developmental interventions on the Sundarbans.

To the best of our knowledge, this dissertation or part there of has not been submitted for the award of any academic degree, diploma or associate ship of any other similar title to any other University.

Md. Abdul Mannan has fulfilled all the requirements according to the rules of University of Rajshahi for Doctor of Philosophy Degree and has made distinct contribution to this field.

We also certify that we have gone through the draft and final version of thesis thoroughly and found it satisfactory for submission to **The Institute of Environmental Science, University of Rajshahi**, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The study aims at designing a perfect model for, **Environmental Impact Assessment of Development Activities in the Sundarbans**. The main objective of the existing management system of Sundarbans forest and delineates the causes hindering the sustainable development of the forest. The goal of the study has been to propose recommendation for, **Environmental Impact Assessment of Development Activities in the Sundarbans**.

Participatory Rural Appraisal (PRA) and survey methods were used to Assess the present condition of the forest. The nature of the study is imperial. Both primary and secondary data have been used to provide for the study. The technique by which the information has been collected from of Sundarbans forest involves the collection of data mainly from forest related people.

To materialize the present and past developmental activities of the Sundarbans, various policy measures as well as institutional measures have been taken. To emphasize the different aspects of the Sundarbans different development plant have been taken and various government agencies and NGO,s are working in this field to change the fate of them through various multidimensional programmes have been attempted to discuses in the thesis. All these along with the government's policies have created the context for the development of the Sundarbans and how in this thesis through making necessary analyses and interpretations base on available data. But from the different development projects we see that the input and output have not been varied so much.

Environmental Impact Assessment (EIA) Test has been done in six chapters and the monitoring schedule has been made. If we carry on our activities according to the above said monitoring schedule, we will get better results. Respondents provided information on several issues of the forest with the past and present conditions. Many foresters' views including that of 16 Deputy Rangers have been considered in relations to the present management situation of the forest. Several local people have also given their views, which have also been considered.

It is clear from the study that Sundarbans is a valuable source of natural resources. But the condition of the forest is becoming worse day by day. Necessary steps and measures are required to be taken to improve the situation. It has been reviewed that creating an environment that could foster a fearless forest can stop the disappearance or extinction processes. The problems of forest degradation and biodiversity reduction can be eradicated naturally. It is necessary to make general people conscious about the law relating to preservation of forests, long term benefits from the proper maintenance of Sundarbans, the sheer disadvantages for not maintaining the forest properly, and to increase the number of employees.

The problem of piracy in Sundarbans been shown as one of the main problems hindering development work therein. In relation to development work of the forest most of the total respondents assigned at various important management positions of the Forest Department (57.14 % of the officials) mentioned that improving the development work should include measures to protect of Sundarbans from any sort of piracy or robbery. Another problem that chokes the development work of Sundarbans is the inability of the management to forecast properly the weather or other radical environmental phenomenon causing disaster of Sundarbans.

After a long survey and study, some logical suggestions have also been made. To protect Sundarbans, all management work should be taken for development and preservation. To do this first of all we need to protect the management staffs that are engaged in the protection of Sundarbans. Then it is expected that the condition of the forest will be improved. Proper community involvement should be made in order to eradicate piracy and other activities detrimental to the Sundarbans, such as indiscriminate felling of trees, and killing of tigers, deer's, and other animals including water resources.

Finally, for, **Environmental Impact Assessment of Development Activities in the Sundarbans**. The sustainable management of the forest the study proposes to carry out the recommendation made in the thesis.

ACRONYMS

&	=	And
ACF	=	Assistant Conservator of Forest
ADB	=	Asian Development Bank
BA	=	Bachelor of Arts
BFIDC	=	Bangladesh Forest Industries Development Corporation
BFRI	=	Bangladesh Forest Research Institute
BLC	=	Boat License Certificate
BME	=	Benefit Monitoring and Evaluation
BN	=	Bangladesh Navy
BPC	=	Bangladesh Parjatan Corporation
CCF	=	Chief Conservator of Forest (Dhaka)
CITES	=	Convention on International Trade in Endangered Species
CNN	=	Cable News Network
CPR	=	Common Property Resources
CRP	=	Central Reserve Police
DFO	=	Divisional Forest Officers
DFOSF	=	Divisional Forest Officer of the Sundarban Forest
DNPD	=	Deputy National Project Director (for this project)
DRO	=	Deputy Range Officers
DROSF	=	Deputy Range Officers of the Sundarban Forest
ECW	=	Economic Commission for World
EIA	=	Environmental Impact Assessment
EMP	=	Environmental Management Plan
FAO	=	Food and Agriculture Organization
FB	=	Forest Bawalis
FBM	=	Forest Boatmen
FBMSF	=	Forest Boatmen of the Sundarban Forest
FBSF	=	Forest Bawali of the Sundarban Forest
FCDI	=	Flood Control, Drainage and Irrigation
FD	=	Forest Department
FEJB	=	Forum of Environmental Journalists of Bangladesh
FG	=	Forest Guards

FGSF	=	Forest Guards of the Sundarban Forest
FM	=	Forest Mawali
FMSF	=	Forest Mawali of the Sundarban Forest
FR	=	Forest Rangers
FRSF	=	Forest Rangers of the Sundarban Forest
FSF	=	Foresters of the Sundarban Forest
FWC	=	Forest Wood cutters
FWCSF	=	Forest Wood Cutters of the Sundarban Forest
GO	=	Gazette Officer
H.S.C.	=	Higher Secondary Certificate
H $\dot{C}$ -O	=	Aldehyde Group
HCO ₃	=	Bi Carbonate Anion
I	=	One
IES	=	Institute of Environmental Science
IUCN	=	International Union for Conservation of Nature
IX	=	Nine
JFM	=	Joint Forest Management
KNM	=	Khulna Newsprint Mills
LCO	=	Local Community Organization
LGED	=	Local Government Engineering Department
LP	=	Local People
LPSF	=	Local People of the Sundarban Forest
M.M.	=	Mile Meter
M.Phil.	=	Master of Philosophy
M ³	=	Cubic Meter
MA	=	Masters of Arts
MARC	=	Multidisciplinary Action Research Centre
MSD	=	Mangrove Silviculture Division
NGO	=	Non-Government Organization
NRB	=	National Revenue Board
ODA	=	Overseas Development Assistance
PH	=	Concentration of Hydrogen Logarithms. Negative Sign
Ph.D.	=	Doctor of Philosophy
RAB	=	Rapid Action Battalion

RO	=	Range Officers
ROs	=	Range Officers
ROSF	=	Range Officers of the Sundarban Forest
S.S.C.	=	Secondary School Certificate
SAC	=	Stakeholder Advisory Council
SBR	=	Sundarban Biosphere Reserve
SD	=	Standard Deviation
SF	=	Social Forestry / Sundarban Forest
SMU	=	Sundarbans Management Unit
SMW	=	Sunderbans Management Wing
SO ₄	=	Sulphate
SRF	=	Sundarbans Reserved Forest
SSC	=	Sundarbans Stewardship Commission
TA	=	Technical Assistance
TAG	=	Technical Advisory Group
Tk.	=	Bangladesh Taka
UND	=	United Nations Development
UNDP	=	United Nations Development Programme
UNESCO	=	United Nations Educational Scientific Cultural Organization
US	=	United States
V	=	Five
VI	=	Six
VII	=	Seven
VIII	=	Eight
VOY	=	Views of Young
VOYCE	=	Views of Young Concerned Environmentalists
WC	=	Wood Cutters
WCED	=	World Commission on Environment and Development

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Chapter 1

GENERAL INTRODUCTION

CHAPTER ONE

General Introduction

1.1 Name of Sundarbans

There is a popular belief that the "Sundarban" derived its name from the Sundari (*Heritiera fomes*) trees, a major component of the forest. Legends also have it that the forest received its name from foreign explorers, who termed it as the jungle of sundry trees or diverse kind of trees, which finally came to be called the sundrybans.

1.2 History of Sundarbans

At the beginning of the eighteenth century, the forests were about double of the present size and were under the control of Zamindar. In 1969 British government, first took the control over Sundarbans management. In 1878 the Sundarbans was declared as reserve forest and then was placed under the control of Forest Department (Dey, 2001).

The Sundarban Reserve Forest (SRF) in Bangladesh is the single largest mangrove forest in the world. The SRF is a unique bioclimatic zone in a typical geographical situation in the coastal region of Bay of Bengal. This southwestern most part of Bangladesh, which is a landmark of ancient heritage of mythological and historical events and bestowed with magnificent scenic beauty and natural resources is internationally recognised for its wide biodiversity of mangrove flora and fauna both on land and water and is of immense scientific, anthropological and archaeological interest.

1.3 Areas of Sundarbans

Sundarbans is the World largest mangrove forest, 62% in Bangladesh 38% in West Bengal. The area of Sundarbans in Bangladesh is 6017 sq.km. (70% land and 30% water).

Sundarbans forest is situated on the Southwest coastal areas and it is the largest forest in Bangladesh having 6017 sq. miles of areas. The areas 99% covered by the districts of Sathkhira, Khulna and Bagerhat while other

areas are in Patuakhali and Barguna districts. Rajmangal and Burishwar stand on the east and west side of sundarbans respectively.



Source: Google earth Image

Map 1.1 Google earth Map of Sundarbans

The reasons for the growth of such forest areas are existence of different rivers, fertile soil, low density of people, backward communication, saline water, and scope for little economic activities. Two types of woods and timber are found in Sundarban areas. There are timber of the fresh water and timber of saline water. Many Goran trees grow in the forest. There are many rivers and tributaries inside the forest. One part of the forest is separate from other part. Three main areas like Kachikhali, Hiron point and Maudarbari are the main centres for the animals and beasts (**Task Force, 1990**).

The classification of Sundarbans areas is as follows (BFIDC, 1988):

Land

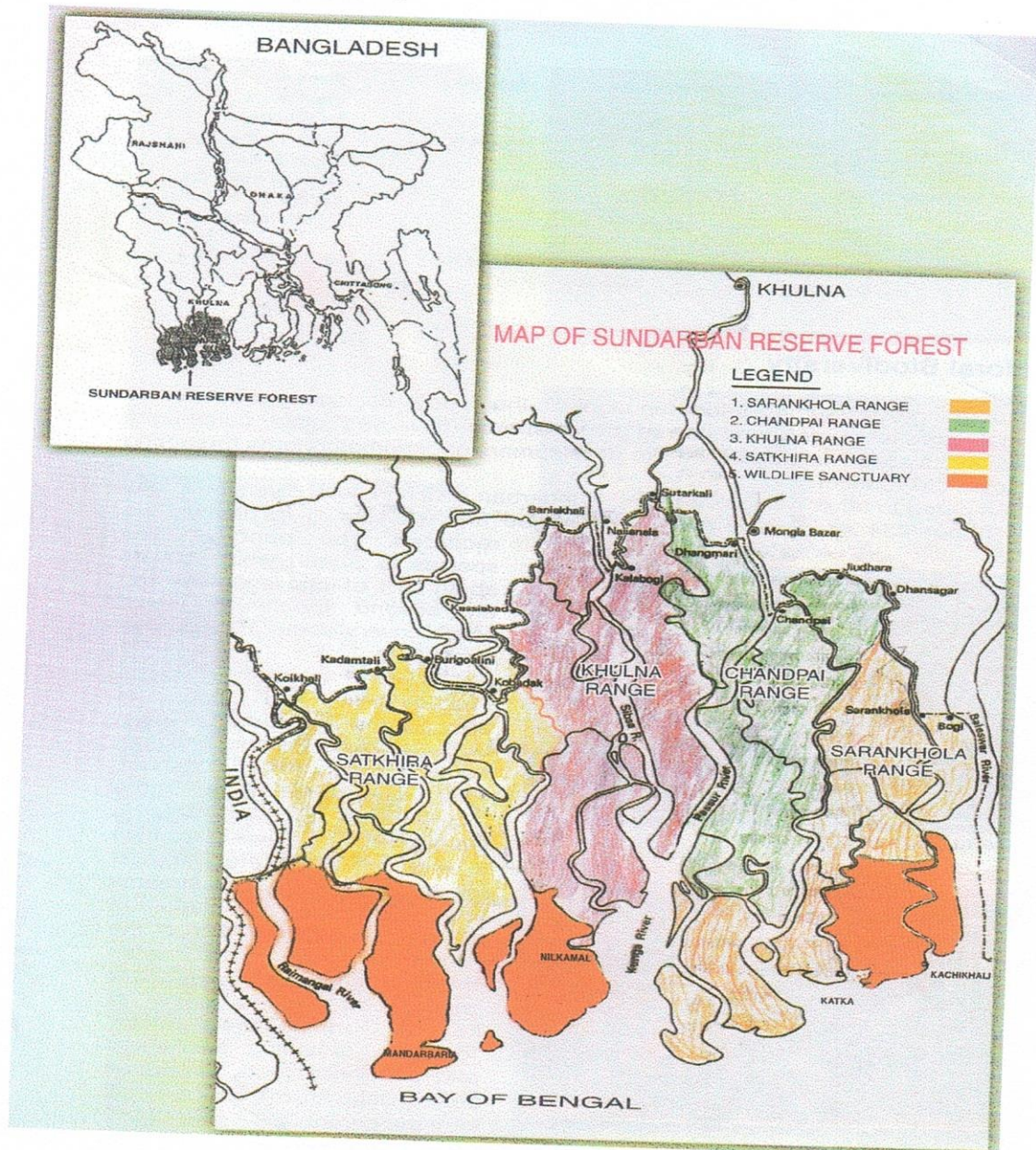
1.	Fresh water area of the East	28%
2.	Half saline water areas	46%
3.	Saline water areas on the west	26%

Name of wood

1.	Sundari and Sundari gewa	50%
2.	Sundari bowul gewa	40%
3.	Gewa prodan goran and garan prodhan gewa forest	10%

1.4 Economic Importance of wood

The economic importance of the forest area is that 60% of the total timber and wood are collected from this forest. These are used for building houses, boats, electric poles, and telegram poles. Annual wood production of the forest is 3 lakh square feet. Gewa wood is used for newsprint and safety matches preparation. This Sundarbans Reserve Forest (SRF) situated in the extreme south-west corner of Bangladesh between the river Baleswar and harinbanga adjoining to the Bay of Bangal and it covers 6017 sq. Km including 3 wildlife sanctuary areas (Dey, 2001).



Map 1.2 Maps of Sundarbans

1.5 Location of Sundarbans

The SRF is situated at the southern part of Khulna, Bagerhat and Satkhira civil district lying in between latitude $21^{\circ} 27' 30''$ and $22^{\circ} 30' 00''$ North longitude $89^{\circ} 02' 00''$ and $90^{\circ} 00' 00''$ East.

1.6 Administrative

Sundarbans is under the administrative of Khulna, Satkhira and Bagerhat districts. Sundarbans is divided into four forest ranges by forest department as,

- (i) Sarankhola
- (ii) Chandpai
- (iii) Nolian (Khulna)
- (iv) Burigoalini

1.7 Wildlife Sanctuaries

Three parts of the forest in the south have been declared as wildlife sanctuaries (**Appendix-1.1**). They are -

- (i) Kachikhali - Katka Sanctuary under Sarankhola range
- (ii) Nilkamol at Hiron point in Khulna range.
- (iii) Mandarbari in the Burigoalini range.

1.8 Different Scenario of Sundarbans

Different scenario of Sundarbans are presented in (**Appendix 1.2**)

UNESCO has declared these sanctuaries as "World Heritage Sites" in 1997.

Located on the southern most extremity of Bangladesh, sundarbans comprise an extensive flat, costal and deltaic land formed by the confluence of the three mighty rivers of the Ganges, Brahmaputra and Meghna. It is crossed by large tidal rivers as well as channels and creeks, all discharging into the Bay of Bengal. Nineteen (19) restricted Khal (deep depression) for fishing are presented in (**Appendix 1.3**).

Khal or channel is a passageway or percaptille depression coataining or periodically flowing water or forming a connehing link between two bodies of water channels may be of three types: i) a river bed;

ii) a relatively narrow stretch of Sea between two land masses and counecting two more extasive areas of sea ; and

iii) the deep, navigalle part of a bay, horbour, etc.

1.9 Climate of Sundarbans

The forest is flat and the maximum ground elevation is 3 meter above the mean sea level. The land developed through the process of sedimentation, subsidence and down wrapping of sediments. The soil is deep alluvium of silty clay loam. It has a tropical humid climate with temperature ranging between 20.4° to 31.5° . The annual rainfall is between 1640 to 2000 mm. The rainfall is strongly seasonal and 85 percent falls during the monsoon, July-October. Semi diurnal type tidal inundation regulates the hydrology of the forest. The four main seasons are pre monsoon (March-May), monsoon (June-September), post monsoon (October - November) and dry winter (December-February). The pre monsoon period is characterized by the southerly winds, high temperature and high rate of evapo transpiration with occasional heavy thunderstorms and norwesters. The forest areas are inundated by tidal water increase, which also raises the salinity of river water.

The monsoon ushers in high rainfall, humidity and cloud cover. Sediment load and water levels of the rivers also increase. The salinity level is lowered due to the influence of onrushing freshwater from the upstream region. Occasional thunderstorms, cyclones, storm surges and rising salinity levels of river water occur during post monsoon season. Generally, violent cyclonic storms brew in the Bay from mid May to mid June due to north coastal winds, Cyclones also occur in October and early November.

The dry winter season is characterized by cool, dry and sunny weather with low precipitation.

1.10 Topography of Sundarbans

The Sundarbans as a mangrove forest is a coupled system linked by water to sea and land. The system is not independent of neighbouring areas and the ecological processes of coastal area. It is not possible to see the Sundarbans thriving independent of sea or land. The Sundarbans at the interface of land and sea is strongly influenced by external factors such as flow of freshwater and sediment from upstream, tidal charges from the sea, land and sea based pollution and sea level rise.

Three great rivers the Ganges, Brahmaputra, Meghan and their distributors carrying freshwater and enormous sediment from upstream have contributed to the formation of the delta on which the Sundarbans has developed. The entire coastal area was once covered by forest. It is believed that the delta is subsiding at a rate of 5mm per year. This process of subsidence has resulted in upliftment of the ground. An expert visit further confirms it.

The Sunderbans is the largest contiguous mangrove forest ecosystem in the world. It is situated in the South Western part of Bangladesh and lies between latitudes 12 30' N and 22 30' N longitude 89 0' E and 89 55' E having an area of 5,773 sq. kilometer. Out of which 4,074 sq. kilometer is mangrove reserve forest and 1,699 sq. km. is open water bodies (**Chaffey et al., 1985**).

The forest is flat land. Maximum ground elevation 3m above sea level. Land developed mainly by sedimentation. Soil is deep alluvium of silty clay.

1.11 Rivers of Sundarbans

About 450 large and small rivers in Sundarban, Baleswar and Pusur rivers bring fresh water from Padma to Sundarban.

The forest encompasses a land area of 6017sqkm, of which 1874sqkm constitute the river water area. The forest is bordered to the south by the Bay of Bengal while polders and agricultural land border the forest to the north. The western border follows the Raimangal-Harinbhanga Rivers, which also forms the international boundary with India. To the east lies the Baleswar River and Meghna estuary.

There are rivers and canals spread across this forest like a net with their innumerable branches. Nearly 450 large and small rivers occupy about 1 lakh 75 thousands 685 hectares or about 30 percent (%) of the Sundarbans. The Biggest River is the Pusur. Other rivers worth mention are Baleswar, Sibsa, Arpangasia, Bhola, Horinbhanga, Kalindi, Andharmanik, Raimangal, Kapotaksha, Koira, and Shela Bhadra *etc.* As one proceeds to the south, the rivers widen. Some rivers are so wide that one cannot see one bank from the other. Baleswar and Pusur rivers and their tributaries and disrbutaries are connected with the Ganges. As a result these rivers and their branches have flow of fresh water. The sibsa and other rivers in the western part have their source of fresh water only in the Ganges and the nothern portion of the sundarbans depends upon the rainwater. As a result, the fresh water flow in these rivers decreases during the dry season when there is a massive intrusion of saline water. Moreover, the condition of the rivers and canals in the sundarbans is deteriorating shoals are forming and navigability is declining. River erosion is taking place at some places.

The rivers, canals, creeks *etc.* spread across of Sundarbans like a net with their innumerable branches. There are neatly 450 large and small rivers that occupy the water areas of the Sundarbans. The biggest river is the pasur. Other rivers worth-mentioning are the Baleswar, the Sibsa, the Arpangasia, the Bhola, the Horinbhanga, the Kalindi, the Andharmanik, the Raimangal, the Kapotaksha, the Koira, the Shela Bhadra *etc.* As they once proceed to the south, the rivers become widen.

There are about 102 Islands in the Sundarhans of which some 58 Islands are inhabited. A large number of these inhabitants are directly or indirectly involved in fishing, fry collection or fish marketing *etc.*

1.12 Shrimp Farming

Bangladesh has extremely favourable conditions for shrimp culture with low cost of production. Prior to construction of coastal embankments, traditional shrimp culture in a limited scale had been in practice in the coastal areas of Satkhira. Under the traditional system, tidal water carrying shrimp juveniles and fin fishes were allowed to enter during February to April through sluice gates of the embankment. The trapped youngs are allowed to grow for about four months before harvest. After the harvest of the shrimp, the land is used for rice cultivation during July to December. However, coastal embankments as constructed for increasing rice production adversely affected the natural life cycle of many fishes and prawns inhabiting the sea and the estuaries. The different types of shrimps received from the Sundarbans (**Appendix-1.4**).

Shrimp crustaceans related to crabs and lobsters, of the order decapoda, found in all types of waterbody throughout the world. There are so many types of shrimps in Bangladesh, like galda, bagda, bil shrimps, *etc.* Some species live near the shore; some others swim about in groups in deep, cold water. They are of grey, brown, white or pink in colour. Some have bands over the body, some have spots. Some shrimps are red, yellow, and green or blue in colour, some species can change colour to match the surroundings. Many deep sea species are luminescent (light product). The size ranges from 2.5 to 30cm.

With the increase in demand and price, shrimp culture started expanding since 1970s. Tidal lands with embankments for protection from brackish water intrusion for rice cultivation are being used increasingly for shrimp culture. According to a survey conducted during 1982-83, the area under shrimp culture was 52,000ha. Presently, land under shrimp culture has increased to about 0.11mha. About 75% of this land is located in the Khulna, Bagerhat and Satkhira districts in the south-west and the rest in the Cox's Bazar district in the south eastern region of the country. According to an estimate, the area suitable for shrimp culture in the country is about 0.2mha. In Khulna areas, shrimp is cultured in the dry season and paddy in the rainy season and in Cox's Bazar area, shrimp culture and salt production are carried out alternatively.

1.12.1 Economic Importance of Shrimp Farming

Shrimp plays an important role in the economy of Bangladesh. It has become third highest export earner. In 1992-93, the country earned about US\$ 150 m from the export of shrimp which is 6% of the total national export earning and 86% of the export earnings from fish and fishery commodities. The present shrimp catch from the sea stands at 17,600 tons while 45,000 ton are caught

pm the inland open water. The production from the coastal shrimp farms is about 20,000 tons.

1.13 Eco-Turism of Sundarbans

1.13.1 Eco-Tourism and recreation

The National Tourism Policy proposed that, because of its unique and diverse attractions of international renown, the Sundarban should be developed. Ecotourism is a sustainable form of land use, which contributes to environmental conservation, while providing accrued socio-economic benefits to the people through the non-consumptive uses and indirect values of the natural biological resources. The goal of ecotourism is to promote an environmentally friendly business and to generate local income. In reality, ecotourism is an economically viable industry at the national and local levels. The accrued benefits derived from ecotourism offer positive social and economic impact to the local community through employment opportunities, educational and healthcare programmes.

The Sundarban is a unique ecosystem. Different scenario of Sundarban in Bangladesh are presented in **(Appendix 1.2)**. Its exceptional scenic beauty and rich wildlife can be a source of attraction to different levels of people and is convenient for outdoor recreation. Ecotourism or conservation tourism may be developed without causing damage to vegetation and wildlife. Because of weather condition tourism will be limited to winter months when the climate is favourable. The only way to visit the Sundarban is by water transport. Access to the forest by water transport is environmentally friendly. The Sundarban consists of a cluster of is let having diverse and rich natural resources and intersected by a network of rivers and channels. There is a great chance of seeing different wildlife species e.g. Royal Bengal Tiger, Spotted deer, Estuarine Crocodile, a variety of dolphins, reptiles and a certain number of birds. 50,000 days visitors visit SRF annually and 500 to 600 international tourists travel to the Sundarban especially for the recreation and leisure. Different rates of transport for tourist are shown in **(Appendix1.5)**.

1.14 Statement of the Problem

Sundarbans, the world largest mangrove forest is now under threat due to over exploitation of forest resources, illegal encroachment, over hunting and fishing, shrimp culture, conversion of forestland into agriland and inappropriate management by forest department. About 50 lakh people living around Sundarbans are mainly relying on natural resources of Sundarbans. Forest Department assumed that about 1,50,000 people enter into Sundarbans everyday for their livelihood. In that situation, a sustainable management plan instead of present traditional management can only protect the bio-diversity of Sundarbans. The proposed study would explore the causes of forest

degradation, illegal encroachment, over exploitation and the weaknesses of existing forest management. The mitigation measures of these problems were addressed in sustainable development procedure. Here lies the justification of the study.

1.15 Need for the Study

Sundarbans forest has a number of vital implications for the development of our economy and maintaining ecological balance as well. It is due to the existence of Sundarbans the growth and development of paper mills, newsprint factories, rayon mills, match factories, pencil factories, transport industry, weaving mills, leather factories, construction industries, wood processing factories, pharmaceuticals industries, bamboo and cane industries and other industries like saw mills, wood product factories etc. have been facilitated.

Realizing the importance of the maintenance of existing forest and further forestation in order to maintain a squarely proportion of forest area in relation to our total country area, the Government has taken some pragmatic measures for the development of the forest areas and has also constituted Bangladesh Forest Industries Development Corporation for optimum utilization of forest resources without breaking down the ecological balance.

Sundarbans has been losing its potential to contribute to our economy owing to rapid deforestation process. Discerning the importance of stemming impending disaster going to be taking place in Sundarbans and in order to increase its potential the government has postponed any sort of extraction from the forest till 2010. Postponement of extraction may be a solution but it is at the cost of hampering the productivity of various industries based on the forest resources of Sundarbans. Moreover, the mere stoppage would be of vain if the various stakeholders associated with the forest under study are not made alive to the hard consequences of the rampant cutting down of the woods, and extraction as well as destruction of other animal resources resulting in the ecological imbalance. A mechanism should be worked out in order to balance between the needs of the forest resource based industries and the needs of protecting the forest from the rampant extraction of its resources. A number of researches have been made on various issues responsible for degradation of Sundarbans over the last hundreds of years.

Thus it is the high time to assess the ecological impact of Sundarbans when the various issues affecting the ecosystems as well as proper management of Sundarbans should studies on a continued basis.

1.16 Objectives of the Study

The research work has been designed considering the following objectives:

- (i) To observe the present environmental impact assesment of development activities in the Sundarbans.
- (ii) To find out the present environmental problem of the Sundarbans.
- (iii) To assess the steps taken by Bangladesh Govt. for the conservation of ecosystem of the forest.
- (iv) To know the adverse effects due to ecological changes in biodiversity, soil structure, rainfall, temperature and deforestation.
- (v) Finally, to find out the eco-friendly development activities in the Sundarbans.

This chapter attempts to describe the historical background of the Sundarbans with its objectives. In this chapter areas of Sundarbans, location of Sundarbans, climate of Sundarbans, topography of Sundarbans, rivers of Sundarbans, cannels of Sundaebans the statement of the problem, need for the study, and objectives of the study have been presented. This chapter actually outlines the plans of the study, and the next chapter "Review of literature of developmental activities of Sudanbans." describes as to how the plans of the study have been executed.

Chapter 2

REVIEW OF LITERATURE OF DEVELOPMENTAL ACTIVITIES OF SUNDARBANS

CHAPTER TWO

Review of Literature of Developmental Activities of Sundarbans

The researcher has gone through a huge number of literatures related to the study. The aim was to find out a gap potential to further research, which would help fill in the research gap. Different research studies have been carried out in the functional aspects of the Sundarbans. Some of the related literatures reviewed by the researcher have been enumerated below:

Review of Literature

Ali (1983) had research on *National Forest Policy* was made in 1979. Prior to 1980 the forest department attempted to involve the rural people in forestry through its extension activities when Bangladesh came into being in 1971; the country inherited a mismanaged forest department. The first decade kept the government busy with projects for rehabilitation of the war affected people and restoration of communication work. It was during 2nd Five Year Plan 1980-85, that the government directed its attention to the preservation and building up of forest resources. The project known as community forestry project-I was made operational in June 1982 with allocation of 26.36 crore Tk. The project aimed at creating employment opportunities for rural landless labourers and opening up ventures for income generation for the poor farmers.

This study did not consider socio-economic and environmental issues of forestry. The discussion of Sundarban forestry have not considered here.

Ahmed and Rahman (1992) prepared a research on *Planning and Management of Social Forestry in Bangladesh*. They found that the highlighted multi-dimensionality has placed additional responsibilities to the traditionally organized forest department the government. The department is now required, besides its conventional roles of protection of and production in reserve forests, to develop contacts with people. The tasks mobilizing and organizing the rural people who are mostly illiterate, landless and socially disadvantaged to involve

them in social forestry of all descriptions (strip plantation, homestead forestry and community forestry) call for systematic and vigorous extension works.

This research did not consider the socio-economic and environmental issues of forestry in Bangladesh. The discussion of Sundarban is not reflected here. So an indepth study is necessary.

Katiyar (1993) prepared a research on *Environmental Concerns, Depleting Resources and Sustainable Development*. In 1980, the World Conservation Strategy emphasized the need for conservation of living resources to achieve sustainable development. Sustainable development, as defined by (WCED) is development that meets the needs of the present without compromising the ability of future generation to meet their own needs. By needs it has meant the essential needs of the world's poor, to which overriding priority should be given.

Simply put sustainable development is a developmental process where the exploitation of resources, the direction of the investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs, and aspirations. At the same time due to his very biological nature, man has to depend on natural resources for his sustenance. But the basal productivity of natural systems is so low that it cannot support today's population, so, people must intervene to increase economic yield. Again, increasing economic yields in most cases adversely affects the self-restoring capacity of the environment, which is well evident today. Accordingly, sustainable development is defined as a production system in which the technological and management inputs do not adversely affect the bio-physical system which has a basal productivity, *i.e.*, output, which can be harvested with little or no input

The writer discussed about Sustainable development of the bio-physical system which has a basal productivity. But this research did not take other resources into consideration for this analysis. The research did not consider the socio-economic and environmental issues of forestry in Bangladesh. The discussion of Sundarban is not reflected here. So an indepth study should be required in this regard.

Ali (1994) prepared the article on *Sundarbans Resource and Eco system*. The Sundarbans is the largest contiguous mangrove forest ecosystem in the world.

The Sundarbans is composed of 5,773 sq/km of reserve forest of which 4074 sq/km is mangrove and 1699 sq/km is open water bodies. The Sundarbans represents about 45% of the natural productive forest managed by Forest Department and provides livelihood for at least 500000 people mainly woodcutters, fishermen, honey-collectors and golpata collectors. The forest is being managed primarily for the production of timber, pulpwood, thatching material and honey.

He reported that, a very rich and diverse flora and fauna including at least 330 species of plants, 120 species of commercially important fishes, 270 species of birds, 12 species of mammals, 35 species of reptiles and 8 species of amphibians. The mangrove ecosystem in the Sundarbans is more dynamic, fragile, unique and complex where the individual plants and physical environment interact in the process of fixation of energy, accumulation of biomass decomposition of dead organic matter and in nutrient recycling.

He also reported that top dying of sundri trees in some compartments is bringing changes in the floristic composition. Harvesting of shrimp fry in large quantity is causing immense damage to fish population. Lack of good communication and transport facilities and acute shortage of drinking water are the added problems in the management of the Sundarbans. Due to its unique nature, there exists a vast potential for development of eco-tourism in the Sundarbans.

In this article it has been discussed about the Sundarbans resource and Ecosystem. But the writer did not consider environmental impact of the Sundarbans. So, an in depth study should be required

Fakir (1994) had published an article on "Integrated Management of Ganges Flood Plains and Sundarbans Ecosystem". Khulna University is located in the resourceful southwestern part of Bangladesh. Endowed with highly fertile land and favorable sub-tropical monsoon climate, the region has

immense potentialities for agricultural production. The vast Sundarbans, the world's largest single tract mangrove with innumerable rivers, streams and their tributaries criss-crossing the deltaic area flanks the region in the south. Besides, it is gifted with a rich and varied biological and genetic diversity of plants, birds, fishes, mammals, reptiles and amphibians. The marine and brackish water in this region is recognized as a potential area of physical, chemical and biological resources. In this area the shrimp culture has been flourishing well in spite of various problems. The agricultural land of this region offers tremendous scope for production of high value crops. But emerging problems of situation, increase in salinity, desertification, and stagnation of water, top dying of sundri, genetic erosion of valuable biological diversity etc. has been seriously affecting agriculture, forestry, fisheries, livestock and ecology, resulting in environmental imbalance in this region.

This article discussed about the integrated management of Ganges flood plains and Sundarbans ecosystem. But this article failed to reveal the environmental impact and economic damage. So a comprehensive study is necessary.

Fakir and Islam (1994) had a focus an article on "Strengthening Social Forestry in Khulna Region." Khulna Division lies in the South Western part of Bangladesh and is one the most vulnerable head of the Bay of Bengal. Out of the 16 districts in Khulna Division only three support Government owned forest – the Sundarbans. Through the Sundarbans forest produces volume of timber and fuel wood, the very little reaches the poor living in the remote areas of the region because of the difficulties in extraction, poor communication and industrials uses of wood as raw materials for Khulna News prints Mills and Khulna Hardboard Mill.

Fuel wood is almost a basic need for the rural people. In order to provide the poor with fuel wood in an economic and environmentally sound way, there is no alternative to social forestry. Besides, social forestry can provide them with timber, food, fodder, land fertility, and cottage industries. This, in turn, will help improve the living status of rural people and overall economic growth of the country.

Social forestry activity started in Bangladesh in 1979. Initially, its success was limited due to constraints in fund, lack of appropriate technology. Public awareness, rural institutions and political commitment. Social forestry programme has given due emphasis and consequently gained great momentum under the present Government.

To make the social forestry programme a success, creation of public awareness, motivation of the poor, community organization, financial support, development and dissemination of appropriate technology through research are of prime importance. The role of Khulna University in making Social forestry Programme a success in this region is stressed.

In this article the author discussed about "Strengthening Social Forestry in Khulna Region" But this article did not take others resources into consideration for this analysis. So an indepth study is necessary in this regard.

Hassan and Mazumder (1994) had published an article on "The Ganges Floodplain Soils and The Related Environmental Aspects." The Ganges Floodplain covers 3.6 M ha of land area in Bangladesh. The once productive region has recently been suspected to suffer from an adverse geophysical change mainly because of change in the Ganges flow during the lean season due to the commissioning of the Karaka barrage. The relationships among the geological, edaphically, environmental, social and eco-catastrophic aspects of the region have been narrated in the present paper. The necessity for an integrated management of the ecosystems has been emphasized.

The Ganges sediments are recent, unconsolidated materials which are textually homogeneous both in horizontal and vertical directions. The estuarine floodplain is partly saline. Southwest part of the estuarine floodplain is covered by the Sundarbans. The meander and the pondered estuarine floodplain are used for agriculture. Soil formation in the unripe ned sediments proeedes through ripening, homogenization and profile development. The soils are alkaline calcareous, silt loam to clay depending on their occurrence in the landscape. Dominant minerals in the sand fraction include quartz, feldspars, micas, calcite, dolomite, biotitic, amphiboles, epidotic and gurney. Dominant

clay minerals are sometime, elite with some calamite, chlorite and vermiculite. These soils are rich in their mineral nutrient contents. Soil and water salinity shows a seasonal gradient reaching at its peak in May and at the bottom in November in general, salinity increases from south towards north and from east towards west.

This article discussed about "The Ganges Floodplain Soils and the Related Environmental Aspects." But the writes did not consider the Bio-diversity of Sundarbans. So an indepth study is necessary.

Huda (1994) had research on "Seed Production Potential of the Ganges Floodplains." Seed is the critical input which crop production and effectiveness of the inputs like fertilizer, irrigation etc depend fully. Organized seed production programme, which can provide quality seed at right time, in right place and at a right price, is necessary to ensure use of quality seed. Suitable agro-ecology is the most important factor in the development of seed industry. Low rainfall and humidity in the north-western part of the region is very congenial for seed production More than 40% of the country's total seed, supplied by the public sector is produced in this region. Rice, wheat, Jute, Pulses, Oil seeds and vegetables seeds are being produced by Bangladesh Agricultural Development Corporation in these areas. Private seen entrepreneurs have initiated seed production in some places of the region. Potentiality of this region for production of good quality seeds need to be explored to meet the local demand as well as for export needs.

This article discussed about "Seed Production Potential of the Ganges Floodplains." But the writer of the article did not consider socio-economic condition of the Sundarbans. So, it helps to understand the concept and its implication.

Islam, et al., (1994) wrote an article on "The Effects of Human Interventions on the Fisheries resources of ganges flood plains and the Sundarbans estuary". The Ganges Flood Plains contain various types of water bodies viz. ponds, beels, baors, flooded lands, rivers etc. while the Sundarbans estuarine area comprises the extensive flat coastal and Ganges delta which is crossed by

large tidal rivers discharging into the Bay of Bengal. The total area under water is relatively constant but the area under flooded lands is gradually declining because of various interventions by human. On the other hand, the area under shrimp cultivation is increasing gradually. The different features of ponds, beels, baors, flooded lands and rivers of the Ganges flood plain, and the Sundarbans estuary are presented in this paper along with the status of the fish resources. Effects of different human interventions like Farakka Barrage, Coastal Embankment Project (CDF) and Flood Control, Drainage and Irrigation (FCDI) are probable reasons behind fall in capture fishery by 30%, beel fishery by 40%, flood plain fishery by 26% and the combined river and estuarine catch by 31%. However there is a well as increase in culture fishery by 48%.

This study discussed about the effect of human intervention of gang as flood plains and the Sundarbans estuary. But this research did not mention other species of Sundarbans. So a comprehensive study should be required.

Leech (1994) made an important research entitled "Integrated Resource Development of the Sundarbans Reserved Forest". The Sundarbans is an extremely complex and fragile ecosystem that has a high public and political profile in the Bangladesh psyche. It is essential that it can be managed wisely for the benefit of the country, both now and in the future. Timber production is only one of the major utilization aspects of these forests.

In this study the researcher discussed about researched forest avoiding all other flora and fauna. So a comprehensive study is required in this aspect.

Mazid (1994) wrote an article on "Status and Potential of Shrimp Farming in Khulna Region." Aquaculture plays an important role in nutrition, income employment and foreign exchange earnings of Bangladesh. Fish contribute nearly 80% of animal protein intake, 3.5% to GDP and 7% to export earnings. The country earns about US\$ 150 m cones from shrimp alone. Potentiality exists for freshwater aquaculture in about 0.15mha. Whereas brackish water aquaculture mainly involving shrimp cultivation, covers an area of 0.11mha. The culture system is predominantly. Shrimp Farmers mostly using Extensive and semi-intensive fertilization and occasionally both feeding and fertilization.

Integrated fish/shrimp farming with paddy is also in practice. The giant freshwater shrimp and tiger shrimp are cultured mostly by extensive, extensive improved and to some extent by semi-intensive methods. The production ranged from 150-5.000 kg/ha/yr based on communication, electricity. Marketing and inadequate feeds and seeds etc are major constraints to both fresh and brackish water aquaculture development.

The major environmental factors having negative effects on aquaculture development are by and large because of man made intervention in river morphology. Disruption of ecology. Intensive agriculture and modern developments. Added to these natural calamities like flood. Draught and cyclone also adversely affect. Chemical pollution is very little in the brackish water but soil erosion. Heavy salination Salinity and oxygen fluctuations, mangrove disruption, land use conflicts etc, are emerging as the major problems along with indiscriminate wild collection of juvenile shrimp.

This article discussed about "Status and Potential of Shrimp Farming in Khulna Region." But this article failed to reveal the environmental impact of the Sundarbans. So a comprehensive study is necessary.

Rahman (1994) had made an article on "Diseases and Wood Decay of Tree Species with Particular Reference to Top Dying of Sundriy and the Magnitude of its Damage in the Sundarbans in Bangladesh." The Sundarbans, occupying on the south – western part of the Gangetic flood plains in Bangladesh is the largest single tract mangrove ecosystem in the world. It covers an area of .57m.ha.

Status of the diseases and disorders has been determined through analysis of 120 permanent sample plots (PSP) data and reconnaissance survey of the Sundarbans. Top dying disease syndrome is the most serious tree disease problems in the country. Previous all dead and dying sundry trees were considered to result from top dying, but the present study has revealed that there are at least four independent problems such as: 1) typical top dying; 2) root rot and resultant die back of sundry; 3) sapwood decay and death of sundry; and 4) massive mortality of sundry due to siltation in localized areas.

Other disease problems include root rot and die back of gewa, die back of passur, keroa and goran; heart rots in living keroa, passur, dhundul and been; mistletoe of gewa and sundry.

Examination of records from the PSPs in the Sundarbans indicates that gewa is the most common tree species in terms of number of trees followed by sundri, goran, baen, amur, keora, kankra, passur, singra, dagor and dhundul in decreasing order.

Sixteen wood and cull decay fungi have been collected, identified and deposited in forest Pathology Herbarium of Bangladesh forest Research Institute, chaittagong.

A comparative data of 1975-76 Showed 1.7 million top dying sundri in the sundarbans, while in 1983-84 has been estimated at 45.2 million. Out of this, 25.02 million trees occupying an areas of 25446 ha have developed moderate top dying (less than 50% of the crown affected) and 20.18 million trees covering 19848 ha have been severely affected (more than 50% of the crown damaged). This represents a very huge increase in the bulid up of top dying trees from 1975-76 to 1983-84.

Trends in the incidence of top dying of sundri, sundri, - gewa and gewa – sundri forest types during 1988-89 showed slight increase in the rate of top dying of sundri.

Previously it was believed that major impacts of top dying resulted from secondary invasions by heart rot fungi and wood boring beetles. Present studies suggest that the most important cause of further death and deterioration of sundri trunks are sap wood decay fungi. Extent of degeade of wood quality due top dying has been determined .Out of 88525-felled top dying sundri, 15.69% were found to be totally dead. It has been estimated from 22518 felled dying sundri trees felled in compartments 32. 36 37 that 1803m³ or 42.32% was saw long and suitable for lumber production, 1571,21 m³ or 36,86, that 1803 m³ was typical top dying degrade and the remaining 887.30 m³ or 20 .82% degrade resulted from dead trees. This is a huge loss in wood production in forestry terms.

This article discussed about "Diseases and Wood decay of tree species with particular reference to top dying of sundriy and the magnitude of its damage in the Sundarbans in Bangladesh." But this article did not consider environmental impact of the Sundarbans. So, a comprehensive study should be required.

Kabir (1994) authored an article on "Environmental Aspects of Ganges Withdrawal on the Sundarbans Ecosystem". Major environmental changes are under-way due to anthropogenic processes, which has been exacerbated by deliberate diversion of Ganges water upstream at the Farakka Barrage. Early signs are that the flow changes have induced measurable impacts on the southwest region of Bangladesh. These impacts include changes in the micro and macro-flora and fauna due to salinity intrusion and more distant impacts on larger fauna caused by changes to early stages of their life cycle, especially in the Sundarbans. The Sundarbans is experiencing a severe salt intrusion, reaching a peak in April/May. It has been reported that about 45 million sundri trees have been seriously affected by top dying.

Kabir wrote an article entitled to "Environmental Aspects of Ganges withdrawal on the Sundarbans Ecosystem". This article did not consider socio-economic condition of Sundarbans. But it helps to understand the concept and its implication.

Larsen (1994) observed the "Mangrove Harvesting and Transportation in Sundarbans". According to the information recently published by the DFO/DNPD, the Sundarbans Division had a revenue of 12, 33, 08,500 Tk. and an expenditure of 3, 41, 69,200 in 1992-93. This gives a net income of 8, 91, 39,300 Tk. for the fiscal year.

Based on one of the potential improvements for reducing wastage, which is discussed in this report, it should be possible to increase the annual revenues of Sundarbans Division by about 4,00,00,000 Tk. per year, more or less, depending upon the actual harvest levels, etc. This would produce a considerable increase in net income.

The researcher did not show the environment and socio-economic impact of Sundarbans. So an indepth study is required.

Khan and Alam (1997) had a survey on "Market Dynamics in Selected Social Forestry Projects in Bangladesh: An Exploration". In view of the limited research on market dynamics of Social Forestry (SF) projects in Bangladesh, this article is an attempt to shed light on some market related aspects of two selected SF projects, which are popularly cited as examples of 'successful' SF practices in the country. The principal aim of this research is to probe into selected market dynamics in the study areas to assess and understand how conducive the market environment for the performance of the concerned SF projects is. The market forces in the study area comprise of commercial timber loggers, city-based timber traders (including their rural agents) and socioeconomic elites. The SF farmers, as observed during the field work, have virtually no control over market and, therefore, are vulnerable to varied manipulation and exploitation by market forces. This is attributable to many reasons including the relatively poor condition of the farmers, and the strength and pervasiveness of the commercial network in Bangladesh, patronized by the state itself.

The discussion regarding Sundarbans forest is not reflected here. This research is conducted only to assess the marked environment for the performance of the concerned Sundarban Forest Projects. This study did not assess the natural environmental factors. So an indepth study is required.

Chowdhury (1998) explained in his paper on "Productivity of the Sundarbans is 1.12 cubic metres per hectare per year, which is the lowest among the mangrove forests in the world." Productivity is reducing day by day because all kinds of flora and fauna, including trees, fish and birds are decreasing (State of Sundarban). The researcher in this paper discussed about Sundarbans but did not assess the environmental impact of Sundarbans.

Shahid, et al., (1998) had observed on "Potential Use of Remote Sensing for Integrated management of The Ganges Flood plain and The Sundarbans". The Ganges flood Plain and the Sundarbans ecosystem cover a large area in

southwestern part of Bangladesh. Environmental condition of this area is rapidly changing due to Farakka Barrage, deforestation, flood, cyclone, drought, industrial and other pollution etc. The current and accurate data on these environmental changes are essential for formulating policies. Plans and programmes for development and management of the area. The best method of collecting these data is through remote sensing techniques.

Its attempts have been made to highlight the use of remote sensing technology to study environmental changes of the Ganges floodplain and the Sundarbans ecosystem. The study includes changing trends of shrimp farming and agricultural area, dry season water pools, water logging and salinity intrusions. The paper also describes the future potential of remote sensing technology in the study of environment of Ganges floodplain and the Sundarbans ecosystem.

All studied were made to use of remote sensing technology for environmental changes. But no work about environmental management and developmental activities of Sundarbans. So, a depth study is needed in this regards.

Ali and Ahmed (2001) analyzed the "Bio-diversity Conservation: Vision for Bangladesh". Accelerating the establishment of the national network of nature conservation and reserved, protected areas that include a full range, type and level of bio-diversity and which will have a reasonable distribution and appropriate area coverage. Establishment of a network of ecologically critical areas by including more critical areas of the country and ensuring their proper management. The 'ecologically critical area management' (ECAM) will have a significant and positive impact on the long-term viability of the nationally and globally significant bio-diversity resources. Conservation of special habitats and eco-systems such as hill forests, Shal forests, wetlands, mangrove ecosystems, coral reef ecosystems, estuarine ecosystems as well as the protection of migratory animals and birds. Conservation of habitats other than those within the nature reserve system, including but not limited to selectively felled forests, secondary bushes, farm fields, etc. Emphasis may be placed on conserving the agro-ecosystem and agricultural species by establishing a

number of sites for in situ conservation of the wild relatives of crop species and by seeking gradually to establish a number of protected areas or agricultural field types which are of local significance. Establishment of network for off-site (ex situ) conservation of genetic materials from rare and endangered species of flora and fauna. They reported that strengthening research work to conserve the bio-diversity of freshwater and marine aquatic life for off-site conservation of endangered species of aquatic life forms. Restoration of degraded eco-systems to restore habitats that have been seriously affected by drought, salinity, deforestation, soil erosion, beach compaction, sand dune formation and deposit of coarse sand due to flash floods. Developing information system for monitoring the conservation of bio-diversity. Monitoring conducted by using a unified monitoring technical code and by using aerial surveys, lasers, GIS and others. Subsequently, establishment of wildlife monitoring system and developing standards for surveying wildlife may be emphasised. As well as all these, national monitoring and information system for bio-diversity in agricultural systems may be set up and may focus on the monitoring, classification and storage of information about diversity in wildlife, crops, livestock, poultry and aquatic life.

Implementation of eco-system approach and community-based conservation programme of bio-diversity. Measures to mitigate the adverse effects caused by cyclones and floods and anticipated global warming and sea-level rise co-operation on the protection of bio-diversity. Bangladesh will continue to expand bilateral and multilateral cooperation and wishes to enhance exchange and cooperation in the field of management, scientific research technological development, technical transfer and manpower training. This may include joint establishment of trans-boundary nature reserves or the cooperation among countries having nature protection of migratory animals.

This research was not conducted on Sundarbans forest. But this will build up, strong conception.

Manju (2001) had experiment on "Sundarbans Biodiversity Preservation Project: Blessing, or curse in disguise". The Sundarbans over an area of 6,000 square kilometres, i.e. more than half of the reserved forest area of

Bangladesh. Stretching along both sides of the border, Indian state of West Bengal and southwestern Bangladesh, the Sundarbans is the largest mangrove forest in the world. There are reportedly 425 species of wild animals including the famous Royal Bengal Tiger and 334 species of trees and plants in the Bangladesh portion of the forest. Situated on the lap of the Bay of Bengal the developed a unique and sensitive ecology under the influence of the ebb and flow of tides that occur twice daily. The Sundarbans supplies 45 per cent of the country's demand for timber and fuel wood. It is the direct source of livelihood for about 50 lakh people residing in the neighbourhood. Over the last 100 years, the Sundarabans has become the victim of men's cruel and greedy exploitation. Terrible damage has been done to its flora and fauna.

He reported that the Sundarbans, with its extensive natural resources and still-rich bio-diversity, has, of late, earned international attention. The UNESCO has declared three sanctuaries in the Sundarbans as World Heritage Sites in 1997. The Sundargans' Bio-diversity Preservation Project is, therefore, not only an initiative to enrich the World Heritage Site, but also to preserve it for mankind. The need to formulate an integrated plan to ensure proper management of the Sundarbans despite the ever-increasing population pressure in the neighbouring localities is urgent.

The main aim of the Sundarbans Bio-diversity Preservation Project is national use of resources by ensuring participation of people directly dependent on the resources of the Sundarbans. It also aims at the development of a durable and sustainable management system of the forest within the project period. Hence, priority has been attached to increasing the institutional capacity of the Sundarbans management authorities. Batiahata, Dakope, Boira and Paikgachha in khulna district, Ashashuni, Kaliganj and Shyamnagar in Satkhira district, Morrelganj, Rampal Shyamkola and Mongla in Bagerhat district, Bhandaria, Mathbaria and Nasirabad in Pirojpur district and Bamna, Patharghata and Borguna Sadar in Barguna district stand adjacent to the Sundarbans. About 50 lakh people of these areas are totally dependent on the Sundarbans for their livelihood. The project includes an initiative to create scope for the well-being of these people through the development of social

infrastructure, increase in the institutional empowerment of users of the resources of the Sundarbans and their participation in the management of resources.

The writer in his article did not consider the assessment of impact of environment and socio-economic condition. So an indepth study should be required.

Ahmed and Hamid (2003) had published an article on "History of Human settlements around the Sundarbans". His ultimate target all human activities in the welbeing of the society. This well being is initiated by the people themselves by utilizing various natural and other man made resources. The increased pressure on and demand for forest resources and agricultural land due to the growth and migration of populations have led to a wide spread degradation of the Sundarbans over the last two hundred years. In this paper an attempt has been made to trace the history of human settlements in this part of the globe and consequent incorporation of the forest with the socio-economic life of the inhabitants. It is revealed that in the way of meeting their ever-increasing demand man has to a great extent over exploited the scarcest natural resource of this region. This has resulted in serious depletion of this valuable heritage.

This study discussed only human activities but this study did not analyze the environmental and socio-economic condition of Sundarbans.

Ahsan, et al., (2003) Examined in their article on "Soil and Water Characteristics in the Eastern part of the Sundarbans". The soil and water characteristics in the eastern part of the Sundarbans have been determined as an outcome of special soil survey work conducted in February, 2000. Within the study area soil colour ranges from olive grey to dark grey. Topsoil textures ranges from silty loam to silty clay, subsoil textures ranges from silty loam to clay; subsoil textures ranges from silty loam to clay. Soils are stratified to weakly structure, no calcareous to calcareous. Topsoil organic matter status varies from low to very high and it ranges from 1.72% to 4.93%. The pH values ranges from 4.5 to 8.5 in different horizons. Strongly acidic pH in lower part of

the pedon may be the indication of buried toxic potential acid sulphate layer. Subgroup level of these soils is classified as Typic Haplaquepts respectively. The total N, p and Zn deficiency are considered to be widespread in these areas. K and S are found rich in all the pedons. Almost all the micronutrients are found rich except Zn. Some soils are found SO_4 dominated and some are Cl dominated. The ionic preponderance decreased in the order to $\text{Cl} > \text{SO}_4 > \text{HCO}_3$ and $\text{SO}_4 > \text{Cl} > \text{HCO}_3$. Electrical conductivity of topsoil ranges from 5.7 to 24.4 dS/m. Electrical conductivity of river water increases from upstream to down stream within the Sundarbans and it ranges from 8.7 to 23.8 dS/m. Highest electrical conductivity (EC_w dS/m 23.8) is observed in the Betmore river near Harintana and the lowest (EC_w dS/m 13.3) in the Mrigamari river near Chandpal. Cl and SO_4 are also increased from upstream to down stream.. SAR value ranges from 7.98 to 11.48. The ionic preponderance decreased in the order of $\text{Cl} > \text{SO}_4 > \text{HCO}_3$ in all the water samples. PH of the river water samples ranges from 8.1 to 8.4. Ground water table is found within 1.0 meter in all the sites. Elcectrical conductivity of ground water within the Sundarbans ranges from 13.3 to 30.7 dS/m. pH value varies from 7.7 to 8.0. SAR value ranges from 9.8 to 13.5.

This study discussed about soil and water characteristics in the Sundarbans but did not reveal the importance of other resources such as wood, fishes, animal, lives etc. So an indepth study should be required in this regard.

Azad, et al., (2003) prepared a research report on "Use of Biomass as Cooking Fuel: A Study of a Village Peripheral to the Sundarbans". Biomass resource dominates in the energy sector of Bangladesh; About 80% households in the rural areas depend on biomass for cooking. Its extensive and unplanned consumption pattern of biomass fuels leads the consumption beyond the regenerative limit, which also has serious environmental consequences. Every year a significant amount of forest biomass is used by the villagers as cooking fuel especially at the peripheral areas of the Sundarbans. This causes a tremendous pressure on the Sundarbans and the stress is increasing day by day as the population is increasing and availability

of biomass from domestic sources is decreasing. A coastal village located in the periphery of the Sundarbans has been considered as the study area. The study has been conducted through questionnaire survey. Different types of biomass fuel and their consumption pattern have been determined. The study comprises a quantitative analysis of biomass fuel with respect to their sources. The results indicate, people who belong to lower income group highly consume tree and agricultural residues because of their easy access. Higher income groups use fuel of higher quality i.e., fuel wood. Biomass from the Sundarbans is highly consumed by the same and woodcutters (Bawalees). About 35% of fuelwood used by the villagers come from the Sundarbans, while the rest from homestead forests.

This study did not mention about socio-economic condition and environmental impact. But this study will build a solid conception.

Ahmed and Ahmed (2003) in their paper had record on "Control of Illegal Activities in the Sundarbans: An Overview of the Regulatory Aspects". A large number of statutes are used for enforcing law to manage the Sundarbans. Two statutes are frequently used the Forest Act of 1927 and Wildlife Preservation Order, 1973. Both the statutes are no amended according to the present needs. According to the section 33(1) of the Forest Act 1927, for activities such as fishing, burning lime or charcoal, unauthorized extraction of trees, trespasses or pasturing cattle, in any reserved forest, the person may be arrested but he is bailable. Such convicts should not be bailable if the question arises to preserve the resources of Sundarbans. Similarly, the right of discharge of perishable goods according to the Wildlife Preservation Order 1973 should not be allowed any more. Mobile Court may be established under Section 30 of the Order of 1973, which is not implemented, in reality.

This paper discussed about the control of illegal activities in the Sandarbans. But the paper did not mention economic impact and environmental impact of Sundarbans. So comprehensive study is required.

Bhuiyan (2003) wrote an article on "Prospects of Ecotourism in the Sundarbans". The Sundarbans Mangrove Forest of Bangladesh has many

ingredients, which fulfil the requirements to develop ecotourism. The extensive forest, the innumerable rivers and creeks passing through it, the islands with tempting silvery sea-beaches, the majestic Royal Bengal Tiger, The basking crocodiles, the roaming spotted deer besides rivers and glades, the typical appearance of the forests along with soothing breeze kissing over the serene water of the river and embracing the tossing head of the river bank plants all take a tourist to surprise, as if lost into the mysteries of nature. The Sundarbans, its rivers and creeks with deep dense foliage of the mangrove forest offer immense opportunity for the tourist to move in a maze in the watercourses. There are many people is the special characteristics of the biotic and abiotic systems of the Sundarbans forest. One of the strongest attractions for many people is the special characteristics of the Sundarbans and the ecology of the mangrove formation.

This article mentioned the prospects of ecotourism in the Sundarbans but did not consider environmental impact of ecotourism of Sundarbans. So an indepth study should be required.

Huq and Tareque (2003) introduced a study on "Importance of the Sundarbans Mangrove Forest in the Context of Fisheries Resource". The sundarbans mangrove forest has a significant contribution in fisheries resources of Bangladesh from ecological and economical point of views. Information regarding the topic has been collected from different relevant GO's and NGO's. The total land area of Sundarbans is 577285 ha of which 401685 ha is land area and 175600 ha is water body. This water body supports diversified fisheries resources and in case of some particular fisheries species, serves as an obligatory spawning and nursery ground. Among the fisheries resources, 400 species of 63 families of fishes, 5 families of shrimp, 4 families of crabs, 15 families of molluscs and some other reptiles and mammals of fisheries importance have been enlisted. The production and income from the Sundarbans fisheries resources in 1990-2000 was 3354.83 MT and Tk 9136869.6 respectively.

This article discussed about mangrove forest in the context of fish rich resources. The writer did not consider other species to analyze it. So an indepth study is necessary.

Khan and Rouf (2003) wrote an article on "The Sundarbans Fishery at a Glance". The Sundarbans supports a very rich and diverse flora and fauna including 334 species of plants, 315 species of birds, 53 species of reptiles, 49 species of mammals, 8 species of amphibians and more than 120 species of fishes. The Sundarbans water area (3359 sq.km) annually contributes over 15000 metric tons of finfish, more than 3600 metric tons of shrimp and crab, 750 metric tons of illish and nearly 180 million tiger prawn fry. It has been indicated that the trash fish shows the highest level of extraction than other groups of fishes in the Sundarbans. Usually three types of vessels and sixteen types of gears are used to harvest the Sundarbans fishes. The annual value of fishes caught is reported to be Tk. 183 crores. This is three times higher than the extracted annual wood products valued Tk. 68 crores.

This article discussed about the Sundarbans fisheries only. The writer did not mention other important resources of Sundarbans. So as indepth study should be required.

Karim and Islam (2003) examined on "Shrimp Culture around the Sundarbans and its Effects on Land, Agriculture, Livestock and Poultry: A Case Study of Some Selected Villages of Rampal Thana, Bagerhat District". The spectacular rise of the demand of brackish water shrimp international market has stimulated the interest of its production. Presently its culture has taken a massive horizontal expansion and engulfed almost the entire coastal belt of the country. The study identified that problems created by shrimp cultivation are mutually interdependent. Its effect influences directly and indirectly the physical, socio-economic and environmental status of the area concerned. Present practices of shrimp cultivation make some social inequality in terms of land ownership. Quantitative relationship between the percentages of household and the percentages of land represents a greater degree of inequality in the distribution of land. The percentage of agricultural land use has decreased significantly. The average yield of paddy per hectare of land (once

occupied by shrimp farm) has declined substantially. The possibilities of cultivation of jute, wheat and vegetables have been diminishing gradually and ultimately downgrading the socio- economic base of the population of the area. The increase of soil and water salinity has upset vegetables production. The flooding of land for shrimp culture reduced the availability of grazing land and has made it difficult for the survival and existence of livestock.

This study analyzed the impact of shrimp culture on land, agricultural, livestock, and poultry. But the writer did not consider other species. So an indepth study should be required.

Matin, et al., (2003) wrote the article on "Habitat, Regeneration and Harvesting of Goran (*Ceriops decandra*) in the Sundarbans Mangrove Forest". Mangroves of Bangladesh occur in the form of natural forests as well as plantations. The Sundarbans located in the southwestern part of Bangladesh serves as a source of many woody and non-woody products. Among the diversified plants that occur in the Sundarbans, Goran (*Ceriops decandra*) is the second most valuable fuel wood species. Goran is species of saltwater zones and occupies 2% as pure forest and 14% as dominant species in mixed forest. The species is also found in moderate salt-water zones as dense under story. It occurs as undergrowth associated with scattered *Excoecaria* and *heritiera*. It shows natural regeneration from viviparous propagules or from coppices and is harvested by cutting in a cycle within a silvicultural system similar to cyclical coppicing. Very little information is available on recruitment, survival and growth of Goran. Regeneration data from 12 permanent Sample Plots (PSP_s) maintained by Bangladesh Forest Research Institute revealed the occurrence of only poor regeneration of Goran during 1981 to 1991. Under the current system there is no fixed felling cycle for Goran. Goran is harvested during November to April. The species has great importance from its ecological and-economic points of view.

In this article, the researchers conducted their research on Goran trees only. They did not consider other species for this study. So, an indepth study is necessary in this regard.

Murtaza, et al., (2003) in their study on "Socio-economic Conditions of the People Depending on the Resources of the Sundarbans: A Study of the Impact Zone". The Sundarbans has been playing a significant role in the economy of the southwestern region of Bangladesh, in particular as well as in the national economy, in general. The limited resources of the forest are being indiscriminately extracted which exerts a profound impact on overall environment as well as on the economy the country at large. The study reveals that the people living in the impact zone of the Sundarbans are to some extent dependent on the limited resources of the forest for their livelihood. It is pertinent to formulate a policy for sustainable forest resources extraction of the forest for overall betterment of the stakeholders. For this purpose, there is an urgent need for adequate and up-to-date knowledge about the socio-economic status of the people those are dependent on the resources of the forest, particularly living in the vicinity of the Sundarbans.

This study discussed about socio-economic condition of Sundarbans only. But the environmental impact assessment did not consider here. So an indepth study should be required.

Rahman (2003) made study entitled "Top dying of Sundri (*Heritiera fomes*) Trees in the Sundarbans: Extent of Damage". The Sundarbans is the largest single tract mangrove forest in the world. Sundri (*Heritiera forms*) is the most important tree species in the Sundarbans covering 62.7 per cent of the area and constituting 63.8 per cent cent of the standing tree volume. Top dying of sundri is considered to be the most serious of all the diseases and disorders of trees in Bangladesh and is believed to be the result of complex interactions of biotic and biotic factors. Out of 55 compartments in the Sundarbans 22 compartments have been badly affected by top dying of sundri. An examination of the records of 85525 trees from the Forest Department's Top Dying marking and Felling Registers revealed that 16.92 ± 5.88 per cent of top dying trees were totally dead and unsuitable for lumber production. Such trees are mostly affected by sapwood rot caused by a number of fungi and are also attacked by insect. Salvage harvesting operations have been completed in several compartments having a high proportion of top dying of sundri. An analysis of

the data obtained from the Forest Department's top Dying Marking and Felling Registers for 25 sundri trees from each of the compartment nos. 32, 34, 37, 38 and 39 revealed that on an average 57.43 ± 6.40 (at $P=0.05$) per cent of the total volume of sundri wood could be recovered as saw log. Wood deterioration from these compartments due to top dying has been estimated to be 42.18 ± 4.69 per cent (at $P=0.5$) of the total wood produced up to a top inner bark diameter of 10cm. This is considered to be a very heavy economic loss in forestry term. Total volume of sundri round logs and fuel wood produced from top dying sundri trees extracted from the Sundarbans during 1990-91 to 1997-98 have been provided.

This study discussed only Sundari Trees in the Sundarbans. This study did not consider other resources for the analysis. So, an indepth study should be required.

Rahman, et al., (2003) observed their study on "The Salinity, Its Distribution and Importance in the Sundarbans Reserved Forest in Bangladesh". Salinity is regarded as a problem when the concentration of sodium chloride, sodium carbonate, sodium sulfate or salts of magnesium in water contents is present in excess. Local variations in the rate of water input and removal cause geographic and temporal variations in salinity. In the ocean, latitudinal variations in the relative rates of precipitation and evaporation control the salinity of surface water. In the Sundarbans Reserved Forest (SRF), the tidal water is the main source of salinity which is counter balanced by the flow of fresh water coming from the upland region. A huge amount of fresh water is carried from the upper catchments areas from India, Nepal and Bangladesh to the SRF through its river system. There are three saline zones in the SRF. The salinity pattern shows both seasonal and spatial variations. Salinity has considerably increased in recent years due to diversion of the Ganges water upstream at Farakka in Indian.

This study discusses about Sundarbans Reserved Forests regarding the salinity, its distribution reserved forests. But the writer overlooked of socio-economic and environmental impact assessment of Sundarbans. So a comprehensive study should be required.

Rakkibul, et al., (2003) had a study entitled "Development of Ecotourism in the Sundarbans: Expectations and Concerns". The prospect of Ecotourism in the Sundarbans Reserve Forest (SRF) is great. The area natural features together with other asserts of water way, vegetation, climate, location, sea-beach, various wildlife such as Royal Bengal Tiger, deer, monkey etc. render the Sundarbans to be an ideal place for ecotourism. The main attractions of the Sundarbans are wild life, natural beauty and the opportunity to sail in the solitude of wilderness through its hundreds of rivers and channels. The present study was carried out to identify problems and prospects of ecotourism in the Sundarbans for promoting its natural resources conservation through upliftment of socio-economic conditions of the surrounding people. Maximum tourists (29%), visit the Sundarbans for taking rest and relaxation. About 23% tourists come to get experience from natural beauty and wilderness in the Sundarbans. The study showed that the highest percentage of tourists (27%) visit the Sundarbans for observing wildlife in natural environment. The major problems identified by tourists are security (27%), accommodation (23%), communication (13%) and absence of proper tour guide (12). Most of the tourists want to visit the Sundarbans for a three days trip and their expected expenditure is Tk. 800/- to 1000/- whereas the tour operators charge Tk. 2500/- to 6000/- for three to four days trip in the Sundarbans. Tourists and tour operators in the Sundarbans expect the facilities of natural resorts, different kinds of infrastructure such as observation towers, Jettles, wooden trail, goalghars, improved communication system, security, development of tour guides mostly from local people, improve water vessels, fresh water supply, night canoeing facilities, public awareness etc. Ecotourism should run in the Sundarbans under a management plan through which income generation of the local people of the impact zone will be ensured by their active participation as local tour guides, ownership of tourist water crafts, local handicrafts selling, conserving local cultures and traditional things.

This article discussed about "Development of Ecotourism in the Sundarbans." But the writer did not consider environmental impact of Sundarbans. So an indepth study should be required.

Rouf, et al., (2003) had an empirical study on "Livelihood of a Shrimp Fry Collector Community Adjacent to the Sundarbans: A case Study of Sonatala Village, Bagerhat". Shrimp fry collector community is considered as one of the most vulnerable communities in the southwestern part of Bangladesh. In the context of livelihood, less awareness and lack of law enforcement; limited access to information; unavailable drinking water; corruption in land allocation; extinction of valuable fish species are noticeable. Access to health and educational facilities are limited. Communities have limited access to both on-farm and off-farm income activities. Sufferings are overcome by co-operation in certain extent but encircled economically by Dadon system. Moreover, Government's invention on shrimp fry collection, restriction on gear use, closure of fishing season, declaration of sanctuaries have reduced their earnings. They are ultimately facing food scarcity, insecure shelter and debt. For the improvement of their livelihood, alternative and diversified livelihood strategies are needed. Most of the recommended alternatives require technical as well as financial support. It is not easy to provide all this supports to the large number of poor fishing community as well as solution of their problems.

This study did not consider other resources except shrimp culture. So an indepth study should be required.

Rahman (2003) described in this article on "The Sundarbans: A World Heritage Site". The Sundarbans Covering an area of 601702.7 ha is located in the southern parts of Bagerhat, Khulna and Satkhira districts of Bangladesh. It is divided into 55 compartments. An area of 139699.5 ha (inclusive of 48670 ha water bodies) in three locations in compartments nos. 53, 54,55 and part of 49 was declared as Wildlife Sanctuaries on 6 April 1996 under Article 23 (1)(2) of Bangladesh Wildlife (Preservation) Order 1973 amended as Bangladesh Wildlife (Preservation) Amendment Act 1994. These are known as east, west and south wildlife sanctuaries. The UNESCO in its South Asia Meeting to Review Status of Conservation of World Heritage and Design in a Co-operative Plan of Action have declared the Wildlife Sanctuaries as World Heritage Site for future in New Delhi, 16-18 January 1997. A plague of the World Heritage Site

was unveiled by the then Prime Minister of Bangladesh on 4 February 1999. A complex network of tidal waterways, mud flats and small islands of salt tolerant mangrove forests, intersects the area. It has a unique ecosystem having a wide variety of flora and fauna. The Royal Bengal Tiger, the estuarine crocodile, spotted deer and other innumerable varieties of wildlife are present in the forest. The Sundarbans being a reserved forest is a public property where there is no access of the general public without prior permission from the local forest administration. The world Heritage site is a property of the global community.

In this article discussed about "The Sundarbans: A World Heritage Site." But the writer did not consider environmental impact of the Sundarbans. So, indepth study is necessary.

Shah (2003) published an article on "Research Needs for the Sustainable management of the Fisheries Resources of the Sundarbans Mangrove Ecosystem". The Sundarbans mangrove is a unique natural resource for Bangladesh. It is located in the southwest of the country, in the coastal districts of Satkhira, Khulna and Bagerhat. It covers an area of 6017 km² of which water areas cover 1874 km². The fisheries and wildlife resources of the Sundarbans are one of the most diverse ones; so also its water courses inside. For various criss-crossing problems, the sustainability of the fisheries resources of the Sundarbans has been at a stake.

In this article the writer discussed about sustainable management of the fisheries resources only. But this article did not take other resources into consideration for this analysis. So an indepth study should be required in this regard.

Sazzad, et al., (2003) in their study on "Problems and Prospects of Development of Tourism Facilities at Katka in the Sundarbans" focused that tourism is a rapidly growing activity in third world countries. In the coming years, it would be the largest incomegenerating sourceforce a number of countries. During the time of reduced performance in the export sectore, a number of developing countries have encouraged tourism, as a quick foreign exchange earning sourcewhich is vital for their development. Bangladesh is a

small country, but it has too many places which would attract the tourist. Due to lack of proper management and planning these places have not been able to attract the internal and international tourists as well. The present study discusses how Katka could be developed as a tourist spot. Katka is one of the most attractive spots in the Sundarbans, but the tourists visiting here are facing a number of problems like accommodation, shortage of drinking water, transportation and so on.

This article discussed about “Problems and Prospects of Development of Tourism Facilities at Katka in the Sundarbans.” But the writer did not consider Bio-diversity of Sundarbans. So an indepth study should be required.

The present chapter has presented a good number of literatures that have been reviewed while carrying out this study. It has been observed that none of the work cited above did give emphasis to the present environmental impact assesment of development activities in the Sundarbans. The present study for the first time has placed importance on the Sundarbans and selected the Sundarbans East and Sundarbans West for study purpose. Any study should begin with its full conceptual base and with this view in mind the next chapter, “Materials and Methods” has been designed to present conceptual aspects of the study.

Chapter 3

MATERIALS AND METHODS

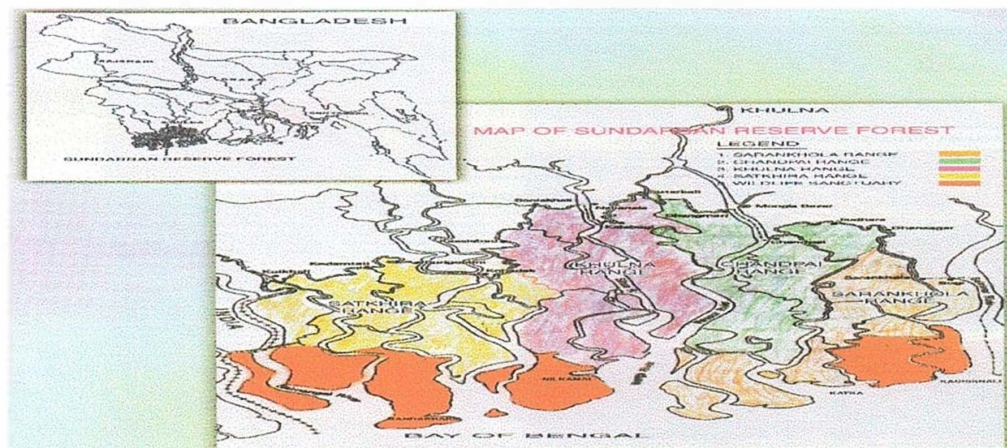
CHAPTER THREE

Materials and Methods

The previous chapter, *i.e.*, the second chapter has dealt with the Review of literature of developmental activities of Sundarbans. This chapter, the materials and methods of the study, deals with determining sample size, identifying the nature and sources of data, process of collecting data, tools and techniques used in analyzing the data. The study was based on field survey and sample collection. Publications of Bangladesh Forest Development Corporation, Ministry of Industry, and Task Force Report were collected. The researcher was interviewing the officials of the Corporation through an Interview Schedule. The researcher was interview related executives of the forest authority and workers of the forest areas. Khulna University was also interviewed to know their perception and experience about the environmental impact of the forest, as the university exists in that zone.

3.1 Study Area

The Sundarban Reserve Forest is situated at the southern part of Khulna, Bagerhat and Satkhira civil district lying in between latitude $21^{\circ} 27' 30''$ and $22^{\circ} 30' 00''$ North longitude $89^{\circ} 02' 00''$ and $90^{\circ} 00' 00''$ East. Sundarbans is under the administrative of Khulna, Satkhira and Bagerhat districts



Map 3.1 Sundarban Reserve Forest

Table 3.1**Sundarban is divided into four forest ranges by forest department**

Ranges	Study spot & area
(i) Burigoalini	Burigowalini, Kobadak, Kodomtola and Koikhali station; Dobeki, Shekbaria, Munshigonj, Notabeyki, Holdibonia, Mandarbari and Pospokati camp.
(ii) Nolian (Khulna)	Kashiabad, Baniakhali, Nolian, Kalabogi and Sutarkhali station; Hozbaza, Gorankhali, Kosom, Hodda, Shipsa, Vodra and Koilasgonj camp; Avoyronno Nilkamal, Gewa Operation Center, Mowsumi Goran Kup, Mowsumi Goal pata Kup (Shipsa), Mowsumi Goal Pata Kup (Matua Shipsa).
(iii) Chandpai	Chandpai, Daonmari, Diudhara and Dhansagor station; Bodhomari, Nandabala, Harbaria, Gharamari, Japshi, Boraitola, Katakhal, Kolomtezi, Nangli, Mortirkhal bishes, Poshur Nodi Jowtho and Horiptana duthmokhi jowtho bishes camp.
(iv) Sarankhola	Bogi, Supoti and Sarankhola station; Jeale polli camp (dubla), Domoria, Chorkhali, Shapla, Dotmokhi, Terabeka, Vola, Tearchar and Kokilmoni camp; Kotka avoyronno center, Kachikhali avoyronno center, Ganpara bishes camp and Sonnashi mobile camp.

3.2 Administrative Structure of Sundarbans

Sundarban forest Division includes 4 (four) Ranges, (Sarankhola, Chandpai, Khulna and Satkhira), 17 Forest Revenue Station and 54 Patrol Posts/Camps. A total of 1048 staffs are working in different categories. Administrative structure of different ranges is presented in diagram 1 to 4. Sampling areas are shows by block mark.

Diagram 1

Divisional Forest Office of Sundarbans West

District - Sathkhira

Administrative Structure of Burigowalini Range

Sampling are: Block Mark (Blue Colour)

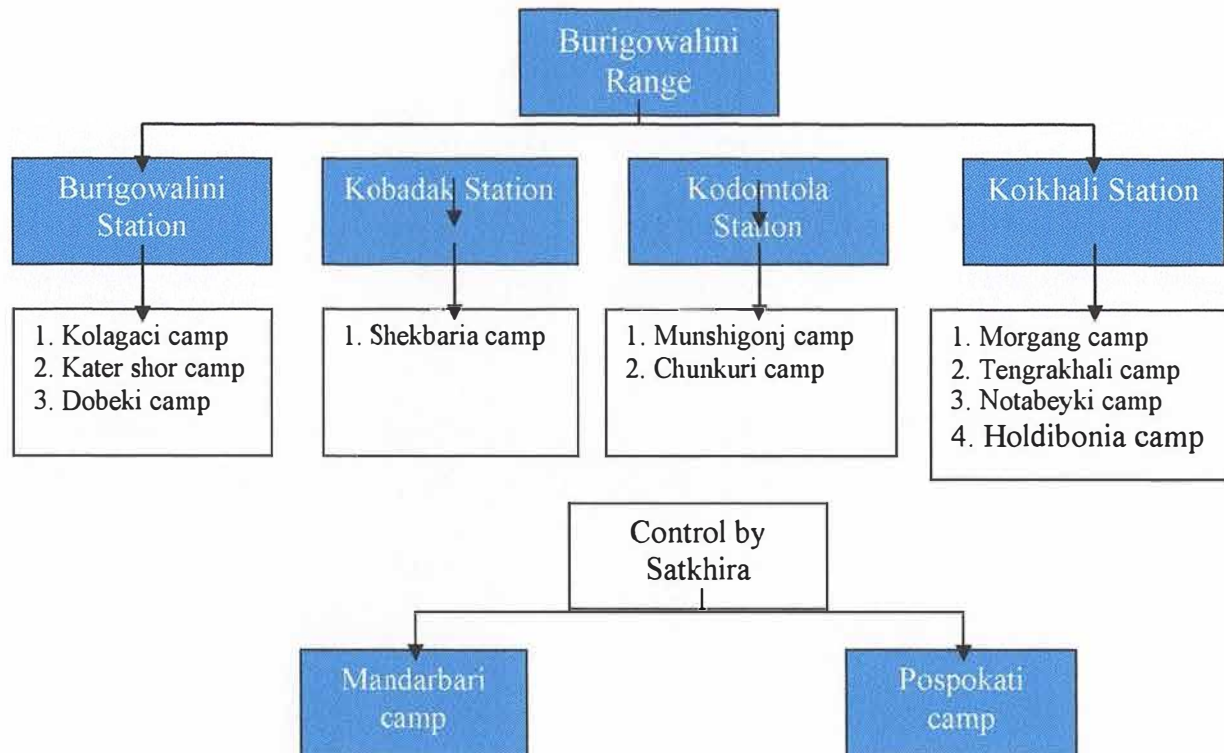


Diagram 2

Divisional Forest Office of Sundarbans West

District – Khulna

Administrative Structure of Nolian Range

Sampling are: Block Mark (Blue Colour)

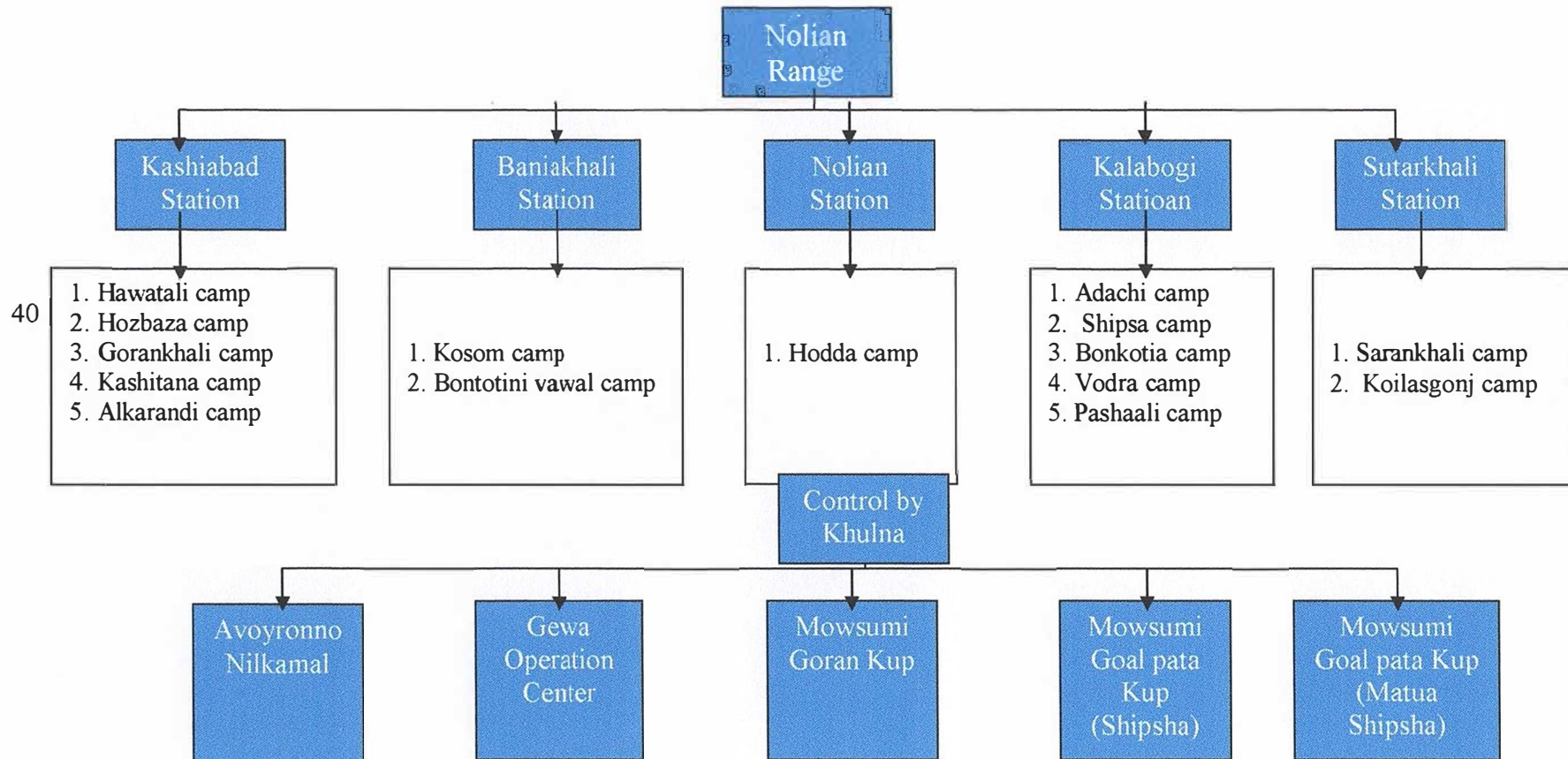


Diagram 3

Divisional Forest Office of Sundarbans East

District - Bagerhat

Administrative Structure of Chandpai Range
Sampling are: Block Mark (Blue Colour)

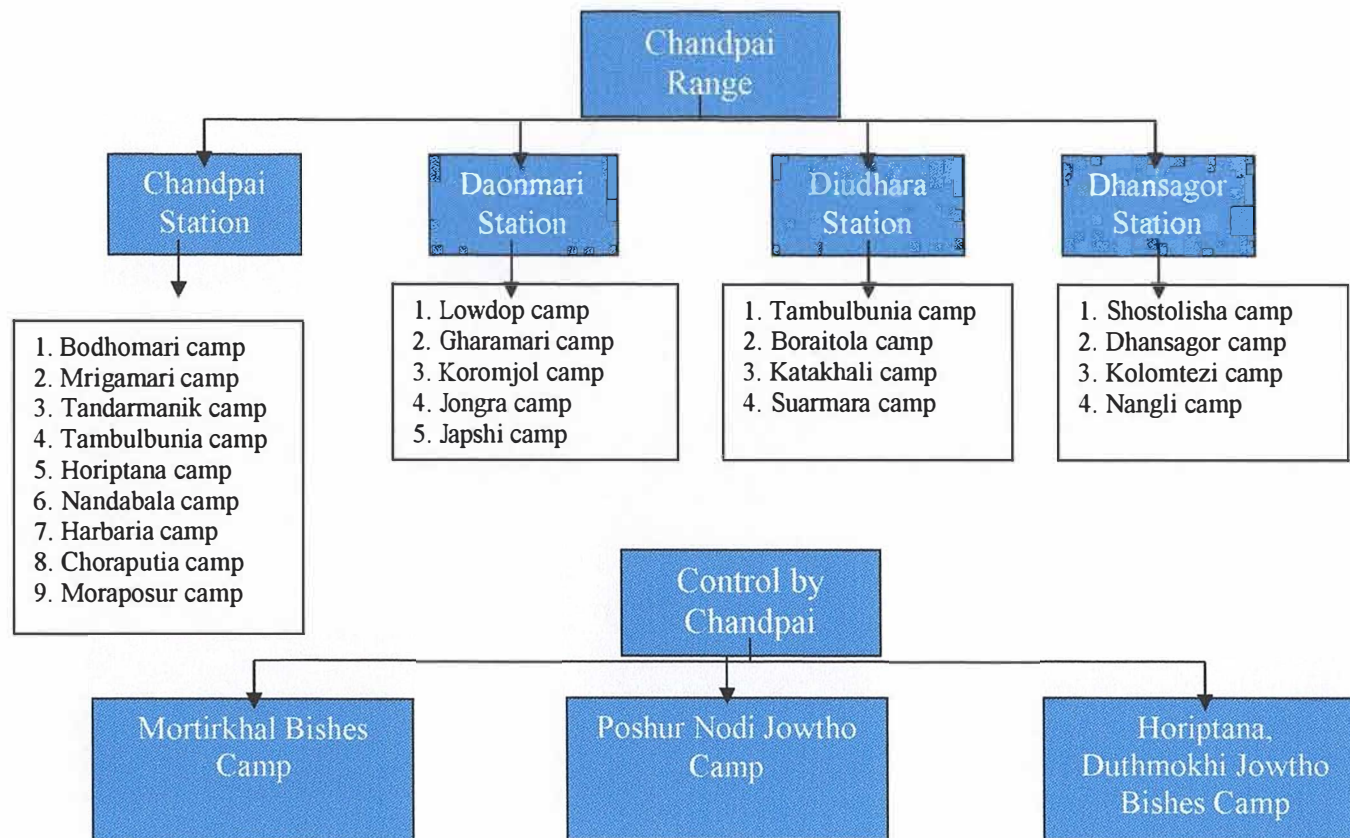


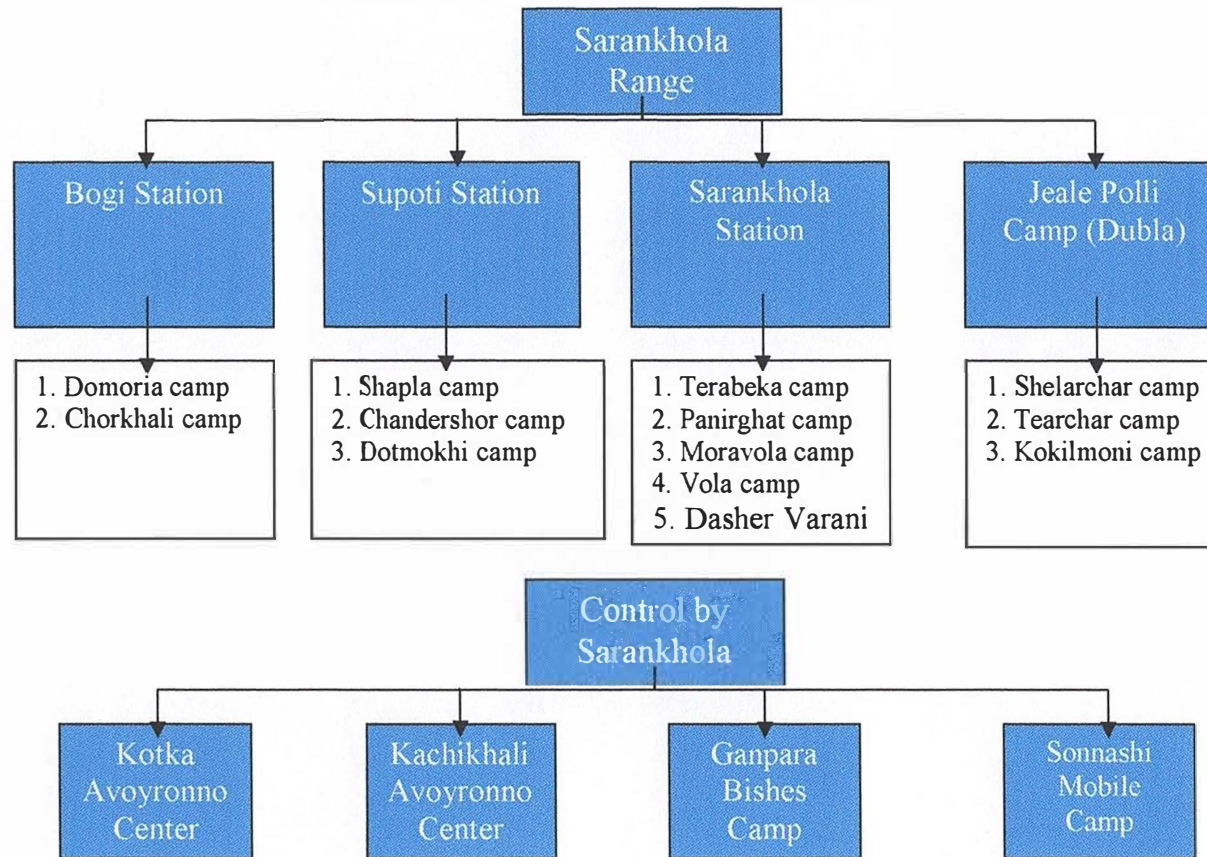
Diagram 4

Divisional Forest Office of Sundarbans East

District - Bagerhat

Administrative Structure of Sarankhola Range

Sampling are: Block Mark (Blue Colour)



Three parts of the forest in the south have been declared as wildlife sanctuaries. They are -

- (i) Kachikhali - Katka Sanctuary under Sarankhola range
- (ii) Nilkamol at Hiron point in Khulna range
- (iii) Mandarbari in the Burigowalini range

Located on the southern most extremity of Bangladesh, sundarbans comprise an extensive flat, costal and deltaic land formed by the confluence of the three mighty rivers of the

Ganges, Brahmaputra and Meghna. It is criss-crossed by large tidal rivers as well as channels and creeks, all discharging into the Bay of Bengal.



Plate 3.1 Burigowalini Range Office of Sundarban



Plate 3.2 Station Office of Burigowalini Range



Plate 3.3 Nolian Range Office of Sundarban



Plate 3.4 Station Office of Nolian Range



Plate 3.5 Saronkhola Range Office of Sundarban



Plate 3.6 Rest House of Saronkhola Range Officer



Plate 3.7 Station Office of Saronkhola Range



Plate 3.8 Land Port of Saronkhola Range



Plate 3.9 Chandpi Range Office of Sundarban

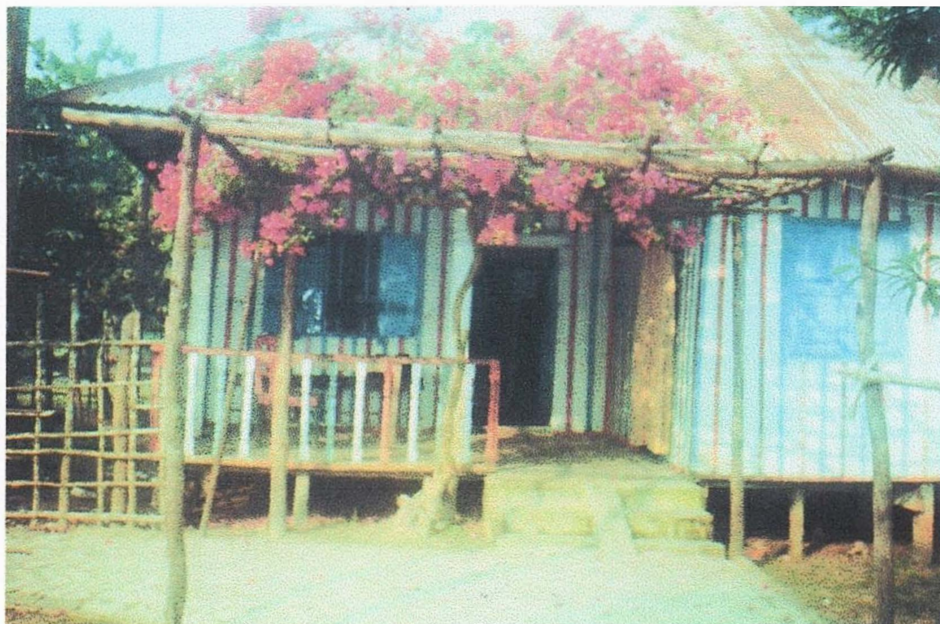


Plate 3.10 Station Office of Chandpi Range



Plate 3.11 Bagerhat Divisional Forest Office

3.3 Simple Random Sampling

Simple random sampling refers to the sampling technique in which each and every item of the population is given an equal chance of being included in the sample.

Table 3.2

The break down of the respondents

Categories of the respondents	Number of respondents		Characteristic particulars of the respondents
First category	10	These categories of respondents are government employees	Forest Experts
Second category	28	These two categories of respondents are the employees of the Forest Department	Divisional Forest Officers, Range Officers, Forest Rangers and Deputy Forest Rangers etc charged with managing Sundarban.
Third category	54		Foresters, guards, and Boatmen etc.
Fourth category	33	These categories of respondents are not government employees	Forest wood cutters
Fifth category	35		Bawali, i.e., people involved in collecting Goal patta
Sixth category	30		Mawali, i.e., people involved in honey and wax extractions
Seven category	35		Local people

Field and regional forest officials were interviewed on the weakness and strength of existing management system, wood and goal patta extraction, honey and wax extraction, and to get their suggestion to overcome these problems. Ten Forest Experts of the Sundarban Forest, two Divisional Forest Officers of the Sundarban, four Range Officers of the Sundarban, six Forest Rangers of the Sundarban, sixteen Deputy Rangers of the Sundarban, eleven Foresters of the Sundarban, fifteen Forest Guards of the Sundarban, twenty eight Forest Boat Men of the Sundarban, thirty three Forest Wood Cutters of the Sundarban, thirty five Forest Bawali of the Sundarban, thirty Forest Mawali and thirty five Local People of the Sundarban Forest were interviewed to identify the causes of natural resources depletion and their possible mitigation at grass root level (Appendix 6.2.1 to 6.2.12).

For collecting primary data seven categories of questionnaires have been used. The first set of questionnaire has been designed to be used by the officials

like Forest Experts, the second set of questionnaire has been made to be used by the employees like Divisional Forest Officers, Range Officers, Deputy Forest Rangers, and Forest Rangers etc of the Forest Department tasked with overseeing the Sudarban forest; the third set of questionnaire has been made to be used by the employees like forester, guard and boatman etc; the fourth, by the wood cutters, the fifth, by the Bawali (people involved in collecting Goal patta) ; the six, by the Mawali (people involved in honey and wax extractions); and the seven, by the Local people. The respondents selected for the purpose of the study have been picked up purposively totaling 225 in number. The break down of the respondents has been shown below in terms of their categories.

The nature of the study is empirical one. Both primary and secondary data have been used to provide for the study. The sources of secondary data include all the previous data, maps and reports collected from Forest Department (Dhaka and Khulna). For the confirmation of secondary sources a close relation has been maintained with Sundarban bio-diversity conservation project.

They perception about the losses of forest and bio-diversity of Sundarban and their conservation and management with local participation. Different published articles, books and research report information were noted. Several data were collected. Data were analyzed through statistical Test, like Time series analysis, Correlation, Regression, T-Test, F-Test, and ANOVA etc.

3.4 Soil Analysis Methods

3.4.1 Evaluation of bearing capacity

The bearing capacities of the shallow foundation may more appropriately be determined from the parameters of soil such as the values of cohesion and the angle, of internal friction as obtained from the performance of laboratory tests. These have been done considering the general equations of the Bearing capacity of the foundation as suggested by Terzaghi. The evaluated values are provided in the following:

Table 3.3

**Bearing Capacities of the Shallow Foundation from Field and Laboratory Test
(F. S. - 2.50)**

Bore Hole	Depth in feet	Field SPT	Cohesion kg/ cm ²	Bearing capacity (tsf)	
				For Raft Foundation	For circular or square footing
BH-1	5	1	0.06	0.18	0.23
	10	2	0.13	0.37	0.47
	15	2	0.13	0.37	0.47
	20	2	0.13	0.37	0.47

- Note:**
- a. Width = 4 ft for strip footing and width = 8 ft for isolated footing,
 - b. The above values are the net allowable Bearing capacities.
 - c. The cohesive soil has been considered in a saturated condition.

Table 3.4

**Bearing Capacities of the Shallow Foundation from Field and Laboratory Test
(F. S. - 2.50)**

Bore hole no.	Depth ft	Unconfined Compression strength, psi	Allowable bearing capacity, tsf	
			Square Footing	Raft Foundation
BH-1	8.00	5.54	0.45	0.36

Bearing Capacities of Piles from the SPT and soil parameters

Table 3.5

The Skin Friction and the End Bearing Capacities of Piles (In Tsf, F. S. = 2.5)

Depth ft	BH-1			
	N	Cu Tsf	f_s Tsf	f_b Tsf
5	1	0.06	0.01	-
10	2	0.13	0.02	-
15	2	0.13	0.02	-
20	2	0.13	0.02	-
25	1	-	0.01	0.38
30	2	-	0.02	0.93
35	5	-	0.04	2.72
40	5	-	0.04	3.11
45	8	-	0.07	5.61
50	7	-	0.06	5.45
55	16	-	0.13	13.7
60	15	-	0.13	14.0

Note:

- N= Blows/ft, Cu=Cohesion.
- F_s = Allowable value of the skin friction.
- f_b = Allowable value of the pile end bearing capacity.
- SPT (N) values are corrected within calculation
- The values of f_s and f_b have been halved in making preliminary estimate about the carrying capacity of a Bored R.C.C. pile.
- In the case of plastic silty soil, the values of the cohesion have been obtained from the SPT values.

3.5 Soil Salinity Methods

Soil reaction (pH), electrical conductance of saturated soil extract (ECe), exchangeable sodium percentage (ESP) and sodium adsorption ratio (SAR) have been used as parameters for assessing the nature and severity of salinity problem in coastal areas.

The important parameters that determine water quality are:

i) Total salt concentration: It is measured by the electrical conductivity (EC) of water, expressed as dS/m or mmhos/cm. The major cations in water include sodium, magnesium and calcium and the anions include of chloride, sulphate and bicarbonate. Other ions that may be present, but usually in low concentration are carbonate, nitrate, silica or boron.

ii) Sodium hazard: The sodium hazard is denoted by the residual sodium carbonate (RSC) and sodium adsorption ratio (SAR) of the water which are defined by the relation-

$$\text{RSC} = (\text{carbonate} + \text{bicarbonate}) - (\text{calcium} + \text{magnesium})$$

$$\text{SAR} = (\text{sodium}) / (\text{calcium} + \text{magnesium})^{1/2}$$

Where all the concentrations are me/l.

During field survey soil samples were collected from both outside and inside the polder. Traverse routes followed the catena, from the bank of the river to the center of the polders using river transport. From each catna 6 soil samples (topsoil, subsoil and substratum) from ridges and basins were collected by auger. Surface salt crust was also collected separately. Number of sports varied according to complexity of the soil were shown on Siol Salinity map 2009.

Profile descriptions were done according to Soil Survey Manual. Detailed land use data were recorded. Electrical conductivity and pH of the soil sample were determined from 1:5 and 1:2.5 soil water extract, respectively. N was determined by Kjeldhal method. P by revised Olsen, Bray & Cartz method. Organic carbon by dry combustion method. S and B by calcium biphosphate extraction method. Cu, Mn. Fe and Zn by DTPA cxttraction method. CaCO_3 were determined by rapid titration method. Soluble salt of selected 74 profile samples were analyzed. Cl was determined by 0.01N AgNO_3 titration method. SO_4 by turbidimetric method. CO_3 and HCO_3 by 0.01N H_2SO_4 titration method. CEC was determined by BaCl_2 method. On the basis of the soil sarvey information, a Soil Salinity map (1:2.8) million is prepared delincatiog 5 mapping units. Soil

salinity boundary of 1973 and 2000 is shown on present Salinity map, 2009 (1:2.8 million). Coastal boundary is also shown on salinity map. Using the salinity map, present extent of saline soils was calculated cartographically.

3.6 Methods of Sampling

When a sample is required to be reflected from a population, it is necessary to decide which method should be applied. The various methods of sampling or sampling designs can be grouped under the heads as random sampling and non-random sampling. Random sampling is also referred to as probability sampling, since if the sampling process is random, the laws of probability can be applied; thus the pattern of sampling distribution needed to interpret and evaluate a sample is provided. A non-random sample is selected on a basis other than probability considerations such as expert judgment, convenience or some other criteria. The most important aspect of non-random sampling worth noting is that it is subject to sampling variability but there is no way of knowing the pattern of variability in the process.

3.6. 1 Simple Random Sampling

Simple random sampling refers to the sampling technique in which each and every item of the population is given an equal chance of being included in the sample. The selection is thus free from personal bias because the investigator does not exercise his discretion of preference in the choice of items. Since selection of items in the sample depends entirely on chance, this method is also known as the method of chance selection. Some people believe that randomness of selection can be achieved by unsystematic and haphazard procedures. But this is quite wrong. However, the point to be emphasized is that unless precaution is taken to avoid bias and a conscious effort is made to ensure the operation of chance factors, the resulting sample shall not to be a random sample.

Random sampling is sometimes referred to as representative sampling. If the sample is chosen at random and if the size of the sample is sufficiently large, it will represent all groups in the population. A random sample is also known as a probability sample because every item of the population has an equal opportunity of being selected in the sample.

Random sampling is not always used as primary sampling procedure. However, it is necessary to introduce an element of randomness in the final selection of items. For example, with each group the choice of cases to constitute the sample should be based on chance selection. If the element of randomness is not introduced, bias is likely to enter and make the sample unrepresentative.

The present chapter has presented a good number of literatures that have been reviewed while carrying out this study. It has been observed that none of the work cited above did give emphasis to Environmental Impact Assessment of Development Activities in the Sundarbans. The present study for the first time has placed importance on the Environmental Impact Assessment of Development Activities in the Sundarbans for study purpose. Any study should begin with its full conceptual base and with this view in mind the next chapter, "Degradation and Destruction of Sundarbans of The Study" has been designed to present conceptual aspects of the study.

Chapter 4

DEGRADATION AND DESTRUCTION OF SUNDARBANS

CHAPTER FOUR

Degradation and Destruction of Sundarbans

Sundarbans forests continue to disappear all over the world. They were estimated to cover 18.1 /million km² worldwide but a more recent estimate indicates that the figure is now 15.2 million hectares (FAO, 2007). About 90% of the global mangroves are growing in developing countries and they are under the condition of critically endangered and nearing extinction in 26 countries. The world mangroves experts are of the opinion that long term survival of mangroves is at great risk due to fragmentation of the habitats and that the services offered by the mangroves may likely be totally lost within 100 years. Large area of mangroves found in Asia and Africa, followed by North and Central America. An alarming 20% of mangrove area, or 3.6 million hectares, has been lost since 1980. More recently, the rate of net loss appears to have slowed down. Reflecting an increased awareness of the value of mangrove ecosystems, but the annual rate of loss is still disturbingly high (FAO, 2007).

4.1 Mangrove Destruction

Vast areas of mangrove are being destroyed throughout the world, either directly, or as a secondary result of other activities. The causes of mangrove destruction in various countries are very similar. The degree of destruction in each country depends on specific purposes. The main problem is that the population of each country increases, and this leads to increased demand for food, fuel, building materials, urbanization and land for cultivation. However, it can be assumed that the causes of mangrove destruction around the world are many. They may be classified as:

- over-exploitation by traditional users,
- conversion to agriculture and aquaculture,
- conversion to salt pans,
- conversion to urban development,

- construction of harbours and channels,
- mining,
- liquid waste disposal,
- solid waste of garbage disposal
- oil spillage, and
- other hazardous chemicals.

Natural stresses such as cyclones and freshwater discharges also destroy mangrove forests, but the areas are minimal compared with those lost from human activity. Within the southern Asia region, the mangroves of India and Bangladesh have been exploited heavily for timber, fuel wood, bark tannin, animal fodder, native medicines and food (fish, shellfish, honey, wild animals) for centuries. Population pressure has greatly increased the rate of exploitation, leading to serious degradation. The area of pure Sundri mangrove (*Heritiera fomes* - the main economic species and a mangrove species unique to the Sundarbans) is reported to have shrunk from 31.6 to 21.0 % between 1959 and 1983 (Chaffey *et al.* 1985), representing a period of exploitation before the relatively recent expansion of shrimp aquaculture in Bangladesh.

4.2 Causes of Mangrove Destruction

Degradations of mangroves are caused by nature-induced changes. The, damaged forests take a very long time to recover. To cite an example, a cyclone has destroyed about 8.5 million trees in Bangladesh, which is equivalent to 66.3 million m of sawed timber, in the year 1988.

Diseases also cause devastating damages to mangroves. For example, top dying disease has damaged about 45 million *Heritiera fomes* (Sundari) trees. This is about 20% of the entire forests in Bangladesh. The top dying disease is believed to be caused by an array of factors increased soil salinity due to reduced water flow, reduction in periodic inundation, excessive flooding, sedimentation, nutrient imbalances, pathogenic gall cankers, and cyclone induced stress.

4.2.1 Rainfall

The mean annual rainfall in the region with 80% probably varies from about 2000mm in the east and 1600mm in the west. The rainy season is June to September and October to February winter. Eighty to eighty five percent of annual rainfall occurs during the monsoon season from May to September.

4.2.2 Poor flushing

4.2.2.1 Prevention of freshwater flow and tidal flow: Mangroves are the best developed in areas that receive freshwater run-off and tidal water flushing. Embankment construction or siltation at the river mouths restricts the inflow of tidal water in mangrove swamps. Dam and barricade constructions in upstream areas for diverting water for irrigation purposes have resulted in poor flow of freshwater into mangrove swamps. The poor flows of tidal and freshwater result in high salinity of mangrove swamps and thus reduce the growth of mangroves. To cite an example, in Colombia, large parts of mangrove forests along the lagoon of Cienaga Grande de Santa Marra, have died within 3- decades. Another good example is at Pichavaram, south India, where the mangroves are largely dying due to hypersalinity and other associated factors like increasing of temperature, poor precipitation poor flushing of mangrove soil by tidal waters etc. These have been illustrated diagrammatically.

4.2.3 Poor Supply of Freshwater

The availability of freshwater is an important factor for the development and growth of mangrove forests. Freshwater supply has often been indicated by the ratio of rainfall to evapotranspiration. Under the humid conditions, where the ratio exceeds 1, the mangroves grow luxuriantly. In arid climates, on the other hand, where the ratio falls below 1, the mangroves get stunted. High rainfall in humid areas leaches out residual salts from the mangrove soil and thus encourages the growth of mangroves. For example, along the Panama coast and southern coast of Costa Rica, where the annual rainfall ranges between 2100 and 6400 mm, mangroves exceed 35 m in height and have a biomass of 280 t ha⁻¹. In the arid

regions, barren salt flats often develop along the landward rim of the mangroves, due to poor leaching of salts from the soil due to low rainfall and this result in poor growth of mangroves because of high salinity of the soil.

4.2.4 Low Nutrient Supply

The major inorganic nutrients required by phytoplankton for growth and reproduction are nitrogen, (as nitrate NO_3 , nitrite NO_2 or ammonium NH_4) and phosphorus (as phosphate P^{4-}). Diatoms and NH_4 silicoflagellates also require silicate (SiO_2) in significant amounts. Other inorganic and organic nutrients may be required in small amounts. All of those nutrients are the limiting factors for phytoplankton growth under most conditions.

The upper layers of water usually have a reduced nutrients compared to lower waters as the phytoplankton population grows in the upper 100m of water; the plants absorb more and more of the light.

Less light means that the compensation depth begins to move upward and becomes shallower. The original 100m reservoir of nutrients is reduced, and as plants increase in numbers, more and more of the water column and nutrient supply become inaccessible to the phytoplankton, thus the total potential productivity is reduced. Finally, as the plants grow, they absorb the nutrients and these nutrients are not available to other plants.

4.2.5 Waste Disposal and Pollution

Domestic and industrial wastes are also discharged or disposed in mangrove areas in different countries. This may result in the degradation or loss of mangroves and, in addition, toxic leakages from the garbage and solid waste can find their way into the downstream ecosystem, causing extensive damage and health hazard. Chemicals from agricultural fields and nutrients and chemicals from shrimp ponds also cause serious harm to the environment. Oil spills, large and small, cause damage to the mangrove ecosystem. Oil deposition on aerial roots which function as "breathing roots" may reduce oxygen diffusion to the underground root system which depends on the aerial roots for oxygen supply.

4.2.6 Improper Management

Improper management practices, as well as over-exploitation of mangrove, has been another major cause of degradation and destruction of mangroves. Large-scale harvest of mangroves for timber and fuel wood over ages, and in recent years, the large-scale charcoal manufacture and harvest of mangrove species for the rayon industry, have added a new dimension to the on-going process of destruction of mangroves.

The management of mangroves in Asia, particularly in Bangladesh, India and Malaysia has been in place for several decades and has withstood the test of time. The Sundarbans in Bangladesh has been under a simple, easy-to-implement management regime which was installed more than a hundred years ago has ensured sustainability and if the management practices are followed properly, this will ensure maintenance of the stands in stable condition for an indefinite period of time.

One major weakness of the management regimes implemented for mangroves in Asia is that they almost exclusively aim at the management of specific economically important species of plants. Mangrove forest is not just a collection of trees. It is an ecosystem which has a rich diversity of both floral and fauna resources. A management strategy for the integrated management of all resources of a mangrove forest has not been formulated yet.

The management of fauna resources is very weak. Very detailed information is available on the commercially important tree species. However, very little information has so far been generated on the fauna population. The current management practices are restricted in most countries to the designation of some areas as sanctuaries and the protection that wildlife receive as a result of the protection provided to the economically important resources. However, the management regimes have been standardized and this has allowed the maintenance of a stable crop. Which in turn has resulted in the conservation of

wildlife habitats. These indirectly help in the conservation of wildlife in the forests. All that is needed now is the incorporation of the sustainable management interventions for the other components of the mangrove forests to ensure that sustainability which has been achieved at mangrove tree resources level can also be achieved at an ecosystem level.

Historically, human pressure on the mangroves has been limited and, except for some subsistence populations, the people saw mangrove areas as inhospitable, unhealthy, and dangerous. Mangrove forests are not easy places to penetrate into and few communities of people actually live within the mangroves, but many people live in close proximity. During the last sixty years, the pressures of increasing population, shortage of productive lands for agriculture in tropical countries, and industrial and urban development have led to a significant proportion of the world mangrove resources being consumed. The International Union for Conservation of Nature estimates that as much as 50% of the original mangrove extent has been lost.

There is a general agreement that the global area of mangroves is declining, although some regions may have seen a net increase in mangrove coverage. Obtaining estimates of decline for other areas of the world is difficult but it is probably reasonable to assume that the rate of decline in the Asia-Pacific region is the highest. Despite their environmental and economic benefits, mangroves are currently being lost at a rate of 2-8% per year, with between 29 and 84% loss of the original mangrove cover in South East Asian countries. However, the increasing area of mangrove restore sites in some regions is worthy of note. Reforestation areas in Bangladesh, Pakistan and Vietnam and now cover over 170,000 ha, while Cuba is reported to have planted around 25,700 ha of mangroves.

The ecological role of mangroves is now widely recognized and many tropical countries have adopted legislation designed to protect them. These rules, however, are often inoperative in practice. For instance, Malaysia constituted a

National Mangrove Committee which specifically prohibited the clearing of mangroves for the installation of shrimp farms, but the practice is still continuing. This implementation difficulty is in part due to the fact that riverine and coastal ecosystems, such as mangroves, have customarily been used under common property regime serving multiple uses and users. The privatization of this kind of land will inevitably harm customary users who have few means to defend their rights. Their customary rights have never been formalized and the benefits they gain do not enter either private commercial or national economic accounts, as they are principally from self-provisioning. Users of these ecosystems are ten marginalized.

4.2.7 Agriculture

The history of restriction of Sundarbans is nothing but the history of conversion of mangrove forests for agricultural purposes. This reclamation process was initiated in 1770 and it continued till recent past. In the largest delta region of the world, existing between India and Bangladesh, 1,50,000 ha of mangroves were destroyed during the past 100 years, and these were mainly reclaimed for agriculture.

The mangrove areas are deforested and reclaimed with rainwater to drain the salt content of the soil and these areas are protected from seawater intrusion by constructing embankments. Once the salt is leached to a sufficient level, the land is cultivated either with paddy or coconut.

4.2.8 Aquaculture Practices

A large scale destruction of mangroves was made for aquaculture in several countries. To cite an example, in the Philippines, between 1968 and 1983, 2,37,000 ha of mangroves were lost for pond construction. This is almost half of the total national mangrove area (Fernandez, 1978). One major issue associated with the located in mangrove habitats is acidification of pond waters that kills aquatic organisms. In *Ecuador*, the decline in mangrove areas was largely due to

the construction of 21,587 ha of shrimp ponds, compared to only 1,157 ha for urban expansion in 1969-84. In Thailand, around 50% of the total denuded mangrove area of 1,71,472ha was converted into aquaculture ponds during the period 1961-87

Possible factors responsible for degradation of mangroves and depletion of fishery resources at Pichavaram situated in southeast coast of India. This specific area has already lost 75% its green cover within the last century and about 90% of the forest area is degrading.

Conversion of mangrove forest land into shrimp ponds has become common in most countries in the South-east Asia. The situation has become very serious in Thailand, Cambodia, Sri Lanka and Bangladesh. The area under mangrove forest in Thailand has shrunk from 367,900 ha in 1961 to 168,682 ha in 1994 primarily because of the conversion of mangrove forest into shrimp ponds. Likewise, the area under mangrove forest in Vietnam is reported to have shrunk from 250,000 ha in 1943 to about 50,000 ha in 1995, with most of the cleared forest land being brought under shrimp cultivation. Chakoria-Sundarbans in Bangladesh had an area of 18,200 ha which was dramatically reduced to 5,446 ha as consequence of anthropogenic disturbances, salt production and clear-cut for shrimp cultivation in the last two decades.

Shrimp pond construction not only strips away the vegetation cover, exposing large areas of soil to erosion and oxidation, but dramatically alters water drainage patterns, as water supply and drainage canals are dug to service producers who are developing areas several hundred meters from the shoreline. However, under the system, the main emphasis is on fish production and the mangroves are marginal.

For centuries in Java, Indonesia and the Philippines, mangroves have been transformed into ponds (known in Java as tambaks) for the cultivation of finfish, penaeid shrimp and prawn. In Java the species cultivated most commonly is *Chanos chanos* (milkfish) which breeds just offshore in shallow water of sandy

bays. Ponds are generally 0.5 to 2ha in area, narrow in shape and communicate by way of sluice gates with a system of tidal canals. The average milkfish production in Indonesia is around 400 to 500 kg/ha per year. Culture of shrimp and prawn is more recent and not restricted to South-east Asia. Several types of coastal aquaculture exist including:

- Bottom culture (where no enclosures are used), e.g. blood cockle and seaweed (typically in open bays)
- Floating cage or pen culture of fish, e.g. groupers, red snapper, milkfish and sea bass (typically in estuaries and creeks)
- Rafts, poles, lines and cultch used for culture of oysters, mussels and seaweeds (in bays, creeks and estuaries) Pond culture, e.g. of shrimp and milkfish (in the inter-tidal or supra-tidal zone)
- Shore based fish and shrimp hatcheries (not usually in or close to mangrove areas due to need for clear seawater)

Many types of coastal aquaculture are practiced within or close to mangrove areas. Many of these have no or very limited adverse effects on mangroves and have been practiced for hundreds of years providing livelihoods to thousands of rural families. Although there may be issues of localized water pollution/eutrophication arising from intensive cage culture of fish, the main concern for mangrove areas and their associated creek systems is related to the construction of shrimp and fish ponds, particularly where these involve the clearing of existing mangroves.

4.2.9 Oil Pollution

Pollutants are carried into the Sundarbans and ultimately into the Bay of Bengal from various upstream sources including the industrial units, municipal wastes, agrochemicals and port sewages in the Mongla and Khulna region.

The main threat today may come from outside the area in the form of pollution. On the northern edge of the area, Mongla, Bangladesh second sea port is situated. This port and its associated marine traffic is a frequent source of oil spills and there is a permanent risk of accidents with chemicals. Moreover, toxic products (pesticides, *etc.*) enter the system due to upstream pollution in the huge Ganges catchment. Pollution may not be a direct source of mortality, but it may also reduce the health of the forests, increasing the mortality rate of the flora and fauna on the long term. Many products such as pesticides have also been proved to reduce the reproductivity (birth rate) in animal populations.

Almost all Khulna-based industries like the match factories, fish processing plants, jute mills, the Khulna Shipyard and newspaper mills discharge liquid or solid wastes directly into the Bhairab- Rupsha river system. According to a DOE paper, the Khulna Newspaper Mills alone is estimated to use and discharge 30,000 m³ of processed water and chlorides and dissolved and suspended solids everyday along with the municipal wastes of the regional cities.

Oil spills during transfer of refined petroleum from tankers to receiving stations in Mongla and Khulna, fuel oil spillage and discharge of oily ballast and sewage from some 600 ships anchored in Mongla port and residual heavy oil sludge, lubricants and engine oils discharged during ship breaking operations in Khulna are major sources of water pollution affecting the Sundarbans.

4.2.10 Mining Operations

A future threat is the exploitation of mineral gas, which is abundant in the underground of the Sundarbans. The recent Bangladesh government decision to allow exploration by international oil giants in the area has caused added concerns, as mangrove environments are known to be the most vulnerable coastal habitats to such activities.

4.2.10.1 Forest Experts Comments about Degradation and Destruction of Sundarbans

In reply to 9th question (*i.e.* How far the natural destruction affects our biodiversity?) about the natural destruction affects on our biodiversity ten Forest Experts (FE) has made individual comments. One of them has made comments that flow of freshwater, increasing saltiness, situation *etc.* have impact on biodiversity. Another Forest Expert has made comments that because of less freshwater flow and siltation increase the biodiversity. He also has said that storm/cyclone, natural (high tide) spate, harmful for the animals and the plants. Another Forest Expert has told that only storm and spate have impact on biodiversity. The last Forest Experts of the ten Forest Expert has made comments that because of increasing the saltiness of water and decreasing of navigation of river decrease the biodiversity of forest.

In answer to 9th question (*i.e.* How for the natural destruction affects our biodiversity?) out of the DFO, one has made comments about the natural destruction and its effects on the biodiversity that the natural destruction such as the stream tidal waves, intensity of salinity and situation, water flow influence the biodiversity of the forest. Another DFO has made comments that the natural destruction has many negative effective such as, the increase of water salinity and the decrease of navigation of the rivers influence the biodiversity of the forest.

In reply to 9th question (*i.e.* How for the natural destruction affects our biodiversity?) about the natural destruction affects on our biodiversity four Range Officers have made individual comments. One of them has made comments that flow of freshwater, increasing saltiness, situation *etc.* have impact on biodiversity. Another Range Officer has made comments that because of less freshwater flow and siltation increase declined the biodiversity. He also has said that storm/cyclone, natural (high tide) spate, harmful for the animals and the plants. Another Range Officer has told that only storm and spate have impact on biodiversity. The last man of the four Range Officers has made comments that

because of increasing the saltiness of water and decreasing of navigation of river decrease the biodiversity of forest.

In answer to 9th question (*i.e.* How for the natural destruction affects our biodiversity?) from the table we show that regarding to the question about the natural destruction and its effect on our biodiversity, half of the total six forest rangers have said that the natural destruction affects mostly our biodiversity. One of them has said that the natural destruction affects much our biodiversity. Another one has said that the natural destruction affects abundant our biodiversity. Only one of the six forest rangers has made details comment and he has said that the natural destruction has an effect of storm and flood on wildlife and food habit and also our biodiversity.

In answer to 9th question (*i.e.* How for the natural destruction affects our biodiversity?) the table we see that in regard to the natural destruction affects our biodiversity six of the total Deputy rangers have said that the natural destruction affects a huge number of our biodiversity. Another four Deputy rangers have said that the natural destruction affects many of our biodiversity. Two of them have said that the natural destruction affects enough of our biodiversity. Only one deputy ranger has said that the natural destructions like storms and high wave's earthquake etc. affect our biodiversity. One of the rests two has said that the natural destruction affects almost roughly and other has said rains have sufficient role in destruction our biodiversity.

In answer to 2nd question (*i.e.* What are the causes of forest degradation and bio-diversity reduction?) the table shows that in response the question about the causes of forest degradation and biodiversity reduction most of the foresters have made the same comments *i.e.* eight of them have said that the main causes of forest degradation and biodiversity reduction are illegal felling, natural calamity (cyclone tidal surge, saline water intrusion *etc.*) and water pollution. On the other hand, other three foresters have said the causes of forest degradation and biodiversity reduction are natural calamity (cyclone, tidal surge, saline water intrusion *etc.*) and water pollution. It is noted here that the causes of forest and biodiversity reduction are very much natural and man-made.

In answer to 2nd question (i.e. what are the causes of forest degradation and bio-diversity reduction?) in reply to a question about the causes of forest degradation and biodiversity reduction all of the forest guards have made the same comments. They have said the causes of forest degradation and biodiversity reduction are natural calamity (like-cyclone, tidal, surge, saline water intrusion) and water pollution.

In reply to 2nd question (i.e. What are the causes of forest degradation and bio-diversity reduction?) about the causes of forest degradation and biodiversity reduction all the forest boat men have mentioned the following causes that legal felling causes the legal felling, natural calamity (like cyclone, tidal surge, saline water intrusion *etc*) and water pollution *etc*. It is obvious that natural causes are pivotal as well as man made causes degradation of the forest and biodiversity reduction.

4.3 Losses of Resources

4.3.1 Losses of Timber

Timber and other Forest resources and their Uses: Among various timbers available from Sundarbans, Sundri, Bain, Goran, Gewa, Passur Dhundul *etc*. are important. Sundr and Passur are used for house building and furniture, Bain for planks and fuel wood, Goran for posts, Gewa for boxes and Dhundul for Wood pencils. Besides these hental posts are used in house building and hental leafs and Golpata is used for rooting. Sundri top dying is a big ecological problem in Sundarban. At present 3000 ha. Sundri top dying area is being operated for extraction of timber and fuel wood for catering the need of the local people. For last 5 (five) year on an average 100000 cft. Top dying sundri timber has been extraction from Sundarban. A total of 2000000 cft. Gewa timber is supplied to Khulna Newsprint Mill and Dhaka Match Factory every year. On an average 20000 M.Ton Goran and 35000 M. ton Golpata are being extracted from Sundarbans.

4.3.2 Losses of Honey

4.3.2.1 Honey Collection and Apiculture: On an average 60,000 kgs of honey are extracted from of Sundarbans every year through the honey-collectors and FD takes the honey as well as wax from them at fixed tariff and arrange for sale of filtered honey after processing in the Departmental Filtering Unit at Sealdah. About a thousand of families earn their livelihood through collection of honey from of Sundarbans forests.

Apiculture (bee-keeping) is now gradually becoming popular and necessary training is imparted under the SBR programme. Apiary-boxes have been distributed among the villagers as per recommendation of local Panchayats and these are supplementing the income of the beneficiaries.

4.3.3 Losses of Fish

For the purposes of this exercise, the value of all fish products caught in the inshore fisheries and estuarine/offshore fisheries has been assessed as production attributable to of Sundarbans. Market prices at first point of sale – the price paid by buyers on the beach in of Sundarbans have been used.

The annual value of fish caught is 183 crore taka (1.84 billion taka), which is three times larger than the annual value of forest products being removed. Assuming that this recorded level of production represents a sustainable level of production, the present value of the resource to the nation at a discount rate of 12 percent is 1,525 crore taka (15.3 billion taka).

4.3.3.1 Fisheries Resources of the Sundarbans: Fisheries mean all aquatic resources. These resources may be living and/or non-living and present in the aquatic environment. The Sundarbans has a large area of water body, which provide huge amount of resources, and most of them are valuable. A substantial amount of fishes, crustaceans, molluscs, mammals, decapods, oysters, lobsters, reptiles, crocodiles, aquatic birds, aquatic plants, phytoplankton and zooplankton etc. are included in the mangrove fisheries.

4.3.3.2 Fish and Fisheries: There are about 53 species of pelagic fish belonging to 27 families, 124 species of demersal fish belonging to 79 families. The important fish species of the Sundarbans are: *Hilsa tenuialosa*, *Mystus gulio*, *Lates calcarifer*, *Pomadasys hasta*, *Polynemus spp.*, *Pangasius pangasius*, *Johnius dussumeri*, *J. argentatus*, *Harpadon nehereus*, *Plotosus canius*, *Trichiurus haumela*, *Setipinna taty*, *pampus argenteus*, *Sadinala spp.*, *Liza parsia*, *Selar spp.*, *Mugil cephalus* etc. Besides these, there are 24 species of crabs belonging to 5 families (e.g. *Scylla serrata*, *Matuta lunanis* etc.), 2 species of snails (e.g. *Pythis plicata*, *Indoplanorbis exustus* etc.) 6 species of oysters (e.g. *Crassostrea gigas*, *Pila globossa*, *P. acutata* etc.), 4 species of lobsters (e.g. *Thenus orientalis* et.). 3 species of turtles (e.g. *Chelonia mydas*, *Trionys hurum* etc.) 10 species of snakes (e.g. *Naja naja* etc.), 3 species of frogs (e.g. *Euphlyctis hexadactylus* etc.), 2 species of crocodiles (e.g. *Cracedylus porosus* etc.), and 315 species of birds such as *Aola grajii*, *Anas sp.*, *Alcedo spp.* etc. (Shah, 1998; Chowdhury *et al.*, 2001). It has been recorded that 23 species of ichthyoplankton belonging to 19 families (e.g. *Oscillatoria tenuis*, *Spirulina major*, *Chaetomorpha gracilis* etc.) from the Coxali river estuary at Satkhira range.

4.3.3.3 People Involved: Annually many people are involved to harvest fisheries resources from of Sundarbans area. Some people are involved in tourism. Sundarbans is the hopes of eco-tourism. There are many fascinating islands, beach, and water bodies etc. in of Sundarbans where tourists can access for recreational purposes. About 3.114 million people live within 20 km from the boundary of the Sundarbans with an average household size of 6.3 persons (MARC, 1995). The total fisher population actively engaged in shing was about 200,000 in 1993. Thus the Sundarbans fishery provides employment facilities to thousands of people and greatly contributes to our national income and GDP.

4.3.3.4 Production of Fisheries Resources: The fishery in of Sundarbans is divided into two broad categories such as inshore fishery and offshore fishery. The inshore fishery area is about 817 sq. km and the offshore area is confined to a

total area of 3,210 sq. km. (Chantarasri, 1994) reported the abundance of fish in inshore and offshore areas at 3.7 tons and 2.9 tons per sq. km respectively.

Sundarbans produces more than 30 products, which can be categorized as wood products, non-wood products, fisheries and other services like tourism. The value of fishes caught from Sundarbans was Tk. 183 crore (Tk. 1.84 billion), which is three times higher than the value of forest products (Tk. 68 crore) in the year of 1999-2000.

4.4 Reduction of Bio-diversity in Sundarbans

4.4.1 Losses of Biodiversity: Many factors contribute to mangrove forest loss, including the charcoal and timber industries, legal and illegal logging, oil spill, tourism industries, unplanned development projects, urban growth pressures, and mounting pollution problems. However, one of the most recent and significant causes of mangrove forest loss in the past decade has been the consumer demand for luxury shrimp, or "prawns", and the corresponding expansion of destructive production methods of export-oriented industrial shrimp aquaculture along the forest.

The dramatic decrease is blamed on their over exploitation, legally and illegally, because of their commercial value and subtle changes in the ecosystem. A number of issues related to the Sundari, Gewa and Goran trees have emerged for immediate concerns of the foresters.

According to experts, the reasons for the decline in Sundari (*Heritiera fomes*) are twofold. First, as a valuable timber species with real commercial value, it has been subject to heavy exploitation. Second, increasing salinity as a subsequent impact of the subtle ecological changes, noticeable increase in salinity and siltation have resulted in hostile anaerobic conditions in which the Sundari finds it difficult for healthy respiration. This has resulted in die-back whereby the tree is progressively defoliated from the top downwards. The phenomenon, in fact an infectious disease, is called "top dying".

With regard to Gewa, forest officials say high pressure from deer population in some areas of forest patches have sparsed or caused nil regeneration of the species, leaving the areas under-stocked. The decline in Gewa (*Excoecaria agallocha*) is largely attributable to harvesting of around 50,000 mt per annum as feedstock to Khulna Newsprint Mill for the production of newsprint over the years.

The marsh crocodiles, once abundant, are already extirpated. The salt-water crocodile (*Crocodylus porosus*) still survives in low densities and like the marsh crocodiles its population is being reduced through indiscriminate hunting and trapping for skins, quite apart from the immediate conflict with men. Despite an apparent reduction in illegal trade in its skin, the population shows little sign of recovery.

Some 30 species of snakes have been recorded in the SRF and there appears to have been a general decline in densities or at least in their sighting particularly in the past two decades. The Rock Python (*Python molurus*) is one of the valuable SRF snake species, which is said to have declined over recent years. IUCN has listed it as a "vulnerable species."

A number of species like Javan rhinoceros (*Rhinoceros sondaicus*), water buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvauceli*), gaur (*Bos gaurus*), hog deer (*Axis porcinus*) and marsh crocodile (*Crocodylus palustris*) became extinct during the last 100 years from the Sundarbans.

While the Sundarbans, the world's largest mangrove forest, is faced with growing problems of deforestation and biodiversity loss, the government's decision to allow hydrocarbon exploration by some international oil companies in the area caused wide concerns as mangroves are known to be the most vulnerable coastal habitats to such activities.

The fragile and delicate mangrove ecosystem depends on many variable components like tides, salt contents in water and soil, duration of sunlight, contents of sediment and organic substances in water, and temperature and density of seawater and freshwater. The composition of terrestrial and marine flora

and fauna also plays an important role in the mangrove ecosystem. If sun is regarded as the source of all energy flow, water must be considered as the nursing mother of an ecosystem.

In the Sundarbans, the flow of freshwater received from the tributaries of the Ganges (Padma) is lighter in the turbidity than that of the Bay of Bengal waters. The temperature of the two waters also varies seasonally. The freshwater carries loads of mineral and microbe-rich silts, which do not flow easily into the tidal waters from the sea as the influence of the tides make the water flow back and forth. The mixture of the flows of fresh water and brackish water and the mineral microbe silts from upstream and the forest wastes like over mature leaves creates an ideal environment for different mangrove organisms.

Many experts fear that far-reaching changes are taking place in the delicate ecosystem due to growing pollution and human interference in the areas adjacent to the forest. The Mongla Port on the northern edge of the forest and its associated marine traffic are a frequent source of oil spills and there is a permanent risk of accidents from handling chemicals in the port area

Many factors contribute to mangrove forest loss:

- charcoal and timber industries,
- legal and illegal logging,
- oil spill,
- tourism industries,
- unplanned development projects,
- urban growth pressures,
- Shrimp culture.

Brackish water shrimp and fish farming is now a firmly established and substantial industry of great importance for export earnings and for national foreign trade balance. Shrimp farms operate over large areas of otherwise unprotected land subject to regular tidal, saline inundation and also inside many of the coastal polders despite the fact that they were originally intended to exclude salt water.

The collection of shrimp post larvae along the banks of estuaries, tidal lagoons and khals provides an income for thousands of coastal residents,

including women and children. Buyers and agents collect and deliver the postlarvae to the shrimp farms where they are reared in ponds, usually from Dec/Jan until late May or early June, when they are harvested and the ponds are drained and flushed with freshwater for planting rice crop. Intern the paddy is harvested in November for the next turn of shrimp culture. The entire industry is dependent on wild stock, which is also heavily fished at sea and thus the reserve is being threatened for over exploitation. A reliable hatchery will ease pressure on the shrimp stock stabilize price and encourage high stocking rates and productivity and should therefore be a matter of highest priority.

Fishes and other living aquatic resources have been serving as a source of food, commerce and recreation for people from ancient times. Living aquatic resources are intensively harvested today around the world as a source of protein in the family diet, for commercial gain or for recreation. There are three basic elements to a fishery: the resources itself, its aquatic environment and the people who harvest the resources or change the condition of its aquatic surroundings.

Livelihood of million others also indirectly depends upon this rich forest. Every year the Sundarbans bears the burnt acting as a vital barrier against all calamitous lashings of the nature to protect the country's southern coastlines including the regional town and cities like Mongla and Khulna.

4.4.2 Depletion of Bio-diversity: The bio-diversity of the Sundarbans has been under threat for various reasons. There has been increasing conversion of the forest land for agriculture, mainly for paddy and shrimp farming and for human habitation. The forest's bio-diversity is also threatened by unabated poaching, hunting, illegal felling of trees, diseases, unplanned and over extraction of resources, insufficient conservation effort, deterioration of law and order situation, corrupt practices of the forest officials and unscrupulous traders etc. Poverty population pressure and encroachment by the forest/local people are blamed for the depletion of bio-diversity in the Sundarbans. Contrary, to this customary belief, plundering and exploitation of forest resources by the poachers and dacoits in connivance with the corrupt forest officials are said to be the main causes of forest

loss in the Sundarbans. Recurrent natural calamities like storms, cyclones and tornadoes pose a big threat to tall slender trees, which act as a barrier against the cyclones and tidal surges originating in the sea. More than a dozen of cyclones have hit the Sundarbans during the last decade. A disastrous cyclone at Dublar Char in 1988 devastated the forests and the fishermen's villages.

Besides these anthropogenic activities and natural calamities, some ecological changes like increase in salinity, outbreak of diseases like "top dying" of the Sundari trees pose a serious threat to rich biodiversity of the Sundarbans. Such diseases are taking a heavy toll of the wood lots in the Sundarbans. Actual cause of the disease is not yet known. Diversion of the natural courses of rivers, construction of embankments, dams and bridges in the upstream as well as decreased flow of freshwater in the rivers resulted in the increase in salinity level and over-silting in many places and caused subsequent changes in the mangrove ecosystem. Increased salinity and siltation within the forest area may hinder the biological functions of the breathing roots and are supposed to be the major causes of top dying of the trees. Possibility of fungus pathogens can not be overlooked. In the Sundarbans, for bringing non-commercial cover areas under tree cover in different areas of Chandpai, Sarankhola and Khulna forest ranges, plantation of exotic species, like *Acacia nilotica*, *Albizia procera* have taken place. Though at a limited scale, many other exotic species have been introduced in the Sundarbans mangrove ecosystems, particularly in areas around the forest offices. It is apprehended that these exotic species may pose a threat to the native variety of mangrove species.

Dey, 2001 reported that Wild Buffalo, 2 species of Deer, Javan Rhinoceros extinct and presently 2 species of amphibians, 14 species of reptiles 25 species of birds and 5 species of mammals are considered as endangered species (**Appendix 4.3**).



Plate 4.1 Damage of Sundri Trees (*Heritiera fomes*) of Sundarban

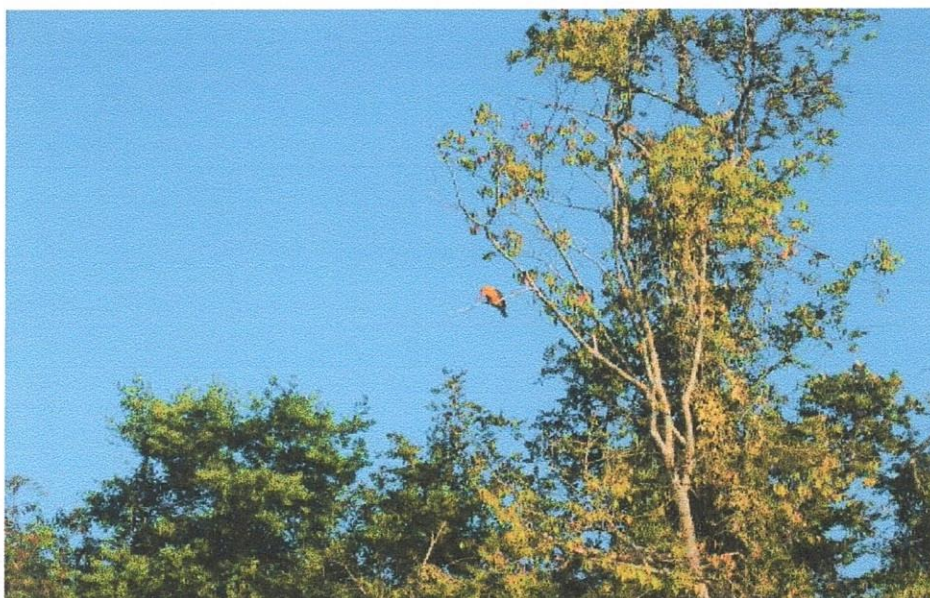


Plate 4.2 Forest Resources of Sundarbans



Plate 4.3 Goal Pata (*Nypa fruticans*) of Sundarbans



Plate 4.4 Plantation (*Exotic plant*) of Sundarban

4.4.3 Bio-diversity

4.4.3.1 Tiger: Royal Bengal Tiger (*Panthera tigris*) is evenly distributed in its present home in the Indian subcontinent. Tiger has acute sensitivity, secretiveness, untiring perseverance, and surprising agility in attack, tenacity to follow, hold and overpower the prey. Tiger has a wider ecological tolerance than other big cats and can live in diverse habitats. An average male Royal Bengal Tiger measures 2.75 metre from nose to tip of the tail and 0.914 metres high at the shoulder. Sundarban tigers are however slightly smaller in size and thinly built to adapt itself to special condition of mangrove forests.

The tiger is inseparable legend attached to Sundarbans and the species occurs throughout the Sundarban Reserved Forest ecosystem in Bangladesh and India. Tidal mangrove forest is a rare habitat for the species where it has been pushed due to habitat shrinkage. In many ways, mangrove has proved to be an unusually secure abode for the tiger, notwithstanding the fact that the species is listed as a CITES endangered species in the Red Data Book.

The Sundarban Reserved Forest tiger population estimate in the last 20 years remaining in the range of 350-400, the largest discrete population of the species in a single tract of natural habitat in the world, and it is also a paradoxical source of national pride, fear and misunderstanding. The gene pool and its conservation are a major responsibility for the nation and the stewards of the SRF in particular. But the paradox, which the wildlife management must address, is: tigers kill human beings and in the SRF, compete with man for space, yet there is a universal demand for protection of the species. Preservation of the tiger is, by far, the most important challenge for those concerned with the conservation of biodiversity in the SRF. This challenge has become even more compelling of late with recent media reporting (CNN, July 1997) of the outcome of a tiger population census in the Indian side of Sundarbans. The population of tigers there once estimated at something similar to that in Bangladesh (300+ individuals) is now down to approximately 50.



Plate 4.5 Tiger (*Panthera tigris*) of Sundarbans

4.4.3.2 Deer:

4.4.3.2.1 Chital Deer

The elegant graceful and lovely spotted coat of the chital or Axis deer (*Axis axis*) has made it highly attractive. It is considered as a primitive true cervids, which flourished in Pliocene and Pleistocene in Europe and Asia. It is medium sized, standing about 0.889M to 0.965M high at the shoulder. Chital likes grass for forage. It needs water and shade. It tends to concentrate in Keora forests and open grasslands.

4.4.3.2.2 Barking Deer

Barking Deer (*Muntiacus muntjak*) use to be found in the northern part of Sundarbans. They are found single or in pair. They like to live in thick jungle and come out to graze in the open area adjacent to forest boundary. They are fairly diurnal in habit. They called from a distance sounds like the bark of a dog. Usually they come out from jungle in the morning or evening.

Hight at the shoulder of an adult male varies from 50 cm to 70 cm. The antlrs are small. They usually breed throughout the year.



Plate 4.6 Deer (*Axis axis*) of Sundarbans

4.4.3.3 Others diversity

Estuarine Crocodile

Estuarine Crocodile (*Crocodilus porosus*) is one of the largest crocodile of the world. The largest specimen ever recorded was 10.05M- recent years; the largest size seen and recorded is 7.92M in length. The species is gradually getting scarce. This estuarine crocodile is an important component of the mangrove eco-system. Crocodile in its present form existed in Jurassic time and were contemporary of the Dinosaur. As the only remaining member of the archosaurian stock, which has survived the age of reptiles, they are of exceptional scientific importance. Due to excessive fishing their populations are decreasing in Sundarbans and it has included in the list of endangered species.

ii) Batagur Baska

The river terrapin (*Batagur baska*) has been one of the most exploited estuarine turtle and is listed as endangered species. It inhabits the lower reaches of major rivers over the tropical mainland of Asia and reported to be available in Sumatra, Malayasia, Thailand, Burma and Bangladesh. Once it was believed to be extinct from Sundarban but a few were seen in 1999-200 (Dey, 2001).

iii) Wild Boar

Wild Boar (*Sus scrofa*) widely distributed in Sundarbans and their number is comparatively higher in the southern part of Sundarbans. Their colour is more or less black mixed with grey. The male stands 90cm height at the shoulder and its average wts. is 150kg to 180kg. They live in grass or scanty bush jungle, some time in forests. They are omnivorous, living on roots, tubers, insects, snakes etc. They feed in the early morning and mostly at night. They breed throughout the year. After breeding the big boars live alone or in company with another of equal size (Appendix 4.4).

iv) Banbibi

Bawali (Wood cutters), Mawali (Honey collectors), fishermen worship various gods like Mother Narayani, Banbibi, Kalu Khan, Gazi Saheb with belief that they will not encounter any tiger attack. People of Sundarban have high regard for tiger and it is intimately associated with their life style.

The occurrence of Barking Deer (*Muntiacus muntjak*) appears to be limited to the north and North East in the SRF. The population of this species is sparse and little quantitative data exists about the population size. Although frequently seen in the Dhangmari, Karamajal, and Jhongra khal area in Chandpai Range, they are not seen in southern Sundarbans. In contrast with spotted deer, this species appears to avoid grassland and in this context, better suited to the denser woodland in habitats to the north.

Wild boar (*Sus scrofa*) occur throughout the SRF including the off shore Islands. Next to spotted deer, wild boar comprises the most important among common ungulates in the SRF both in terms of numbers and biomass, and as prey species for the tiger. Wild boar is prolific in their reproduction. Unlike the spotted deer population, wild boar is not subjected to poaching since there is little demand for its meat. The estimated population is about 20,000.

Monkey (*Rhesus macaque*) occurs throughout SRF. It is a common sight with greater incidence in the south. The population status of monkey, according to 1993 estimate is about 40,000 individuals.

Some 35 species of reptiles have been recorded in SRF. The marsh crocodile (*Crocodylus palustris*), once abundant, is now probably extirpated. The salt water crocodile (*Crocodylus porosus*) still survives in low densities and like the marsh crocodile, its numbers are being reduced through indiscriminate hunting and trapping for skins and egg collection, quite apart from the immediate conflict with man. This species is only sighted rarely, basking in the sun in the wide slopes of riverbank, and there is little doubt that its survival is seriously threatened.

Despite and apparent reduction in illegal trade in its skin, the population shows little sign of recovery and may even be decreasing (**Appendix 4.3**).

Three species of monitor lizards (*Varanidae*) occur in the SRF. Detailed information on population status and the level of the current off take is not known. Due to an official ban on the legal export of lizard skins, the formerly well-known pursuit of the monitor lizard is said to have stopped although incidental poaching probably continues.

At least 30 species of snakes are reported to have been recorded in the SRF and there appear to have been a general decline in densities or at least in sighting especially over the last 15 years. The Rock Python (*Python molurus*) is listed as vulnerable by IUCN and is another valuable species which is said to have declined over recent years and is rarely encountered. In addition, two species of cobra (*King Cobra* and *Spectacled Cobra*), three vipers and six species of snake have been recorded.

Five species of marine turtle: the olive ridley, green, loggerhead, hawksbill and leatherback have been recorded in the SRF. Of these, green turtles are considered to be the most numerous. Their status is not well established. Turtle eggs are collected and eaten by fishermen, and some are marketed and even exported to the Far East but the extent of harvesting is not known.

The SRF and surrounding area has rich avifauna and the most recent list of species indicates that at least 315 species representing 48% of the birds known to occur in Bangladesh have been recorded here. Of these, 84 species are migratory making the SRF a valuable location for passage migrants and seasonal visitors. The inshore island of Tinconia and offshore islands of Putney, Nilbaria, Kachikhali and Duba are valuable habitat for waders and resting point for migrating flocks.

Notable among those are birds of prey, of which there are at least 35 species, some rarities such as Grey-Headed Fish-Eagle (*Ichthyophaga ichthyactus*), Pallas's Fishing-Eagle (*Haliastur leucorhynchus*) Masked Finfoot

(*Heliopais personata*) and migratory waders, gulls and terns. Among the endangered species the SRF list includes spot billed pelican (*Pelecanus philippinensis*), and the Greater and Lesser Adjutant Stork (*Leptoptils dubius*) and *L. Javanicus*. Visually attractive species include the Red Jungle fowl (*Gallus gallus*), eight species of king fisher, green pigeon and parakeets are common (Appendix 4.4).

4.5 Violation of Forest Law

4.5.1 The Bangladesh Wildlife (Preservation) (Amendment) Act, 1974

The 1974 Wildlife Act consolidates and improves the older legal provisions to conserve the wildlife in Bangladesh. The Forest Department has the primary responsibility for implementing the Act. The Act allows the government to declare any land to be a wildlife sanctuary, a national park, or a game reserve. Bangladesh currently has fourteen Protected Areas (nine wildlife sanctuaries, four national parks, and a single game reserve). The Act, however, does not contain any provision for establishing and managing buffer zones. Under current social, economic and institutional conditions the forest department faces many problems in enforcing different provisions of this act.

4.5.2 Forest Act (Amendment), 1989

The Forest Act of 1927 as amended in 1989 has its roots in Indian Forest Act, 1878. The Forest Act grants the government several basic powers, largely for conservation and protection of government forests, and limited powers for private forests. The 1927 version of the act was amended in 1989 for extending authority over "any [Government-owned] land suitable for afforestation".

Forest department is the main agency to implement the provisions of the Forest Act. The Act, however, does not specify any sort of institutional structure for the forest or other land holding agencies. It also does not set out any specific policy direction for managing the forests. Bangladesh has formulated a series of

eleven rules for delegating legal powers to Forest Officers, from the Chief Conservator down to Forest Guards for implementing certain parts of the act.

Most of the forest lands under the management of forest department are areas declared to be reserved and protected forests under this act. The available figures for the current total area of reserved or protected forest are not consistent. The areas in Bangladesh that are referred to as "village forests" are actually privately owned land covering about 270,000 hectares. Under the Forest Act the government may establish village forests by assigning parts of reserved forest to particular villages for their use. However, this provision has never been used in Bangladesh.

The act empowers the government to regulate the felling, extraction, and transport of forest produce in the country. The process to get permit for felling trees and transporting the material is quite bureaucratic and time consuming. The level of competent authority increases with the number of trees in question. Forest department limits the routes for transportation of forest produce, inspects and marks the material for transportation. The government has made many rules for this purpose including the following:

Sylhet Forest Transit Rules, 1951;

Dinajpur and Rangpur Forest Transit Rules, 1954

Chittagong, Cox's Bazar and Comilla Forest Transit Rules, 1959

Control of Transit of timbers and other forest produce for transit in the Sundarbans, 1959

Dacca Forest Transit Rules, 1959

Mymensingh Forest Transit Rules, 1959

East Pakistan General Forest Transit Rules, 1960

Chittagong Hill Tracts Forest Transit Rules, 1974

The government has promulgated regulations both for some specific category of forests like Prohibition and Rules affecting Protected Forests in

Sundarbans Division (1959), and for some specific purposes like Rules for the Preservation of Trees and Timbers belonging to the Government in the District of Chittagong, Sylhet Forest (Protection from Fire) Rules, 1954, and Chittagong and Chittagong Hill Tracts Reserved Forests Fire Protection Rules, 1958).

However, under current social conditions and existing institutional structure, the forest department finds it difficult to enforce many of the rules and regulations issued under the Forest Act. For example, forged claims and encroachment are common due to rough and incomplete records of land and moving people from encroached forest land is socially and politically sensitive (SMPFS, 1998). Bangladesh is seriously considering improvements to improve enforceability of the legal provisions through changes in acts, rules, regulations, and institutional structures of the forest department. The efficiency of change will however be defined by the development of local institutions and human resources for conservation of natural resources.

4.5.3 Laws and policies

The National Fishery Policy promulgated in 1998 includes measures to promote and manage shrimp farming in coastal lands. The establishment of shrimp culture zones is foreseen, but information on implementation mechanisms is not available. Measures are included to mitigate some of the negative effects of uncontrolled shrimp aquaculture. The policy directs that shrimp farm sites should be selected in consultation with the Ministry of Environment and Forests to ensure that they will maintain ecological balance. The policy is new and effective implementation awaits future development. The ground situations, however, quite complex and local power structure plays a significant role in deciding the actual outcome. Almost none of these policies, which safeguard the interest of the people, are being implemented. Chronological development of different legal base of shrimp culture is highlighted in (Table 4.1).

Table 4.1
Different National Policy related to coastal aquaculture and environment protection

Policy	Private Fisheries
Private Fisheries Protection Act 1889	Oldest fisheries regulation. Protection of private fisheries and the rights of land owners who don't like to lend their land for shrimp farming, but is in conflict with the Shrimp <i>Mohal</i> Policy which authorizes the government to declare an area as Shrimp <i>jolmohal</i> .
Forest Act 1927	Allocation of fisheries management responsibilities to the Forest Department in mangrove areas. This implies duplication of the tasks and responsibilities of the Department of Fisheries, with special relevance to fisheries management in the Sandaracs.
The Protection and Conservation of Fish Act 1950	Allowing the government to frame rules for protection and conservation of fish and fisheries.
The Government Fisheries Protection Ordinance 1959	Protection of government owned water bodies against unauthorized fishing.
The Marine Fisheries Ordinance 1983. Amended Rule 28, 2000	Protection of mother shrimps in marine waters. The government has declared four places in the Bay of Bengal in the territorial waters of Bangladesh to marine protected areas with a view to ensuring breeding of fish and shrimps.
The Protection and Conservation of Fish Rules 1985. Amended Rule 8	Regulations of licensing, gears and areas of fishing in marine water. Jurisdiction is limited from the 18.29 m depth line to the limit of territorial waters. This thus excludes shallow waters where shrimp fry catching

(IA) 2000	occurs. The ordinance prescribes mesh sizes for different gears, defines the need for fishing licenses when not registered under any other law (as moships are registered with the Department of Shipping, this rule is by-passed) and facilitates the declaration of marine protected areas.
The Protection and Conservation of Fish Rules 1985. Amended Rule 8 (IA) 2000	Ban on catching of fish, shrimp and prawn fry or post larvae. During the last amendment in 2000 when rule 8 (IA) was added, it conflicts with the National Fish Policy 1998. This also conflict with the Embankment and Drainage Act 1952, which needs to modify the provision that "construction of boundaries, dams and embankments in or across the rivers, canals, floodplains are prohibited in general and can only be constructed for irrigation, flood control or drainage" should include the purpose of "water supply in shrimp farms".
The Shrimp Cultivation Tax Act, 1992	Establishes rules for payment of tax on land used shrimp cultivation within polders of Water Development Board.
The Environmental Conservation Act 1995 and Elaborated Environment Protection Rules 1995	Provision for environmental clearance. Revision is needed to avoid ship breaking industry which is relaxed under the guise of re-rolling mills.
Fish and Fish Products (Inspection and Quality Control)	Lay down detailed procedures for inspection and quality control of fish and fish products during transportation, processing and export as well as

Rules 1997	empower officers to implement the rules.
Shrimp Mohal Management Policy 1992 National Environment Policy 1995	According to the National Environment Policy, the salinity in land can not be increased. The Shrimp Mohal Management Policy declares suitable land for shrimp cultivation as shrimp mohal, thereby challenging the National Environment Policy.
National Environment Policy 1995 Export Policy 1997-2002	An expansion of traditional/semi-intensive cultivation of shrimp, as targeted in the Export Policy, could lead to an increase in salinity, which is not allowed under the provisions laid down in the Environment Policy.
National Land Use Policy 2001	Zoning in the coastal areas on the basis of land topography, tidal inundation, water salinity, soil quality and other environmental factors, with the active participation of local people.

4.6 Wildlife Consumption and Trade

Three wildlife sanctuaries were established in the year 1977 under Bangladesh Wildlife (preservation) (amendment) Act 1974 namely (i) Sundarban East Sanctuary (ii) Sundarban South Sanctuary (iii) Sundarban West Sanctuary.

Table 4.2

Three wildlife sanctuaries

Name of Sanctuary	Compartment No.	Area (ha.)	Place of importance for wildlife
Sundarban East	4567 (part)	22575.0	Katka, Kachkikhali, Supati & Jamtola
Sundarban South	43 & 44	36971.0	Nilkarnal (Hiron Point), Keora shoti, Kalirchar & Putni Island
Sundarban West	53545549 (part)	71502.0	Mandarbaria & Notabaki

Source: Field survey report

Table 4.3

Wildlife Biodiversity in Sundarbans

Wildlife	No. of Species available in Bangladesh	No. of Species available in Sundarban	Species Biodiversity (%) in Sundarban as compare to Bangladesh
Amphibians	23	8	34.78
Reptiles	154	35	22.72
Birds	632	186	29.43
Mammals	123	32	26.01
Fishes	325	177	54.46
Shrimps	35	24	68.57
Crabs	11	7	63.63

Source: Field survey report

Table 4.4

Wildlife of Sundarbans

Wild animal	Amount
Tiger	350-450
Deer	1,00,000-1,50,000
Monkey	40,000-50,000
Wild boars	20,000-25,000
Crocodile	150-200
Otters	20,000-25,000

Source: Field survey report (Appendix 4.5)

4.7 Natural Hazard

Cyclones are recurrent phenomena in the Bay of Bengal. The average annual frequency of tropical cyclones in the Bay of Bengal is about 12, out of which 5 attain cyclones strength. Of the killer cyclones which develop during spring and autumn, about 75 percent occur strictly from mid-April to mid-June and mid-

December. In many case the cyclones may be accompanied by a tidal bone / tidal surge, reaching heights of more than 20 feet, causing mega-deaths, and destroying livestock, trees / vegetation, housing and infrastructure of the country.

4.7.1 SIDR: It's Effect on the Sundarbans

Cyclone Sidr is the fourth named storm of the 2007 North Indian Ocean Cyclone. The storm formed in the central Bay of Bengal, and quickly strengthened to reach peak sustained winds of 215 km/h (135mp/h), which would make it a Category-4 equivalent tropical cyclone on the Saffir-Simpson Scale. The storm eventually made landfall near Bangladesh on November 15, 2007. The storm caused large scale evacuations in Bangladesh. So far 3447 persons death have been blamed on the storm. The name Sidr is derived from the Sinhalese language where Sidr mean hole or eye.

The first area hit by Cyclone Sidr was Hiron Point and part of the mangrove forest Sundarbans in Bagerhat and Dublar Char Island in Barguna. According to the Bangladesh Meteorological Department, Sidr had a radius of 500 kilometres with the eye of the storm being 74 kilometres and wind speeds of 220-240 kilometres per hour. As the storm moved into central Bangladesh it was downgraded to a Category II tropical storm and is currently in the northeast of the country. The Sidr first hit south-east part of the Sundarbans then moved towards of Bangladesh passing through Barguna. Pautuakhali, Jhalokati, Pirojpur, Bagerhat, Barisal, Bhola, Lakshmipur, Chandpur. Madaripur, Shariatpur, Munshigong, Narayanganj. Dhaka, Comilla, Bramanbaria, Narsingdi, Habigang. Kishoregonj. Maulvi Bazar, Sunamganj and Sylhet.

A careful examination of the map of the sundarbans Reserved Forest, Bangladesh showings 55 compartments in relation to reveals that south eastern compartment nos. I to II, 12, 14, 15 and 45 have been mainly affected by the tidal upsurge associated with the cyclone Sidr.

The natural vegetation of the Sundarbans is composed mainly of halophytic tree the eastern part is mainly dominated by Sundri and Gewa, which were affected by cyclone Sidr on 15 November 2007.

The forest area affected by Cyclone Sidr, which struck on 15 November 2007. Initially, the affected area is delineated from a Terra MODIS satellite image acquired on 18 November 2007. Its resolution is 250 meters. The visual interpretation key was used to estimate the area. It was estimated that around 1,900 sq km (31% of total the Sundarbans area) of area in the eastern part of the Sundarbans was affected by the cyclone. Various species, mainly Sundri and Gewa are physically affected within this area.

The flora and fauna of the Sundarbans, became a major casualty of the devastating cyclone. The Forest Department is yet to make an assessment of the colossal losses of wildlife in the Sundarbans.

Sidr damaged 25% of the south eastern part of the Sundarbans. Out the damaged area 7% (ca 30,000 ha) damage was severe 18% (ca.77,000 ha) damage was partial. Sidr uprooted and broke severely damaged crown of still standing trees, foliage have been striped off from branches of trees in nearly one third of the Sundarbans mainly including the World heritage Sites, many forest stations, boats, jetties etc have been severely damaged, fresh water ponds have been contaminated by saline water, six out posts have been totally destroyed. Two tigers, 23 deer, 1 forest staff have been found dead because of tidal upsurge. Residential accommodation of nearly 1000 persons has been badly damaged or washed away. Sundarbans will require years to recover from the damage. Forest Department's official apprehension that the total damage of all kind might amount to US\$145 million while Governments official source supports suggest the damage to be US\$150 million Forest Departments strategies are to rebuild damaged outpost, revive the safe drinking fresh water, mark and estimate fallen trees and record them by species make fill scale estimation of damage, assist in natural regeneration and plant where necessary

Cyclonic Sidr with a peak sustained wind speed of 250 km made landfall on Bangladesh on November 15, 2007 with tidal wave extended upto 35 km into the mainland and caused extensive damage to southern parts of Bangladesh. According to Disaster Management Control Room update it has been estimated that 141 upazilas, 1119 unions, 10.54 lakh families, 40.83 lakh individuals, crop damage in 29374 acres completely and 8 55 525 acres partially, 300511 houses completely damaged, 6 26 000 houses partially damaged, 384000 trees damaged. 792 educational institutions completely and 4393 partially damaged 57 km embankment, 58 km road completely damaged, about 3500 persons killed, 2259 persons missing and 6610 persons injured.

Mangroves are salt tolerant evergreen forests found along coastlines, lagoons, rivers or deltas in 124 tropical and subtropical countries in the world out of which 50% occur in Indonesia, Australia, Brazil, Nigeria and Mexico while Sundarbans is the largest single tract mangrove forest in the world. Sundarbans forest provide wood, fuelwood, diverse forest produce, and also acts as refuge for wildlife, serve as nurseries for fish, shrimp, crabs, and other valuable marine life. Sundarbans and coastal vegetation produce about 3.5 million tons of detritus which produces nutritious food for all species of aquatic animals. Mangroves slow the velocity of water and reduce the height of waves and storm surge. The annual economic value of mangroves, estimated by the cost of the products and services they provide, has been estimated to be \$ 2 to 9 lac per ha. A comprehensive measure to restore and protect our mangrove forest is vital for our existence.

Mangrove ecosystems serve to protect coastal areas against erosion, cyclones and wind. They provide wood, food, fodder, medicine and honey. They are also habitats for many animals like crocodiles and snakes, tigers, deer, otters, dolphins and birds.

Globally there has been about 20% mangrove destruction reducing from 18.8million ha in 1980 to 15.2 million ha in 2005. The rate of mangrove loss is significantly higher than the loss of any other type of forest.

Since the Sundarbans and mangrove plantations in the coastal areas act as shields against natural calamities like cyclones, storms, tidal upsurges, provide a diverse forest produce including timber, fuelwood, fodder, minor forest produce including fishes, act as a nursery and breeding ground of off-shore crabs of the Bay of Bengal we have to take all out efforts to save the world is Sundarbans and promote its further development.

4.7.1.1 The daily news paper (The Daily Star), weekly, half yearly, yearly magazine reports about Sidr:

Originated from a depression over the southeast bay on November 12, it was roosting only 755km southwest of Chittagong port, 675km Southwest of Cox's Bazar and 705 Km South of Mongla port.

The Daily Star correspondents:

First day of the Sidr, the coastal districts including Cox's Bazar. Chittagong. Noakhali, Laximpur, Bhola, Patuakhali and Barisal, Chandpur, Bajguha, Pirojpur, Jhalakathi, Bagerhat, Khulna, Satkhira and their offshore island and chart have been experiencing gusty winds and rain since early yesterday.

Hurricane Sidr hit the coastal districts, Particularly Khulna and Barisal, as it started crossing the country from northern Bay of Bengal last evening with high tidal stage and strong winds of over 200km per hour. Hundreds of thousands of people, especially those living in coastal zone, were evacuated in the last two days. Met officials said the category -s hurricane Khulna and Barisal coasts near the Bateswar River around 7.30 pm with winds of river 210 km in hour. The cyclone was still crossing land at 10.00 pm and would take another few hours to completely cross the country, according to the met officer.

Second day of the Sidr, the actual extent of destruction in Bagerhat could not be known till filing of this report as a very few could reach areas like Sharankhola near the worst hit Sundarbans. The world's largest mangrove forest.

According to the 10.45 pm update of the government, 177 killed in Patuakhali, 134 in Pirojpur, 133 in Bagerhat, 78 in Barisal, 35 in Barguha, 78 in Barisal, 35 in Barguha, 32 in Jhalakathi, 20 in Bhola, 10 in Faridpur, 8 in Khulna, 4 each in Chandpur and Dhaka, 3 in Sathkhira, 1 each in Laxmipur, Chittagong, and Jessore.

Third day of the Sidr, Some experts said they fear many wildlife including tigers, deer, crocodiles, wild birds, Kingfishers and Monkeys might have been washed away and perished under the weight of uprooted trees of the world natural heritage site, Sidr practically ruined the beauty of the Sundarbans, the experts, absorbed. An official of Red Crescent said many residents of Dublar Char Shoronkhola were swept away by the tidal Surge. 20 of who were recovered.

Fourth day of the Sidr, the cyclone left its marks of devastation on 103 upazillas, 710 unions affecting 2745 lakh population of about 8.44 lakh families. The storm also killed 2.42 lakh livestock and completely destroyed crops on 18,122 acre land including six lakh metric tones of Aman crops. According to the estimate 2.73 lakh house were also fully flattened.

Advocate Shahjahan. Chairman of the Borguna municipality told the Daily Star. Following is the toll confirmed by the government. Bagerhat 610. Barguha-275. Patuakhali-261. Pirojpur-184. Barisal-83. Jhalokathi-34. Madaripur-30. Gopalganj-29. Bhola 23. Shariatpur-15, Khulna- 14. Shatkira-11, Faridpur-10, Dhaka-4, Chandpur-4, Munshiganj-4, Laxmipur-2, Narayanganj-2, Laxmipur-2, Narayanganj-2, Jessore-1, Chittagon- 1, Rajbari-1.

Fifth day of the Sidr, the corner of Dublar Char and the worst-hit areas still reeling from the devastation with bodies being recovered and the need of the moment is water. Eight more bodies were found here and many more are feared buried deep in the forest. We know we have no control over these things; we are just some help fewer journalists go in from one water marooned

place to another and then to a ship anchored in the middle of the bay. We start walking farther; we are now fleeing from the haunted island.

Six day of the Sidr, about one fourth of the focus lakh plus hectares of forest area of the world heritage site, the Sundarbans, has been damaged by cyclone Sidr according to a primary assessment of the forest department. The updated government estimates plus the death toll a 2,745 while the Armed Forest Division puts it at 3,113.

Seven day of the Sidr, around 10 lakh tonnes of Aman rice production may be lost due to cyclone Sidr along with other standing crops in an area of eight lakh hectares of land according primary assessment of the agriculture ministry the Disaster management control rooms updated damage assessment says that a total of 200 upazilla with 1.70 unions the number of affected fortifies is 13.22 lakh 54 .88 lakh people crop on over 1.53 lakh acres of land were destroyed and 12.66 lakh were damaged.

Eight day of the Sidr, The Sundarbans is visible on the horizon, just on the other side of the wide Baleshwar River, now it is very calm, no signs of devastation, just some rotten carcasses of cattle and chickens are floating on the surface.

Among the bunch of people waiting on the riverbank Abul Kashem Haolder, a former up member stepped forward and said, "We do not have anything left. Everyone here, both the rich and the poor, has become beggar.

He paused for a while, took a long breath and said, "We have beerier 480 people from this village. Still some dead bodies are floating in the nearby canal."

Southkhali is the worst- hit village in the country by the cyclone Sidr people of the Village said they had 310 families, each with five to 15 members. They have already buried 480 people. While many more are still missing. People from Southkhali, Bogidoshghar, Khuriakhali, Gabtala, and Terabeta are spending their days in real dark in the open sky. As they do not have kerosene or candle to light up at night.

Damage updal:

According to the food and Disaster Management Ministry data yesterday 68 lakh people have been on 4,61,392 acres of land have been damaged completely and on 12,25304 acres partially. The cyclone has destroyed at least 3,63,346 houses partially.

The countries second largest each cow, shrimp, or frozen food industry earned \$ 515 million from export during the last fiscal year (2006-2007).

The government has fixed an export target of \$ 600 million in the frozen food sector of this running fiscal of 2007-2008.

The hurricane damaged structures of 45,559 water bodies on 1.54 lakh acres in eight districts worth Tk 3.18 crore.

Nine day of the Sidr, The sources said approximately about 63.31 lakh kg of fish worth Tk 25.09 crore and 4.460 kg of shrimp worth Tk 8.09 lakh were washed away in this district. Huge fish fries were also washed away. Incurring a loss of about Tk 6.27 corore.

The drive posts my village on their way to Southkhali, I heard thousands of people have died there, but hundreds died in our village too. We have 2400 houses destroyed but we are not getting antacid. "Said Shamsujamaddar in Chalranda, only two villages away from Southkhali.

The local administration sources said Non-government organizations (NGOs) are not informing them about what they are giving out as relief, 80 anomalies in distribution might occur. Sources said cyclone victims in remote places were not getting anything while the areas near to the district headquarters were getting more than once.

Meanwhile, people have yet to have their houses rebuilt.

Individuals and different organizations including Red Crescent. GrameenPhone. Warid Telecom. Save the children and Sammilito Sangskritk Jote Thursday distributed relief in the Cyclone affected areas in Patuakhali.

Tenth day of the Sidr, Meantime, one man in his seventies. Mainuddin, died of cardiac, arrest and one fodder, Rubles, was stampeded to death in

Patuakhali as rumours spread that another cyclone, Codenamed Nargis, was about to hit the Coastal zone, creating Pandemonium in the Southern districts.

Eleventh day of the Sidr, Academic activities of around 10,000 institutions in 30 districts have been seriously disrupted because of the devastating cyclone Sidr, which badly damaged schools. Colleges and Madrasas and educational Material in these areas.

According to the disaster control, centre, 1335 educational, Bhola, Hailakhthi and Barisal were completely damaged by Sider that hit the southern coastal districts on November 15. Education secretary M Mamtazul Islam said cyclone Sidr hit at a time when students were preparing for their final examinations. We will talk with the top government officials about allocating additional funds for repainting the affected schools, he said adding. "Although the Education Ministry has no budgetary allocation for repairing non-government institution it is ready to provide funds in such dire circumstances.

Earlies during the floods of July-August. Over 7000 educational institutions in 39 northern districts. Especially Sirajganj, Monshigonj, Ratbari, Foridpur, Comilla, Bogra, Pabna. Gaibandha, Nilphamari, Kurigram. Shariatpur. Rangpur. Manikganj. Sunamganj and Madaripur were damaged.

The government had to adjourn exam at many institutions that went under flood water while others were used a shelters for the flood affected people.

Many of the cyclone victims of Sharankhola, Morolgonj and Mongla, who have lost their near and dear ones, yesterday used the government to build more cyclone shelters immediately for humans and livestock. Many men and women also burst into tears while describing their dreadful expiring. The peakers also suggested the government, to take measures so that the coastal people can understand the significance of danger signals and take shelters to avoid death. Talukder Khaleque suggested the government to rebuild the schools and Madrasas in Costals areas as educational institutions cum- cyclone centers. He said that the government should completely ban the entry into Sundarbans

for up to 20 years to save its greenery as he said almost half of the mangrove forest has been severely damaged by the cyclone.

Twelveth day of the Sidr, Md. Shahidullah, divisional forest official at Chandpai range, told that it was an adult tiger of 3 feet 11 inches in height, and 8 feet 5 inches in length including the tail?

"The body of the tiger was so gotten we could not even skin it" said Shohidullah the forest officials said believe it was killed when cyclone Sidr Stick the country on November 15.

Earlier, officials of the December of forest said that they found 33 carcasses of deer since the cyclone. Experts said at least 25 percent of the Sundarbans was destroyed by the worth of Sidr. Following a tornado in 1988, nine carcasses of tigers were found floating in rivers and canals of the Sundearban.

Thirteenth day of the Sidr, Out break of different diseases like Diarrhea, Pheumonia fever and typhoid is spreading in Pathukhaly in the aftermath of devastating cyclone Sidr. Locals and districts administration sources said "Diarrhea and cold related diseases are spreading in the affected areas, especially in shoal areas in seven upazilla.,, Team leader captain Foez said, "We're providing health service to on average over 200 patients a day. About 1500 patients took medical services from the team on Monday at Ranipur Village in Mirzagonj; The team has also distributed relief good among the cyclone victims.,,

Fourteenth day of the Sidr, The CA informed that the government has decided to allocate Tk 90 crore from the budget for providing assistance to the victims of cyclones "Sidr". A policy guideline on spending the allocated money has already been formulated, he said.

He left Sharonkhola for Pirojpur district and landed on Syed Mostafa Kamal Playground in Matbaria at 11.00 am.

Local Army-camp commander LT COL Mostafa Kamal apprised the chief adviser of the losses caused by the cyclone and steps taken so far after the

disasters. The chief Adviser also visited KM Latif Institution where-he studied from class – VII to class- IX.

Fifteenth day of the Sidr, The department has supplied adequate quantities of vaccines in the 12 districts for distribution of cost. It also sent cattle and poultry feed. For treatment of injured cattle, he said. President of world poultry Science Association (WPSA) Moshiler Rahman said 14 lakh broilers and layer paltry birds were affected in the fours severely hit districts. About 1100 poultry farms in 12 districts were damaged partially in the cyclone. Director of livestock department Santi Ranjan Das said the government has taken several short- terms. Medium- term and long-term Measures for this sector. Giving details, he said the department is distributing vaccines, animal and poultry feed in cyclone affected district as part of short-term measures, As medium term- measures, the government will distribute cattle and poultry birds free of cost among farmers who lost they farms. As part of long term measures. The livestock department will develop infrastructures for cattle and poultry farms for rehabilitations of many of the farmers.

Sixteenth day of the Sidr, Running the beautiful, green land, scope, cyclone Sidr has dealt a severe blow to the Sundearbons destroying 1528 square kilometers of the forest out of around 6000 structure kilometers, according forest officials, primary assessment. Of the devastated areas totaling about one- fourth of the forest. 1200 square Kilometers are land and the rest water bodies. The officials assess that more than TK 1000 crore worth of forest resources have been long in addition to another Tk 20 core in infrastructure damage Every year, the government earns Tk 60-65 lakh in revenue by giving permission to honey and nymph's collectors. The forest officials say that devastation is severe and it will take years to recover from the loss. Special alternation from both home and abroad to restoration is also required they add. The sources say 90 percent accommodation facilities for the 1100 strong forest officials there have been completely destroyed. The government is going to allocate Tk 34 crore in the initial stage. Over the years, the forest

officials have been felling trees in the Sundarbans. This time the government sheered monitor it so that they just don't fell trees and sell those" Said a high officials of a promote organization who has been working on the Sundarbans for years.



**Plate 4.7 Damages of Rayel Bengal (*Panthera tigris*) Tiger
by Sidr**



Plate 4.8 Damages of Wildlife by the Sidr

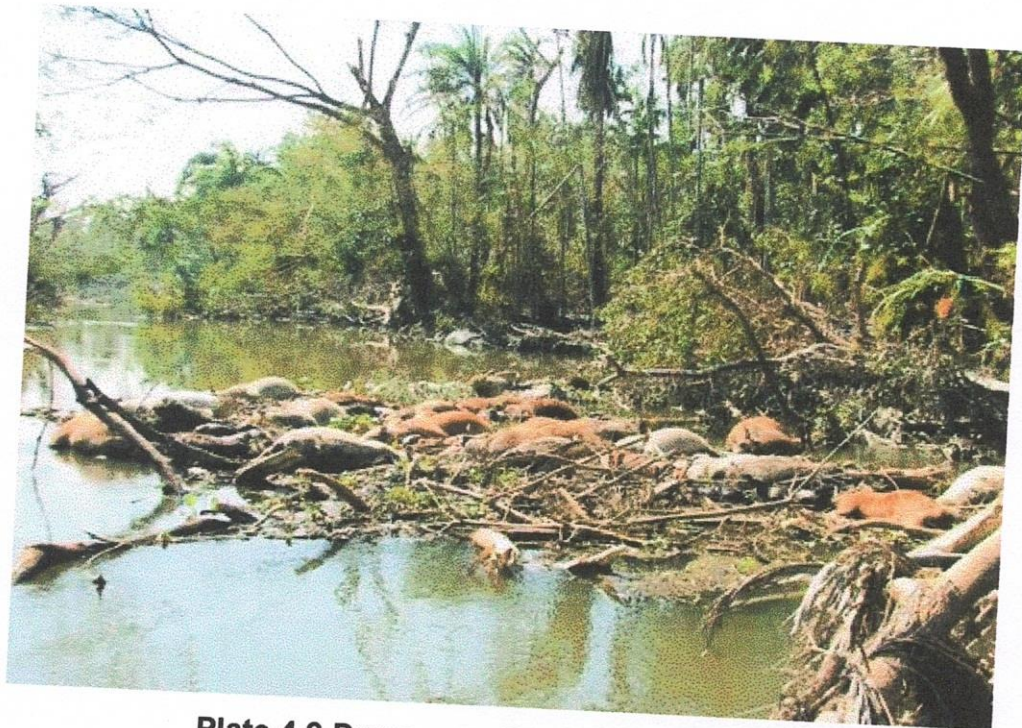


Plate 4.9 Damages of Wildlife by the Sidr



Plate 4.10 Damages of human life by Sidr



Plate 4.11 Damages of House hold by Sidr



Plate 4.12 Damages of forest by the Sidr

4.7.2 AILA: It's Effect on the Sundarbans and Surrounding Area

Cyclone Aila

From Wikipedia, the free encyclopedia

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Severe Cyclonic Storm Aila

Category 1 Tropical cyclone (SSHS)

Severe cyclonic storm (IMD)

Severe Cyclonic Storm Aila at peak intensity

Formed 23 May 2009

Dissipated

26 May 2009

	3-minute sustained:
Highest winds	110 km/h (70 mph)
	1-minute sustained:
	120 km/h (75 mph)
Lowest pressure	968 mbar (hPa); 28.59 inHg

Damage	\$552.6 million (2009 USD)
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Areas affected	India, Bangladesh
Part of the 2009 North Indian Ocean cyclone season	

Cyclone Aila (IMD designation: **BOB 02**, JTWC designation: **02B**, also known as **Severe Cyclonic Storm Aila**) was the second tropical cyclone of the 2009 North Indian Ocean cyclone season. A relatively strong tropical cyclone, it caused extensive damage in India and Bangladesh.

As of 27 May 2009, 330 people have been killed by Aila, and at least 8,208 more are missing, while about 1 million people are homeless. Health officials in Bangladesh confirmed a deadly outbreak of diarrhea on 29 May, with more than 7,000 people being infected and four dying. In Bangladesh, an estimated 20 million people were at risk of post-disaster diseases due to Aila. Damage totaled \$552.6 million (2009 USD).

4.7.2.1 Aftermath of Bangladesh: Immediately following the storm, a 33-member team of the Bangladesh Navy was deployed to the affected regions. The Red Cross also quickly responded, supplying water purifying tablets and other relief items. The Deputy Commissioner of Satkhira district allocated ten tonnes of rice and Tk.100,000 (US\$1,450) in immediate relief funds for that district. The government later allocated Tk. 1.2 million

(US\$17,143) and 1,000 tonnes of rice for the affected areas. These amounts further increased to Tk. 12.3 million (US\$175,714) and 2,500 tonnes of rice.¹

Five days following the impacts of Aila, the Bangladeshi Health Organization confirmed that a widespread outbreak of diarrhea which has infected over 7,000 people. Another outbreak of water borne diseases, namely dysentery, has infected over 3,000 people. At least two people have been confirmed to have died from diarrhea and two other fatalities were reported. Officials feared that the outbreak would lead to many fatalities in isolated areas that have not received aid and have been without food and clean water for nearly a week.

Table 4.5

Total Damages of Aila

Districts	Affected population	No. of deaths	People took shelter	Damaged crops (Acre)
Barisal	367895	7	173225	122591
Bhola	270983	12	173225	16157
Pirojpur	248470	1	30000	55107
Patuakhali	615785	8	39400	97998
Borguna	284079	0	78500	89280
Jhalokathi	213860	0	0	3357
Khulna	494900	35	109000	5834
Bagerhat	234237	2	162700	2643
Satkhira	595122	32	119337	559
Chittagong	12523	1	4148	146
Cox's Bazar	29795	2	13700	0
Laxmipur	12371	7	21030	5021
Feni	40000	0	2600	496
Noakhali	49244	24	36200	1500
Total	3469264	131	963065	400689

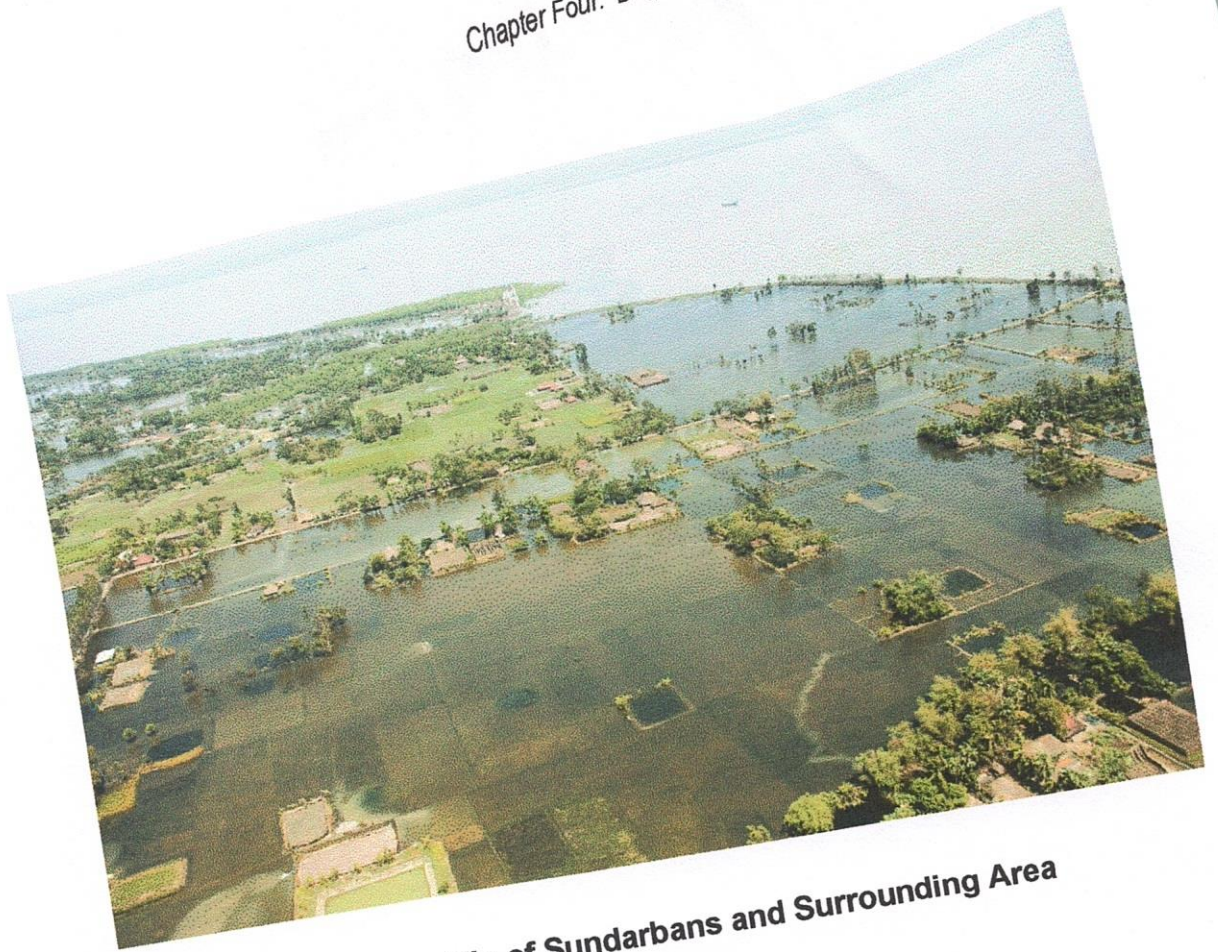


Plate 4.13 Aila of Sundarbans and Surrounding Area



Plate 4.14 Damages of homestate by the Aila



Plate 4.15 Aila of Sundarbans and Surrounding Area

Even where efforts have been made to slow the destruction, remaining forests have a number of problems. In some areas, the health and productivity of the forests have declined significantly. The causes of these tragic losses differ from habitat to habitat but are generally tied directly or indirectly to human activities. Individual study is required to determine the most effective remedial measures. Where degraded areas are being regeneared, continued monitoring and thorough assessment must be done to help us understand the recovery process. This knowledge will help us develop strategies to effectively rehabilitate degraded mangrove habitats in the Sundarbans Forests.

Chapter 5

PRESENT AND PAST DEVELOPMENTAL ACTIVITIES OF SUNDARBANS

CHAPTER FIVE

Present and Past Developmental Activities of Sundarbans

5.0 Introduction

In this chapter various policy measures as well as institutional measures have been discussed. Different development plans emphasizing the aspects of the Sundarbans and various government agencies and NGOs working in this field to change the fate of them through various multidimensional programmes have been attempted to discuss in the chapter.

5.1 Socio-Economic Status of People in the Sundarbans

Over four-fifths of the people living in of the Sundarbans are dependent on agriculture on reclaimed land, which bear mostly single crop of paddy. Besides agriculture, other occupations are fishing and pisciculture, honey collection and woodcutting. Some 50% of agricultural laborers are landless. And 44% of total population belongs to Schedule Caste and Schedule Tribes. As a result, the level of literacy and per capita income are much lower in the Sundarbans than in other parts of West Bengal. The communication is also very poor and most of the areas are inaccessible. Though some of the points are linked with Calcutta by few metal roads, Communication in this area dissected by the network of numerous streams and canals is dependent mainly on boats and motor launches.

5.1.2 JGM and Eco-Development of People in and around of the Sundarbans

Traditional forest management and mere policing were found to be insufficient to conserve mangrove forests and their bio-diversity. SBR was, therefore, created with the main thrust on socio-economic development activities with conservation and ensuring people's participation in the process through mass awareness building and motivation. Following the success of JGM through Forest Protection Committees (FPCs) in the fringe villages in other parts of West Bengal, the same system has been given to include all the families in the villages taking one member from each family with the provision of joint

membership for each household (husband being a member, wife becomes automatically a member).

Different categories of products harvested from the Sundarbans with their annual production and value in the year of 2009-2010 (**Appendix 5.1**).

As provided in the Government Order of 1989, the members of FPCs will be entitled to 25% of net sale proceeds of final harvesting of plantations/forests and 25% of the intermediate yields from coppicing, multiple shoot-cutting and thinning and collection of fallen twigs, grass fruits, flowers, seeds etc. For socio-economic development of the people, a package of eco-development programme which includes agriculture, aquaculture, bee-keeping, farm forestry, horticulture, distribution of smokeless chullah, use of solar energy for generating electricity, vocational training, health services, veterinary services, etc. are being implemented. With the economic enlistment of the people in and around the Sundarbans, the buffer population will help protect the mangrove forests and their eco-system from the biotic interference. This will also minimize the age-old man-animal conflict. Many FPCs comprising of villagers have already been formed and recognized within the areas of 24-parganas.

5.2 Revenue and Income (Per Year)

Previously it had taken the planning of measurement, census and management for the Sundarbans. Data from that plan proved that, several governments also used to maintain the forest and had been collecting the revenue through company, landlords or themselves. At the period of Shah Suja in 1875 to 76, Sundarbans had counted under the revenue income source for the first time. At the time of first yearly maintenance in 1975-76 the forest division had collected Tk. 32,722 as revenue from Khulna (then Jessore), Barisal and 24 Pagan's division by 22-exit toll station. Perhaps that was the first collected revenue.

Different rates of transport for tourist by the divisional Forest Officer, Sundarbans Forest division. There need an estimation of assets of Sundarbans. The assets are of two types – tangible and intangible. Tangible assets refer to the main or subsidiary forest products like animal, birds, land etc. There is an effort for the estimation of the tangible assets of Sundarbans. The people of Sundarbans who used of different assets are presented in (**Appendix 1.7 & 5.2**).

Table 5.1

Statistics for Revenue Income (last nine years) of Sundarbans

Fiscal Year	Received Revenue	Comments
2002-2003	7,33,06,901.98	At present the revenue income from Sundarbans has postponed. Naturally if there is the collection for the revenue, it may easily exit hundred crore of taka.
2003-2004	8,01,50,560.05	
2004-2005	8,02,70,530.70	
2005-2006	8,06,30,850.68	
2006-2007	8,10,40,550.36	
2007-2008	8,05,29,448.88	
2008-2009	8,12,50,5635.60	
2009-2010	8,20,70,530.90	
2010-2011	8,70,40,620.50	

Source: Field survey report

Table 5.2

Different categories of products harvested from the Sundarbans with their average annual production and value in the year of 2009-2010.

Category	products	production (2009-2010)	Value (Taka in Crore) 2009- 2010	production (2010-2011)	Value (Taka in Crore) 2010- 2011
Wood	Timber	18,000 (cubic meters)	68	20,000 (cubic meters)	72
	Pulpwood/Matchwood	63,000 (cubic meters)		72,000 (cubic meters)	
	Fuel wood	61,000 (tons)		70,000 (tons)	
	Goalpata/Hantal	69,000 (tons)		75,000 (tons)	
Fisheries	Fishes	3,700 (tons)	183	4,700 (tons)	193

	Crustaceans	1,400 (tons)		2,000 (tons)	
	Shrimp fries	253 million		270 million	
Non-wood	Honey/Wax	200 (tons)	53	250 (tons)	65
	Grass	8,300 (tons)		10,300 (tons)	

Source: Field survey report

The acceptable account of the intangible asset has not yet been made possible to be calculated. Different categories of products harvested from the Sundarbans with their average amount production and value in the year of 2009-2010 & 2010-2011 (**Appendix-5.1 & 4.1**).

In 1993, the Sundarbans water contributed over 10,000 metric tons of fin fish, shrimp, more than 3,600 metric tons of crabs, dead shell of oyster and about 35 metric tons of gastropod shell for lime and nearly 180 million tiger prawn fry were collected by about 150,000 collectors. This total aquatic production of the Sundarbans worth over 400 million taka of production that provided revenue of nearly 17 million taka to the Government through the Department of Forestry in 1992-93 (Chantarasri, 1994).

5.3 Materials and Methods

This chapter is the study about the present and past developmental activities of Sundarbans. The data on the development of the Sundarbans have been collected from the adopted projects of the present and past, Internet, different forest offices, different libraries and Bon Vhabon, Dhaka. What influence of the development activities on the Sundarbans works is determined and the opinions of the experts regarding the development of the Sundarbans have been accepted.

5.3.1 Result and Observations

5.3.2 Comments of the Sundarbans Forest about Revenue Income of Sundarbans

In answer to 6th question (*i.e.* what are the main sources of revenue of the forest?) in this case almost all the Forest Expert (FE) have given same answers and they have mentioned that the main sources of revenue of the forest are

wood, fish, honey, firewood, Goalpata, tourist fee and wax etc. So it is crystal clear that the above-mentioned property is very valuable to improve the real condition of the forest.

In reply to 6th question (*i.e.* what are the main sources of revenue of the forest?) both of the DFO have said that the main sources of revenue of the forest is wood, fuel wood, Goalpata, honey and water resources.

In answer to 6th question (*i.e.* what are the main sources of revenue of the forest?) in this case almost all the Range Officers have given same answers and they have mentioned that the main sources of revenue of the forest are wood, fish, honey, firewood, Goalpata, tourist fee and wax etc. So it is crystal clear that the above-mentioned property is very valuable to improve the real condition of the forest.

In answer to 6th question (*i.e.* what are the main sources of revenue of the forest?) the table shows that in regard to the question about the main sources of revenue of the forest the total six forest rangers have made almost different comments. Three of them have mentioned that the main sources of revenue of the forest are collecting forest assets. Another one has mentioned that wood, firewood, Goalpata, honey, water resource and tourist fees are the main sources of the revenue of the forest. Only one has made comments about the pass permit. He has said that pass permit and revenue are the main sources of revenue of the forest. Another one has said that the main source of revenue of the forest is selling of sized wood, Goran fuel, Golpata, honey, fish, and others revenue. It is obviously said that all of them has given priority on the natural resources.

In reply to 6th question (*i.e.* what are the main sources of revenue of the forest?) about the main sources of revenue of the forest majority (eleven) of the respondents have mentioned that the main sources of the forest is the forest-grown property. Only two have mentioned that permit the pass and catch fish. Rest of the three has made different comments. One of them has made comment that collecting fish, the crab Goalpata, Goran, the cockle, and honey are the sources of revenue income. Another one has mentioned that huge

forest revenue is being collected through seasonal well, pass through fish and from honey. And one has mentioned that buying controlled materials collecting Goran fuel and Golpata, catching fish and crab. In the analysis it is obvious that all of the Deputy Rangers, who are mentioned as respondents have emphasized on natural resources.

In answer to 12th question (*i.e.* what might be the yearly revenue expenses for forest management?) about the yearly revenue expenses for forest management majority *i.e.* out of four, three of them have made no comments. Only one of them has said that there is no revenue expenditure but need a separate budget.

5.4 Strategy Environmental Management and Protection

The strategy has been developed on the basis of an analysis of the situation by the consultants as presented in the Mid-term Options Report, subsequent consultations with stakeholders, the experience of the Bank in Bangladesh and in the sector, and other relevant experience in Bangladesh and elsewhere. The key elements of the strategy (ends and means) are

- # There must be a single purpose, multi sectoral agency with the authority and power to manage all the resources of the SRF;
- # Authority must come from the legal basis under which the agency is established.
- # Power must come from the agency's ability to retain revenue and purchase specific outputs from service providers - authority without power is meaningless;
- # The agency must be a single-purpose agency - that is, its sole responsibility must be biodiversity conservation and sustainable management of the SRF;
- # The agency must be able to retain revenue for reinvestment in biodiversity conservation and resource management;
- # The agency must be run along private sector lines, although it must be owned by the Government on behalf of the people of Bangladesh;

- # The agency must pay a dividend to the Government at least equal the current revenues received in real terms and be fully self-funding within three to five years;
 - # The agency must minimize its own size by maximizing its use of contracted service providers and through not undertaking those activities, which can be more efficiently carried out by others (private sector, NGOs, etc.);
 - # The agency must have flexibility to attract and reward competent staff and to compensate them for working under difficult conditions when necessary;
 - # The agency must develop institutional memory and capacity based on permanent staff with at least a medium-term commitment to the SRF as opposed to those passing through' as part of a short-term posting by an organization with wider responsibilities.
- (a) Improvement of socio-economic condition of local people.
 - (i) Existing socio-economic condition local inhabitants
 - (ii) Main income source and profession
 - (iii) Alternative profession like training on pond fish culture, honeybee culture, livestock rearing, poultry farming, cane furniture making, tailoring etc.
 - (iv) Creation of education facilities
 - (v) Creation of job facilities like food for work, plantations work etc.
 - (b) Participatory approach in the Sundarban Forest management (degraded area).
 - (c) Strengthening of the Sundarban Forest management.
 - (i) New legislation if present one is ineffective
 - (ii) Strict implementation of law
 - (iii) Involvement of more guards and officials
 - (iv) Improvement of logistic support like speedboat, trawler, 4-wheel jeeps, and wire-less set etc.
 - (v) Training on people's participation in forest management

- (vi) New project on plantation in degraded area to restore the ecosystem.
- (d) Mitigation of bio-diversity loss by natural calamity.
 - (i) Increased plantation nearby the khals, creeks, and rivers to reduce the loss caused by cyclone and tidal wave.
 - (ii) Set up Kella above flood level to shelter the wildlife during tidal surge, tidal bone and cyclone.

Comments of the Sundarbans Forest about Management

To answer first question (*i.e.* what is your idea about Management Structure of the Forest?) of two Forest Expert has expressed that periodic management plant is estimated for the Sundarbans management from for a long time and its subject matter mandatory. In this regard, another FE has said that management is directed keeping place the accepted management plan for forest management.

To another 2nd question (*i.e.*, what are the Characteristics of Management of the Forest?) of maximum FE has expressed that the characteristics of management of the forest are two categories employment opportunities for the people of the forest adjacent areas, to supply the forest goods in the market and to conserve the natural forest for the new generation.

In answer to 3rd question (*i.e.* what is the strength of the forest?) of maximum FE has mentioned some step about the strength of the forest, these are several cultural system of the Sundarbans selection cum improvement system. The working circles under this system are Sundri working circle, Gewa working circle, and Goal pata working circle, fuel wood working circle and miscellaneous working circle. In answer to this question another FE has comment that present working pass permit is given only to the Goal pata, Goran fuel.

In answer to 4th question (*i.e.* do you know at any of its weakness of management?) of ten numbers expressed that the proper implementation of management plan.

To answer 1st question (*i.e.* what is your idea about management structure of the forest?) one DFO has expressed that periodic management plan is estimated for the Sundarbans management from for a long time and its subject matter mandatory. In this regard, another DFO has said that management is directed keeping place the accepted management plan for forest management.

To another 2nd question (*i.e.* what are the characteristics of management of the forest?) two DFOs have expressed that the characteristics of management of the forest are two create employment opportunities for the people of the forest adjacent areas, to supply the forest goods in the market and to conserve the natural forest for the new generation.

In answer to 3rd question (*i.e.* what is the strength of the forest?) two DFOs have mentioned some steps about the strength of the forest, these are several cultural system of the Sundarbans selection cum improvement system. The working circles under this system are Sundri working circle, Gewa working circle, and Golpata working circle, fuel wood working circle and miscellaneous working circle. In answer to this question another DFO has comment that present working pass permit is given only to the goal pata, Goran fuel.

In answer to 4th question (*i.e.* do you know any of its weakness of management?) two numbers expressed that the proper implementation of management plan.

In answer to 1st question (*i.e.* what is your idea about management structure of the forest?) four Range Officers (ROs) have made different comments Mr. Shabuddin and Mr. Rajsg Chakma make same comment about the management structure of the forest that management system followed by forest master plan. On the other hand, other two ROs have made different comments. One of them has said that in the Sundarbans management system provides in the scientific basis by 20/10 years plan. And other RO has said that the management of the forest is completely followed by forest rules.

In case of 2nd question (*i.e.* what are the characteristics of management of the forest?) the four ROs have made completely different comments. One of them has said about the characteristics of management of the forest that after fulfillment the local demand strengthen government by paying revenue of National Revenue Board (NRB). And it is called keeping ecological balance. Another RO has said about the characteristics of management of the forest that to ascertain the proper use of all forest grown properties of the Sundarbans, the sustainability of the forest by cutting of increment portion only and create employment of the people of impact zone and contribute in the national economy. On the other hand, one of them has given emphasis on conservation of forest plus told to ensure the employment of the local people and supply the forest grown materials in the market. And the fourth RO has made comment about the characteristics of management of the forest that sustainable management, create job for local people and conservation of biodiversity. Here it is noted that majority of the Range Officers have emphasized on the employment of the local people and one of them has mentioned about the conservation of the biodiversity.

In answer to 3rd question (*i.e.* what is the strength of the forest?) about the strength of the forest out of four Range Officers three of them have made almost same comments. Out of three ROs, two of them have said that the strength of the forest is the management of the Sundarbans which is conducted in selection-cum-improvement system under various circle like-Sundry working circle, Gewa working circle, Goalpata working circle, Goran working circle and miscellaneous working circle, Gewa working circle, Goran working circle etc. are completed according to the management plan. But now only Goalpata and Goran firewood pass is permitted for work. On the contrary only one of the four ROs has made comment that the activities are completed according to the various circles. In these circumstances we can say easily that to improve the strength of the forest we have to conduct different circle according to the rules and regulation of the forest.

In answer to 4th question (*i.e.* Do you know any of its weakness of management?) about the weakness of the management of the forest out of four

ROs three have made positive comments. One of them has mentioned that almost accurately there is weakness. Another two ROs have made comment that the project of Sundry working circle of management plan is not materialized. Besides, it is problem to supervise properly the activities of management plan, and fuel to protect the pirate, problem of manpower. On the other side, only one of the four Range officers has not made any comments about the weakness of the management system. So it is obvious that there is some problem of the management system.

In reply to 13th question (*i.e.* what is the Organization chart of its management?) about the organization chart of its management one of the four Range Officers has kept silence. Two of the rest range officers have made same comments and they have said that there are following chart of its management forest division/department office, range office, station office and camp. Another one RO has said that there are divisional office, range office, station office and camp **(Appendix-6.2.3)**.

In answer to 1st question (*i.e.* what is your idea about management structure of the forest?) the table shows that half of the forest rangers *i.e.* three of the total six forest rangers have said that the management structure of the forest is good. On the other hand, two-thirds of the total forest rangers have said that it needs a requirement of new management plan. And only one of them has said that manpower goals to check accept one or two. From the comments of the forest rangers we can conclude that the management structure of the forest is well.

In answer to 2nd question (*i.e.* what are the characteristics of management of the forest?) the table shows that in response to the question about the characteristics of management of the forest all the forest rangers have answered somehow same accept one. The exception one has said that the characteristics of management of the forest is employment for local people, demand fulfillment of wood in market, preservation of wild life, reservation of fish, honey wild life and forest product for future. Another one has said that the characteristics of management of the forest are employment people, meeting wood requirement preserving wild life and other assets. Another one has said

that the characteristics of management of the forest are employment for local people and demand fulfillment of wood in market. Among them, one has said that the characteristics of management of the forest are empowering the revenue board by meeting local demand. Another one has said that the characteristics of management of the forest are meeting local demand.

In answer to 3rd question (*i.e.* what is the strength of the forest?) this table shows that half of the forest rangers have mentioned that the main strength of the forest is Sunduri working circle, Gewa working circle, Golpata working circle, Goran fuel working circle and miscellaneous working circle. Another half of the forest rangers have said that the strength of the forest running through several working plan and through several circle.

In answer to 4th question (*i.e.* Do you know any of its weakness of management?) the table shows that in response to the question about any weakness of management all the six forest rangers have given different answer. One of them has given no answer. Another one has said that the weakness of management is epidermis of pirate. Among them one has said that the weakness of management is disability to protect the pirate. Only one has emphasized on the manpower. He has said that the weakness of management is the deficiency of skilled manpower, deficiency of fuel oil, disability to protect the pirate. Another two forest rangers have mentioned the weakness of transportation and fuel oil and disability to protect the pirate. In the statements of the six forest rangers five have said the disability to protect the pirate.

In response to 1st question (*i.e.* What is your idea about Management Structure of the Forest?) about the idea of management structure of the forest sixteen Deputy Rangers have made various comments Out of 16 DRs seven of them have said that the management structure of the forest is well and good. On the other hand, four of them have said that there need a new management plan. Only one of them has said that forest management is well. Another one has said that it should be introduced new sustainable management. Only one D.R. has said that forest management is run according to the direction of working plan. And another one has said that camping system runs by only one

or two persons in the office in miscellaneous jobs in the forest to lead the activities. Merely one deputy ranger has said that the management of the forest is not satisfactory for conservation of the forest office.

In answer to 2nd question (*i.e.* What are the Characteristics of Management of the Forest?) the above table shows that in response to the question about the characteristics of management of the forest out of total sixteen deputy rangers, majority of them have made various comments, which is very difficult to reach a clear cut decision. However, we see that five of the total deputy rangers have said that the characteristics of management of the forest is to make profession of the local people, and fulfill the methods demand of wood and/or the demand of wood in the market/local people. Other three of them have emphasized on the demand of fulfillment of wood in the market.

Only one deputy Ranger has said that the characteristics of management of the forest are to fulfill the demand of wood. Another one has said that it is made profession of the local people. Another one has said that it is made conscious of the local people. And only one has kept license. On the other side, one deputy ranger has said that the forest employees are not suitable for handling tools properly. The camps in the forest are not suitable to conserve or to keep fire arms. There is no essential government vessel, crisis of fuel. One deputy ranger has said that camp in the forest, inspect the seasonal cutting of the well accurately or not. One deputy ranger has said that conservation of ecological balance and strength the government by fulfilling the local demand and paying revenue to the revenue board. And another one has made comment that strengthens the government through collect revenue.

In answer to 3rd question (*i.e.* what is the strength of the forest?) the table indicates that in response to the question in regard to the strength of the forest out of sixteen deputy rangers, only two deputy rangers have kept silence and rest of the other two have made different comments. Consequently, the comments are written down. Majority of the forest deputy rangers ten have mentioned the strength of forest that Sundry working circle, Gewa working circle, Goran working circle, Golpata working circle and miscellaneous circle.

One deputy ranger has mentioned that divisional head office, range office, and station office, sets up in the Sundarbans. There are several camps under the station, which leads the structure of the management by watching various times in the forest.

In answer to 4th question (*i.e.* Do you know any of its weakness of management?) from the above table we can see that in response to the question in regard any of its weakness of management, some of the total sixteen deputy rangers has given same answer and rest of them have given different answers. Five deputy rangers have mentioned the weakness of management as fuel and pirates. One of them has mentioned that there are many problems like problems of office repair problem of fuel oil, problem of government trawler, problem of driver, problem of trawler mechanic, problem of primary treatment and residential problem also. Another one has mentioned attack of the pirate, inefficient and insufficient employed vessels, and crisis of fuel. Only one has mentioned that there are crises of expert manpower, crises of supply of essential fuel oil, crises of high-speed vehicles. One has mentioned that the problem of that of wood and another one has mentioned the theft of wood and corruption of the forest officer/employee. And rest of the six have made comments that crises of fuel oil, old fashioned transport, continue camp system, need a good arms and do not protect the pirates. And sometimes raised the problem of the attack of the pirates. In this discussion/analysis it is obvious that fuel oil, pirate's theft, corruption and vehicles problem are acute. There are other problems like, expert manpower, and good arms, medical and residential problem as well.

In reply to 9th question (*i.e.* Do you want to see any change of present forest management and timber extraction systems? If yes, how?) almost all the forest woodcutters want to see change of present forest management and timbers extraction systems. Someone of them have mentioned that it is possible by proper management and stop woodcutting and it be continued someone have mentioned that it is possible by creating new laws. Only one of them has said that it was started to ban wood collection.

In response to 6th question (*i.e.* Do you want to see any change of present forest management and timber extraction systems? If yes, how?) about wanting to see any change of present forest management system and timber extraction systems, all of the forest Bawali of the Sundarbans forest has said that they have wanted to see some change of present forest management and timber extraction system in woodcutting remained stopped. Of course, some one mentions that Bine fuel, babla. Hetai and Baisut dry fuel should be used as fire fuel. And almost all of them have said that it is managed to be cut.

In reply to 13th question (*i.e.* what are the strength and weakness of present the Sundarbans Forest Management System?) of the strength and weakness of present the Sundarbans forest management system, eight Mawali of them have made no comments. Other twenty two Mawali of them have said that intensive supervision of forest department is the main strength of present the Sundarbans management system. On the contrary, the forest department cannot protect the pirate which is the main weakness of present forest management system. Only one has mentioned that provide good management can improve the management system (**Appendix-6.2.11**).

In reply to 11th question (*i.e.* what are the strength and weakness of present forest management? Please specify?) of the strength and weakness of present the Sundarbans forest management system, 27 of the total 35 local people have made the same comments, and they say that intensive supervision of forest department is the main strength of present forest management system. On the contrary, they say that the forest department cannot protect the pirate which is the main weakness of the forest management system. Three of them have said that strict security of the forest department is the strength of present the Sundarbans management system; and wood stealing is the weakness. Two of them have made no comments. Only one has said that the strength of present the Sundarbans forest management system is the function runs by rules; and weakness is that wood cut in illegal ways and weak educational infrastructure. Another two has emphasized on logistic support, like they need oil and good arms.

5.4.1 Management and Legal Regime for Access to Shrimp Culture

Government owned tidal lands for shrimp culture are leased out. In Cox's Bazar area, three size categories of land e.g. 10 acres, 11 acres and 33 acres are leased out for 10 years, Government has introduced a new fisheries management policy for licensing fisheries based on production oriented biological management plan by replacing the revenue oriented system. The license for allocation of coastal land in Cox's Bazar area is issued by the Department of Fisheries under the Ministry of Fisheries and Livestock which has already leased 6715 ha whereas the Ministry of Land also leased out 5800 ha in Khulna region, the entrepreneurs directly take lease from the private land owner and establish shrimp farm.

5.5 Developmental Activities

5.5.1 Project Title: Development Projects Related to Fisheries on the Sundarbans

The project aiming to propose an integrated development programme for the Sundarbans, encompassing all aspects of natural resource management, and relating them to income generating activities and proper income distribution. Fisheries has been identified as one of the major resources in the Sundarbans mangrove ecosystem, hence the fisheries component was engaged to: (a) assess the aquaculture and fishery potential of the Sundarbans (b) assess in particular the biological dependence of capture fishery resources on the mangrove ecosystem and (c) assess the management implications of fisheries development on the other sustainable uses of the mangroves.

5.5.2 Project Title: *Integrated Resource Development of the Sundarbans Reserved Forest Bangladesh Project (BGD/84/056)*

The project goal is to prepare an integrated plan to encompass all aspects of natural resource management with the following specific objectives:

- (a) assess the finfish resources with special emphasis on economic species in the Sundarbans water,

- (b) assess the crustacean resources, specially the economic species of shrimp and prawns in the Sundarbans water,
- (c) assess such other fishery resource (e.g. mollusk) of economic importance also found in the Sundarbans,
- (d) evaluate present intensity of, exploitation of the stocks of finfish/shrimp and prawn and make an estimate of the intensity of exploitation possible for these stocks in the future to maintain sustained field, taking into consideration as well as the possible improvements in fishing effort,
- (e) formulate a programme for continuing resource assessment in the area.

5.5.3 Project Title: *Sundarbans Biodiversity Conservation Project (SBCP)*

The largest ever biodiversity project undertaken by Bangladesh Government is the Sundarbans Biodiversity Conservation Project (SBCP). The SBCP, planned to be implemented from 1999 to 2006 but it was suspended by the implementing agency and co-founder Asian Development Bank in September 2003 due to problems with project design, activities implementation, and financial management. It was then formally and unilaterally cancelled by the ADB in early 2005, blaming the Forest Department for failing to take steps to revise the project. While the Forest Department is partly to blame for the failure of the project, other parties should be held accountable as well. The 77.5 million US\$ project SBCP was intended to establish a proper management system to maintain the biological integrity of the Sundarbans forest through poverty alleviation.

The overall objective of the SBCP is to develop a sustainable management and biodiversity conservation system for all resources of the Sundarbans Reserve Forest (SRF). In achieving the objective, the project will target: (i) improved capacity to manage the SRF (ii) adoption of biodiversity conservation and sustainable resource management measures (iii) reduction in the poverty level of people in the fringe areas through expanded economic opportunities, improved social infrastructure etc. (iv) promotion of ecotourism and enhancement of environmental awareness and (v) reduction of industrial pollution. The project runs from 1998 to 2003 instead of 2006.

The project did not consider climate change induced exogenous changes. The Sundarbans is very likely to be impacted by climate change and its impacts. The most dramatic effect is expected on the forest vegetation due to a combination of both increased sedimentation and low-flow induced saline intrusion. Significant changes in vegetation cover would be detrimental to the animal biodiversity. Extraction of timber and wood for pulp production would further endanger the existence of the forest. Although the activities envisaged under the project are designed to improve the quality of the forest, the additional threats associated with climate change might negate such improvements.

Assurance of sustained flows in the Gorai-Madhumoti systems during the lean season might help achieving the objectives of the project. This projects susceptibility to the altered water regime under climate change scenarios needs to be considered.

5.5.4 Project Title: Bangladesh: Sundarbans Biodiversity Conservation Project

5.5.4.1 Finance by- Asian Development Bank

5.5.4.2 Project Costs:

At approval, the Project cost was \$82.2 million. ADB was to provide a concessionary loan of \$37.0 million and the Nordic Development Fund (NDF) was to provide a concessionary loan of \$4.5 million. The Global Environment Facility (GEF) was to provide grant financing of \$12.2 million. The Government of Bangladesh (GOB) was to finance \$16.1 million and the PKSF was to contribute the equivalent of \$6.8 million of its own funds as a line of credit for microfinance. Local beneficiaries and NGOs were to contribute the equivalent of \$5.6 million. The cost of the Project was later revised to about \$77 million. The difference was due to (i) the NDF withdrawing its commitment to finance the KNM wastewater treatment plant, (ii) the Government of the Netherlands' (GON) providing grant co financing of \$3.5 million equivalent, and (iii) corresponding adjustments in the ADB loan (Appendix 5).²¹ Actual project cost incurred at the time of loan cancellation was \$22.9 million (30% of the revised

cost estimate), of which \$7.9 million were foreign currency costs and \$14.9 million local currency costs.

5.5.4.3 Evaluation of performance

A. Relevance

The Project is rated "partly relevant." At the time of appraisal, the Project's goal and objectives were consistent with the Government's development priorities and with ADB's country strategies for Bangladesh. Although the project design was conceptually sound, it was overambitious and unrealistic. It failed to assess risks and diagnose key threats and weaknesses in the existing institutional structure. The project scope and implementing and financing arrangements were complex and could not be achieved within the time frame of a single project. The Project began to lose relevance at the onset as a result of fundamental changes in institutional arrangements and subsequent delays and abortion of key project activities. Failure to assess the implications of such changes and delays and take timely remedial measures further undermined the Project's relevance.

B. Effectiveness in Achieving Outcome

The Project is rated "less effective." The Project goal and objectives stated at appraisal are not likely to be achieved in a meaningful manner. Similarly, most of the performance targets stated at appraisal are not likely to be achieved either. Termination of the Project contributed towards this result; however, the causes were prevalent from the very inception of the Project. Achieving the goal and objectives was virtually impossible considering the poor project design and the lack of ownership and commitment by the Forest Department from the outset. Effectiveness was jeopardized by poor implementation, supervision, and lack of attention to addressing problems through appropriate remedial measures. There were exceptions; however the microfinance program has continued and even expanded in some areas. Several useful outputs contributed towards partial achievement of the expected outcomes. Examples are the hydrodynamic modeling exercise, the draft management plans and some technical reports produced by consultants, the social infrastructure developed by the LGED, and the visitor service facilities established in Khulna and the SRF.

C. Efficiency in Achieving Outcome and Outputs

The Project is rated "inefficient." A re-estimation of the Project's economic internal rate of return was irrelevant in this case because of early termination which (i) cut short the project implementation period, (ii) suspended disbursement of project funds, and (iii) curtailed the Project's benefit stream. Efficiency is assessed qualitatively instead, on the basis of how the project resources were utilized in achieving the desired outcomes. At the time of loan suspension, the Project had achieved 23% physical progress utilizing 30% of the total project finances and 60% of the total project period. Most project activities that were undertaken are not likely to yield meaningful returns. In particular, the utilization of funds in connection with (i) institutional strengthening and capacity building, (ii) resource management and ecotourism planning, and (iii) provision of consultancy services, was considered inefficient. The construction of social infrastructure by LGED and the microfinance activities carried out by NGOs do stand out as being somewhat efficient uses of resources; however, even in the case of these activities, the disconnect with the overall objectives of the Project rendered them less efficient.

D. Preliminary Assessment of Sustainability

The Project is unlikely to be sustainable. Firstly, most activities that would have contributed towards achieving the goal and objectives of the Project were incomplete when the Project was cancelled. Sustainability was particularly compromised by failure to implement the institutional and policy reforms which aimed at establishing an effective and efficient system of governance and management for the SRF. Although some progress was made (i.e., draft management plans, sound analytical and research products, microfinance for resource users, and increased awareness), due to the lack of a cohesive management and governance system for the SRF, these are not likely to contribute significantly towards achievement of sustainable outcomes. Secondly, the infrastructure facilities that were developed and equipment and vehicles that were procured under the Project are unlikely to produce sustainable outcomes due to lack of operational and maintenance funds in the Forest Department's budget. Infrastructure facilities and vehicles in the SRF require more regular maintenance because of exposure to salinity and extreme weather events.³⁴ thirdly; the negative publicity caused by the Project may

have reduced the likelihood of future donor support for conservation and management of the SRF.

E. Impact

Overall, the Project is assessed as having a negligible impact. In terms of institutional impact, the Project had a somewhat negative effect on the Forest Department by creating a poor image of its capabilities and reducing the morale of its staff. Similarly, the Project had a somewhat negative impact on ADB's image as a development partner capable of handling complex natural resource management projects. The socioeconomic impact of the Project is generally positive; many rural poor people benefited from the microfinance facilities and from the rural infrastructure established under the Project. The increase in tourism (partly attributed to the Project) has positive spillover effects on the local economy. As a result of the Project, NGOs and civil society were mobilized and gained greater awareness of the importance of the SRF. The Project did not encounter any issues related to indigenous people during implementation. The environmental impact of the Project is considered marginally positive. This was mainly due to the availability of better equipment and facilities for the Forest Department to engage in patrolling the SRF. The increased environmental awareness and appreciation gained by impact zone communities will also lead to better conservation and resource management practices. However, some beneficiaries used the microfinance facility to expand their resource extraction activities from the SRF.

5.5.4.4 Overall Assessment and Recommendations

A. Overall Assessment

Overall, the Project is assessed "unsuccessful." Fundamentally, the Project failed to achieve its stated goal and objectives. It achieved marginal progress on physical and financial targets. Most physical activities were halted midstream due to suspension and eventual cancellation and are unlikely to be followed through to sustainable and logical completion. This is primarily because the Forest Department lacks not only the resources but also the commitment and motivation to carry through with activities initiated under the Project. However, the Project's intended outcomes remain relevant; perhaps

even more so now in the context of increased population and economic development pressures and projected scenarios of climate change.

B. Lessons

The following important lessons were learned.

- (i) Policy and institutional reforms imposed on an institution under a project need to be realistic and achievable, in view of the limited leveraging power of a project. The Project was ambitious in attempting to transform the management of the SRF within the time horizon of a single project period, considering that the SRF had been managed for over a century by the Forest Department under a traditional command and-control regime. The proposed 'revolutionary' reforms should instead have introduced in an 'evolutionary' manner through a phased approach.
- (ii) Policy and institutional reforms in challenging environments (i.e., marked by political patronage and authoritative civil service regimes) are more likely to succeed if they have sufficient 'buy in' and have strong champions within the system. The Project demonstrated that such reforms cannot be enforced simply by dictum (i.e., imposed as loan covenants). The chances of success were also seriously jeopardized by attempting to circumvent the Forest Department on several occasions.
- (iii) Institutional reforms that also have a direct bearing on project implementation should be addressed as project-readiness criteria and, to the extent possible, recommended as conditions for project approval rather than project effectiveness. For instance, establishment of the SMU and SSC were long-term institutional changes to the Forest Department but were also essential for smooth project implementation. They could have been addressed as project-readiness criteria prior to approval.
- (iv) A risk assessment of the EA's capacity to undertake institutional and policy reforms should be conducted during the design phase, and specific corresponding indicators should be listed in the project design and monitoring framework. During implementation such indicators should be monitored by ADB through review of project performance reports. In the case of the Project, although the SMU, SSC, and SAC were established to comply with the effectiveness condition; there was no basis for assessing the effectiveness of

these institutions. Therefore, for all practical purposes, the Project was implemented for several years without functional institutional arrangements.

(v) Projects that involve complex implementing arrangements and challenging reforms require closer supervision. Such projects should be targeted for delegation to resident missions or for special joint supervision arrangements between headquarters and resident missions. However, resident mission staff assigned to such projects should be included as core members from the early stages of project design.

(vi) A change in the officer responsible for a project during crucial stages (in this case soon after commencement of the PPTA and between project approval and effectiveness) should be avoided whenever possible. If unavoidable, the transition should be carefully managed to avoid a complete lapse of institutional memory (e.g. by ensuring the active participation of other team members, especially national officers). This can help to reduce unintended changes in project implementation arrangements (such as when the criteria for NGO participation in this Project were changed between the design and implementation phases).

(vii) Lessons from previous projects implemented by the Forest Department could have been incorporated more effectively into the project design. One such lesson was the Forest Department's poor assimilative capacity of technical know-how imparted by consultants under previous donor-assisted projects. Regardless, the Project included a front-loaded consultancy service package which was largely ineffective. Previous Forest Department projects had also encountered problems with TA consultants not being accountable to the Forest Department but instead to ADB; however, the same problem was repeated in this project.

(viii) The administrative and financial management capabilities of the executing agency must be assessed as a 'quality at entry' issue. For instance, the Forest Department did not have qualified accountants at the time the Project was approved.

Furthermore, the Forest Department was implementing several other large donor-financed projects (including two other ADB-financed projects) when the Project was approved. The implications of implementing several large projects for the Forest Department's financial management and administrative staff

were not assessed beforehand. Similarly, coordination between project executing agencies was undermined, in this case by having two project directors administering two separate project proformas.

C. Recommendations

i. Project Related:

a) Future Monitoring: The Project laid the groundwork for useful programs on biodiversity and water quality monitoring and the Forest Department should continue to implement these programs. In addition, the Forest Department should continue collecting and analyzing data from the sample plots within the SRF. In the absence of such monitoring programs, the Forest Department has little information on the trends and conditions of key species, and therefore has no basis for preparing future management plans and seeking future assistance to conserve and manage the SRF. For instance, there is no scientific basis to document the decline of Sundri species in the SRF. A preliminary analysis of data from the RIMS, undertaken during this project completion review study, did confirm that this is the case (Appendix 3). The conservation monitoring program which was developed by IUCN would substantially improve information on biodiversity conditions and trends in the SRF. The water quality model developed by the IWM is useful analytical tool to assess salinity, sedimentation, and water pollution trends affecting the SRF. Monitoring water quality on a continuous basis will help to establish causality between the health of biodiversity in the SRF and land-use patterns, as well as the impact of climate change.

b) Covenants: The Project included several covenants related to institutional arrangements. Partial compliance or noncompliance with these covenants was one of the key reasons for the cancellation of the Project. The institutional arrangements introduced through these covenants contained key elements for sustainable and integrated management of the SRF (such as transparency, efficiency, and rights of beneficiaries). The Forest Department should therefore consider adopting them (perhaps suitably revised to suit its structure and mandate). Doing so would convey the Forest Department's commitment to adopting good Practices for conservation and management of the SRF and serve as an indicator of readiness to potential development partners interested in supporting the Forest Department in the future.

c) Further Action or Follow Up:

a) Termination of the Project left many initiatives incomplete. The Forest Department could continue several activities to a logical conclusion, there by ensuring that the investments under the Project yield some positive returns. These include (i) selectively continuing timber-stand improvement activities, especially ANR activities; (ii) finalizing the fisheries management plan and the ecotourism management plan; (iii) implementing certain provisions of the wildlife management plan; (iv) incorporating specific provisions from the above plans in the update of an integrated management plan for the SRF; and (v) implementing social programs in the impact zone together with microfinance NGOs to raise awareness on sustainable use of SRF resources.

b) Inadequate funds for operation and maintenance of facilities is a perpetual problem. However, even the limited funds could be more effectively utilized by identifying priorities.³⁵ the Forest Department should also take immediate measures to utilize the equipment and motorcycles procured during the Project, which have remained in storage since the Project was suspended.³⁶

c) The Government audit department raised two types of queries: (i) serious financial irregularities, and (ii) no serious financial irregularities. At the time of the project completion review mission, the Forest Department had responded and resolved five of the nine serious financial irregularities and nine of the 38 no serious financial irregularities raised by the auditors. The Forest Department should address the remaining queries without further delay.

d) **Additional Assistance.** The SRF is a globally significant natural asset which is increasingly under pressure from population growth and economic development, and in future will also be subject to the impacts of climate change. It is therefore a resource that is in urgent need of proper conservation and management. Poor performance of this Project should not deter efforts to conserve and sustainable manage the SRF. Neither should the Project be considered a permanent injunction

on the Forest Department and its ability to assume responsible role in managing the SRF. In many ways, the Project has established a useful foundation from which future projects and programs can be launched. Lessons from the Project are a useful guide for future initiatives.

e) Timing of the Project Performance Evaluation Report. The PCR was done 3 years after suspension of project activities.³⁷ The Project was also subject to a post-project evaluation under a special evaluation study by ADB's Operations Evaluation Department in 2006. Therefore a project performance evaluation report may be considered optional in this case.

ii. General:

a) The following general recommendations are proposed: (i)

The project design and monitoring framework should include leading indicators to facilitate real-time assessments of project performance (particularly with regard to qualitative aspects such as institutional and policy reforms).

(ii) The EA's commitment and capacity should be objectively assessed before commencing a project. A project's ability to leverage reforms as well as an EA's willingness and capacity to absorb reforms must be realistically assessed.

(iii) To the extent possible, institutional, policy, and legal reforms (particularly when such reforms have a significant bearing on implementation of the project) should be proposed as conditions for loan approval (not effectiveness) and monitored as project-readiness criteria.

(iv) The financing plan of a project must be finalized prior to Board approval and must be accurately reflected in the Government's version of the project document (in countries where this is applicable).

(v) Consultancy services on projects must be phased in accordance with the absorptive capacity of the recipient agency, particularly when existing institutional capacity is weak. Front-loading of consultancy services should be avoided, especially in projects where institutional reforms are proposed as a precursor to capacity building.

(vi) Projects with complex scope and implementing arrangements must be more actively supported by resident mission-based staff, either through delegation or shared responsibility for administration.

Table 5.3

Project Framework

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks	Actual Outputs and Outcomes at Cancellation
1. Goal To secure the integrity of the environment and biodiversity of the Sundarbans Reserve Forest (SRF) in Bangladesh.	• Human-induced degradation of the SRF reversed by 2003. Biodiversity losses in SRF reduced by 2001. • Sound management achieved by 2002. • Environmental awareness of the SRF in society improved by 2005. • Sustainable and participatory community activities established by 2003. • Economic and social indicators improved in 17 <i>thanas</i> (local government units) of impact zone by 2004. • Effluent disposal from Khulna Newsprint Mills (KNM) controlled by 2001. • Financial and economic sustainability of the SRF achieved by 2005.	• Annual independent conservation monitoring by the International Union for Conservation of Nature (IUCN). • Existing baseline surveys from Integrated Resource Management Program (FAO/UNDP), Forestry Resources Management Project, (World Bank), and studies by technical advisory group (TAG). • Water quality and pollution monitoring by Surface Water Modelling Center. • Innovative research and Socio-economic surveys by Project. • Benefit monitoring and evaluation (BME) system; project completion report.	• Civil society and high-level political commitment to the SRF. • SRF management will be multisector and multidisciplinary. • Stakeholders accept the Project plans. • Nongovernment organizations (NGOs) and local community organizations (LCOs) participate in community Development in the impact zone. • Shrimp controls introduced to prevent further loss of agricultural land. • KNM phases out Gewa over 4-year period.	
2. Purpose 2.1 Effective organization and management of the SRF.	• Sundarbans Management Unit (SMU), Sundarbans Stewardship Commission (SSC), Stakeholder Advisory Council (SAC) all set up. • Environmentally	• BME reports; review missions; TAG reports • BME reports and review missions; TAG reports; integrated	• Accurate scientific information is available and sound conservation management plans are implemented.	

	sound biodiversity conservation by 2001. • Sustainable SRF management practices based on sector plans and integrated conservation management plan in place by 2002.	conservation management plans; annual State of the Sundarbans Report by IUCN.	• Strong interest in conserving SRF resources, including three wildlife sanctuaries. Public environmental education and tourism are expanded. • Adequate financial resources to sustain investments. • NGOs and LCOs participate effectively with the Project in socioeconomic development of impact zone. • LGED is appointed to implement social infrastructure program and to coordinate with NGOs and/or LCOs and stakeholders. • BPC and private operators fully involved in Project.
2.2 Reduce poverty, improve living standards, promote sustainable development in the impact zone, and promote ecotourism and environmental awareness.	• Legally recognized organizations of SRF resource users that meet members' needs and enforce agreed user practices. • Improved life skills and creation of options in the impact zone. • Improved access to social infrastructure and services in the impact zone by 2005. • Average household income increased by 30%; poverty reduced by 30% in the impact zone by 2004. • Tourist numbers increased by 50% by 2005.	• Government statistics, NGO reports and independent academic studies on 17 <i>thanas</i> in impact zone. • Socioeconomic studies. • Reduced dependency on the SRF, diversification of income sources. • Local Government Engineering Department (LGED) programs and reports. • BME reports, review missions. • Bangladesh Parjatan Corporation (BPC) reports.	
3. Outputs 3.1 Effective organization of the SRF 3.1.1 SMU 3.1.2 SSC 3.1.3 SAC	• SMU set up by December 1998. Fully functional for forestry, fisheries, and wildlife conservation operations by 2003. • SSC established, on Broad-based principles incorporating civil society's participation, by March 1999. • SAC set up by June 1999 and representing views of	• Review missions. • Minutes of SSC meetings; review missions. • Minutes of SAC meetings; review missions.	• SMU works effectively with stakeholders. • High-level commitments to the role of the SSC and the Project. • All user groups are effectively represented on the SAC • Project head office established in Dhaka with the deputy chief conservator of forest as project director and conservator of forest Khulna as deputy project director. • Sundarbans Management

stakeholders in effective manner.

Wing not incorporated in the Forest Department's organ gram with clear line of authority. Four divisions and three units created and operating. SSC formed and three meetings held by April 2004.
• First meeting of SAC was held on 17 March 2004 in Khulna. SMW placed on agenda for discussion at the third SSC

meeting.

3.2.2 Aquatic Resources
3.2.3 Wildlife
3.2.4 Integrated Conservation Management Planning

plots, all in the SRF by 2006.
• Mangrove arboretum, 2 range offices, 20 temporary camps, 7 jetties, 9 pontoons, training established.
• Fisheries/aquatic resources management plan and introduction of fisheries management in the SRF by 2001.
• Wildlife management plan prepared (2001), especially for three sanctuaries.
• Integrated plan prepared and operational by 2002.

Missions.

• Appropriate measures, including upstream pollution controls and mitigation measures re urban, ports and shipping, and industry sources. Suitable controls on shrimp-based aquaculture

Without detailed study.
• 70% stock assessment done under TAG guidance. Draft fisheries management plan prepared. Materials for mass awareness developed.
• Ban on fishing in the breeding and rearing ground at 18 canals and shrimp fry collection from the SRF.
• Baseline

3.3

Socioeconomic development of the impact zone

- Mobilization and organization of 170,000 households and resource users into viable LCOs by 2005.
- \$6.8 million for micro credit by 2005 for alternative income sources and sustainable SRF resource use.
- Social infrastructure constructed comprising village water supplies, sanitation, schools, rural roads, etc. in 17 thanas.
- Improved environmental awareness and education about the SRF in schools in 17 thanas, plus nonformula education and adult literacy programs.
- Expanded NGO coverage in 17 thanas.
- NGO and BME reports.
- Review missions.
- PKSF reports on micro credit.
- LGED reports, review missions.
- NGO reports, review missions.
- Appropriate NGO selection process, NGOs participate in mobilization, training, and set up of LCOs.
- NGOs establish programs in the impact zone.
- Credit reaches target households and leads to increased incomes.
- LGED leads a coordinated approach.
- 24 NGOs contracted to identify and organize resource users. Boat license certificate redistribution study effective.
- Human resource development done by local NGOs with the Liaison Education Extension Unit of the Bangladesh Sundarbans Project.
- The Project set up 670 Rainwater collectors, 41 pond sand filters, and 24 deep well tubes in the impact zone, and constructed 10 km of village roads, 24 culverts, and 12 boat landing stations. The LGED constructed 16 primary schools in the impact zone.

survey of tiger and deer, crocodile breeding center, plot study for three sanctuaries, vegetation study, and wildlife management plan with TAG.

3.4 Ecotourism and environmental awareness

- Modern tourism strategy and plan developed, and training program implemented.
- Public infrastructure built and policy framework to support private sector plans and development.
- NGO and/or LCO participation in training/development.
- Environmental information and education center operational in Khulna.
- National and local environmental awareness campaigns.

- Tourist numbers, receipts, BPC reports.
- Review missions.
- Press, media coverage of Sundarbans.

- Modern, private sector tourism is not dominated by public sector. Appropriate policy framework is adopted.
- Network with Asian locations is established.
- Tourism opportunities can be created, and risks can be mitigated.
- Public education program is successful.

- Strip and block plantation in the coastal embankment, roads, and marginal land.
- PKSf funds to divert to alternative livelihoods.
- Visitor information center built at office of Khulna conservator of forest.
- Karamjal visitor information center built. Upgrading of basic infrastructure, jetties, watchtowers, small huts, and public awareness material developed.
- Mangrove arboretum center at Chandpai range and suspended wooden bridge and watch tower constructed at Herbaria tourist spot.
- An interactive website was developed.
- 70% of 400 person months consumed and number of training programs provided.
- IUCN has developed indicator list

3.5 TAG, monitoring, and research studies

- TAG team established and supporting conservation planning, plan implementation, and training.
- IUCN monitoring.
- Other studies contracted.
- Fellowships

- IUCN and TAG reports.
- Annual State of the Sundarbans reports.
- Contract for services.
- Number of fellowship holders.

- Innovative research and monitoring are used for effective management.
- Government implements the recommendations.

program implemented.
• Inspection and certification system designed.

• Consultant's report.

for monitoring ecosystem health of the SRF. Built capacity of 55 Forest Department officials for biodiversity monitoring.
• Completed biodiversity survey (on undergrowth, regeneration, orchid, fern and lichen, mollusk, bird, dolphin, invasive species, butterfly and dragonfly, etc.).
• Recorded seven new species from the SRF.
• The Institute of Water Modelling undertook salinity study and submitted final report.
• Study of the top-dying of Sundri and its management was completed by Khulna University.
• Five assistant conservators of forest sent abroad to complete 1-year master of science under fellowship program. Component cancelled.

3.6 Effluent treatment

• KNM effluent treatment system installed and

• BME; review reports.
• Water quality

• Discharge levels are environmentally

	operating well.	monitoring reports.	accepted.
3.7 Advisory technical assistance (TA) for KNM	• TA will include the organization and/or management structure, commercialization and privatization options, environmental management.	• TA report. • Policy changes adopted commercialization and management changes.	• KNM, Ministry of Industries, and Ministry of Environment and Forests agree to phase out Gewa use from the SRF and use imported waste. • Financing is available for KNM's rejuvenation based on imported waste for recycling as a source of pulp for newsprint manufacture.
4. Inputs	• Consultants \$11.6 million	• Project implementation progress reports.	• Consultants are competent.
4.1 Consultants	• Equipment and software \$6.9 million	• Project accounts.	• Local contractors are competent.
4.2 Equipment and software	• Civil works \$26.8 million		• Counterpart budget is available on a timely basis.
4.3 Civil works	• Micro enterprise investment, including credit \$11.3 million		• Counterpart staff is available.
4.4 Micro enterprise investment, including credit	• Training \$9.4 million		
4.5 Training	• Marketing \$1.4 million		
4.6 Marketing	• Salaries/Others \$13.6 million		
4.7 Salaries/Others	• Service Charge \$1.2 million		
	Total \$82.2 million		

BME = Benefit Monitoring and Evaluation, BPC = Bangladesh Parjatan Corporation, IUCN = International Union for Conservation of Nature, FAO = Food and Agriculture Organization, KNM = Khulna Newsprint Mills, LCO = local Community Organization, LGED = Local Government Engineering Department, NGO = Non-Government Organization, SAC = Stakeholder Advisory Council, SMU = Sundarbans Management Unit, SMW = Sunderbans Management Wing, SRF = Sundarbans Reserved Forest, SSC = Sundarbans Stewardship Commission, TA = Technical Assistance, TAG = Technical Advisory Group, UNDP = United Nations Development Programme.

5.5.4.5 Overall Assessment and Rating

Overall, the TA was assessed as being partly successful. The consultants performed well under difficult conditions (including strike action and riots). The analysis of future options for the KNM was objective and technically sound. However the consultants and ADB were unable to convince the Government to implement the main recommendation, of deactivating the KNM, due to the political sensitivity involved with option. Alternative options were considered but found to be financially non-viable by the consultants. Their views were challenged by the Government. Consequently, no action was taken after completion of the TA.

5.5.5 Project Title: National Tiger Recover Program Bangladesh

5.5.5.1 Year: 25 May 2010

5.5.5.2 Financed by: People's Republic of Bangladesh

NTRP aims to present the incremental effort that Bangladesh needs to make in order to accelerate the implementation of its Tiger Action Plan with a focus on actions of the highest priority. These efforts are over and above major ongoing or planned projects (below), many supported by donors, which form a vital base for the scaling up envisaged in the NTRP.

□ The EC-funded Sundarbans Environmental and Livelihoods Security (SEALS) project will support sustainable development of the Sundarbans Reserved Forest (SRF), including: sustainable resource use by the local communities; restoring and cyclone-proofing the SRF; an Information Management Information System to guide SRF protection and management. The SEALS project will also complement the Bangladesh Tiger Action Plan, on which the NTRP is based. The total cost of this project is Euro 10,444,444, of which the EC component is Euro 10 million.

□ The USAID's Integrated Protected Area Co-management (IPAC) project will support FD in developing a protected area strategy for all ecologically and economically significant areas, and a SRF co management plan. The IPAC will also complete a detailed economic analysis of the resource dependence dynamics around the Sundarbans Impact Zone (SIZ), including an analysis of SRF fisheries resources. The cost of this project will be US\$ 15.5 million (2008-2013).

- The Multi Donor Trust Fund for Climate Change will fund climate change-related activities, including restoration of mangrove habitats. The Trust fund is capitalized at US\$ 100 million.

Table 5.4**Summary of National Tiger Recovery Program (NTRP)****Country Name: BANGLADESH****Long Term Strategic Goals.**

Tigers were present in the major districts of Bangladesh in 1930's. However, due to habitat degradation, fragmentation, encroachment, hunting and poaching, the tiger reduce to a minimum state. Now, it is only the Sundarbans mangrove forest covering an area of 6017 sq. km. where the tiger are still thriving in Bangladesh. The last population census in 2004 by Forest Department and UNDP indicates tiger population in Bangladesh Sundarbans around 440 (Approx.) where 121 male, 298 female and 21 calf. The track survey and relative abundance surveys conducted by Wildlife Trust of Bangladesh confirm that tigers are currently distributed across the whole of the Bangladesh Sundarbans, and data from two radio collared females. The estimate and relative abundances suggest that it is unlikely that tiger numbers can be doubled; thus the national goal is to stabilize or marginally increase the current tiger population by reducing some key threats to tigers, prey and habitat.

However, this goal should be periodically reviewed in the context of impending impacts of climate change on the Sundarbans. Because of its highly dynamic nature and the manifold environmental variables (e.g., sea-level rise, monsoon rainfall and river runoff, cyclones, ocean surges, silt deposition) and their synergistic interactions that will contribute to climate-related impacts, projecting the impacts on tigers and tiger habitat in the Sundarbans is difficult at best, and constant monitoring and appropriate conservation management interventions will be necessary as well as actions to target the root causes of climate change.

Tiger Conservation Goal: *By 2022, a demographically stable tiger*

population closes to 'carrying capacity' under conservation management in the Bangladesh Sundarbans ecosystem.

Baseline Status.

The current tiger population estimates may not be accurate, but are the best available. Because of the unique challenges of accurately determining tiger populations in the Sundarbans, methods used in other tiger habitats (e.g., camera trapping, occupancy surveys, transect surveys, sign-based surveys) are not easily transferable to this ecosystem. Therefore, obtaining reliable estimates for the Sundarbans will require tailored methods. A peer-reviewed relative abundance survey designed specifically for the mangroves is being run every two years, with the first two surveys from 2007 and 2009 showing a slight increase in relative abundance. This is allowing management to track change in the Bangladesh Sundarbans population for the first time. However, absolute numbers and behavioral data are harder to come by, and other methods need to be developed, (e.g., genetic analysis, and radio-tracking a large number of tigers to obtain more reliable data on habitat use, territory size, response to tidal fluctuations, and other ecological and behavioral variables.)

The available information suggests that the major threats to tigers in the Bangladesh Sundarbans are: a) poaching; b) human-tiger conflict when tigers stray into villages or villagers venture into forests to collect forest produce; c) depletion of prey due to poaching; and c) habitat-related threats stemming from unsustainable wood and aquatic resource harvesting, upstream water extraction/divergence and pollution, and the various effects of climate change.

Thus, interventions to minimize these threats are necessary to achieve the tiger conservation goal.

It is important to note here that the tiger habitat in the Sundarbans also provides essential ecological services of local, national, and global significance, such as: trapping of sediment and land formation; protection of human lives and habitation from cyclones; serving as a nursery for fish and other aquatic life that support a significant fishery; oxygen production; waste

recycling; supply of food and building materials; and carbon cycling and sequestration.

Cyclonic activity is expected to increase in intensity and frequency with global warming, making conservation of the mangroves an even greater imperative to save economies (local and national), livelihoods, and lives. There is clear evidence to show that the impacts of the 2009 cyclone **Aila** and 2007 cyclone **Sidr** were mitigated by the mangrove islands. Unfortunately the economic value of these ecological services has not been quantified; thus, an economic valuation of the mangroves is necessary to facilitate willingness of the Government and communities to invest in protection of this valuable ecosystem from further degradation.

Priority Actions to achieve Long Term Strategic Goals

1. Building Institutional capacity: The Bangladesh Forest Department (FD) is the sole government department responsible for nature conservation in Bangladesh. However, they are still expected by the government to produce short-term revenue from the national forests. As a result, the FD does not receive the required funds to perform conservation duties or develop conservation specialists. A paradigm shift is required to bring both the FD and the government from production forestry to conservation, and to mainstream conservation into the development agenda, (especially since the ecological services provided by the Sundarbans are important to support and sustain economic development). An economic valuation of the Sundarbans, plus reinforcement via policy level communications will support this change. Within the FD, the Wildlife and Nature Conservation Circle (WNCC) formed in 2001 is responsible for wildlife conservation across the country but does not yet have sufficient institutional presence to fully carry out its intended role. Many posts lie vacant, and staff regularly transferred between wildlife and territorial (forest) posts, hampering the development of wildlife or ecosystem conservation specialists. Retaining and motivating staff to work in remote areas with poor services and in risky environments poses an additional challenge. Therefore, a dedicated institution for wildlife conservation and management is necessary, with appropriate training and logistical support. In

discussions with the Secretary to the Ministry of Environment, he proposed forming a wildlife department within the Ministry as a possible solution. The territorial arm of the FD will also require organizational change to effect change from production forestry to conservation. In addition, collaborations with other sectors and stakeholders in wildlife conservation remain weak, yet are needed to bring in the multitude of skills needed to conserve tigers. Therefore, mechanisms to expand overall biodiversity conservation governance across Government Organizations (GOs), Non-Government Organizations (NGOs), civil society, communities are required.

Capacity of Protected Area managers is very important for to stoop tiger and prey poaching and recovery of tiger. The staff should have to be equipped with up-to-date technology. A MIST-bases smart patrol program is to be established in the Sundarbans mangrove forest.

2. Engaging local communities: Patrolling and protecting the vast Sundarbans ecosystem by a small cadre of government staff is inefficient and ineffective. A more practical solution is to engage the local communities as conservation stewards. Currently, local people venture into the mangroves to collect forest products and frequently come into conflict situations with tigers; the Bangladesh Sundarbans suffers the highest level of human killing by tigers in the world. Heavy extraction of forest products— especially timber, fuel wood, fish and other aquatic resources—is also resulting in forest degradation, which can potentially destabilize the mangrove islands, leaving the coastal areas vulnerable to cyclones and ocean surges. Given their poverty, local communities can also succumb to offers from organized poachers. Therefore, creating alternative livelihoods linked to wildlife and healthy habitats will make them willing stakeholders and conservation stewards.

3. Protecting the habitat: The FD lacks trained and adequate staff, field infrastructure, mobility, equipment and operational resources to adequately protect the >6,000 sq km of mangroves with the winding, convoluted waterways and islands. Many areas lack guard posts, and many guard posts do not have boats or fuel to operate boats when available. Accommodation conditions are basic, there are problems of drinking water, and medical

facilities are extremely limited. Existing laws do not provide guards with enough protection in case of death or injury during duty, and there is no risk allowance to compensate for dangers faced by FD staff. Thus, adequate field staffs have to be recruited, trained, and posted with adequate logistical support and appropriate incentives.

4. Trans-boundary collaboration with India on illegal trade: While hard data on the extent of illegal trade and cross-border poaching of tigers is difficult to come by, anecdotal evidence and the volume of other wildlife smuggled across the open, porous border with India suggests that it could be significant. Currently no protocol or system exists for effective cross-border collaboration in the area of wildlife preservation. Thus trans-boundary and regional collaboration is necessary to curb cross border poaching, smuggling and trade.

Program Indicators (interim) to achieve country's Long Term Strategic Goals.

Indicators will be selected from the suite below:

Tigers: relative tiger abundance; ratio of adult to cubs; ratio of male and female tigers; tigers poached; tigers killed in surrounding villages.

Prey: absolute prey abundance; number of prey poached.

Habitat: terrestrial habitat monitoring (includes satellite imaging + ground survey). Aquatic habitat monitoring (freshwater inflow, salinity levels). Key threats (sea level rise, wood collection; monitoring through biodiversity indicators to be fixed).

Program Indicators (2022) to achieve country's Long Term Strategic Goals.

Indicators will be selected from the suite below:

Tigers: relative tiger abundance; ratio of adult to cubs; ratio of male and female tigers (number of active female is a determinant of survival of tiger population); tigers poached; tigers killed in surrounding villages.

Prey: absolute prey abundance; number of prey poached;

Habitat: terrestrial habitat monitoring (include satellite imaging + ground truthing); aquatic habitat monitoring (freshwater inflow, salinity levels); key

threats (sea level rise, wood collection); monitoring through biodiversity indicators to be fixed.

NTRP Component linked to the Priority Actions

1. Mapping of Action against Goals

Long Term Strategic Goal: ***By 2022, a demographically stable tiger population at or near 'carrying capacity' under Conservation management in the Bangladesh Sundarbans ecosystem.***

- Without effective patrolling and control of wildlife crime, tiger and prey poaching and habitat degradation will continue unchecked, making even the stabilization of the tiger population quite difficult to achieve. Addressing these threats will require improved infrastructure, new technology for monitoring and research, and training to enhance skills of FD staff.
- The logistical difficulties that hamper effective and efficient patrolling and protection of the Sundarbans by the FD, and the role of the mangrove tiger habitat in sustaining local livelihoods and economies by buffering against natural catastrophes and contributing to climate change mitigation and adaptation, demands a conservation strategy that engages local communities in conservation. Thus, the overall goal should include community stewardship in conservation, with appropriate strategies and activities.
- The potential for international trade-driven organized poaching to penetrate and decimate the Sundarbans tiger population (like it has done in many other parts of the range) calls for regional/trans-border cooperation to preempt such threats, and is a priority component.
- The underlying data lacunae about the ecology, behavior, and population status of tigers requires more research to establish a baseline for monitoring the status of tigers in the Sundarbans and to track progress towards the long-term strategic goal.

2. Description of Program Components

The program has four priority components: 1) institutional capacity development for conservation; 2) eliciting community stewardship for effective conservation; 3) protection of tiger habitat; and 4) trans-boundary

collaboration with India on illegal trade.

Building institutional capacity

Objective 1. To develop capacity in the Forest Department for effective wildlife and habitat conservation in the Sundarbans.

Recruitment, training, and logistical support for staff, and reorganization of the Forest Department (FD) to create a dedicated wildlife wing or separate department under Ministry of Environment and Forests (MoEF) for conservation and management of wildlife and wildlife habitat in the Sundarbans. Current arrangements result in staff trained in wildlife conservation being transferred to forestry postings as regular staff rotations. Activities include: facilitating a political transition from production forestry to conservation in the FD and relevant ministries by removing the existing relationship between revenue earnings and budget allocation (i.e., currently budget allocations are based on revenue earnings); transition to a budget allocation for Sundarbans based on the ecological services provided by the ecosystem; expand overall biodiversity conservation governance through inter-sectoral collaboration, including ideas for joint projects, and mechanisms to improve the relationships between (and within) the FD and the Department of Environment (DoE) and MoEF, judiciary, NGOs, civil society, local government, and communities; FD organizational and cultural change, including a clear vision and objectives for the FD taken up across all layers of staff, devolving field level decision-making to field level managers, and creating the necessary units for addressing wildlife crime, monitoring, compensations for wildlife conflict and depredations, and inter-sectoral conservation planning; training and capacity building of staff.

Expected outcomes

- ☐ Improved conservation the Sundarbans and its wildlife measured in terms of tiger, prey and habitat

The design and implementation of this component will take approximately 2 years

Engaging local communities

Objective 2. To reduce community dependency on forest resources

Provide alternative income generation (AIG) to reduce the dependency of

local people on forest products and minimize the presence of people in forests, thus reducing the potential for tiger-human conflict and habitat degradation.

AIGs can include: community based ecotourism (boat hire, home stays, and guides); apiculture; handicrafts; cage and pond fish culture; social forestry and nursery; alternative energy (instead of fuel wood); poultry rearing.

Expected outcomes:

- ☐ Improved habitat condition because of reduced extraction of forest resources
- ☐ Socio-economic development of local communities from income generation opportunities

Objective 3. To involve local communities and administrations in forest management

Forest co-management committee formation and strengthening to build forest management partnerships between local communities and the FD to promote a sense of ownership and conservation stewardship among the local communities.

Activities will include: formation of forest co-management committees/councils; benefit sharing from forest management.

Expected outcomes:

- ☐ Socio-economic empowerment of local communities
- ☐ Community stewardship for conservation
- ☐ Positive attitude towards wildlife

Objective 4. To reduce tiger-human conflict

Conflict Tiger Response Teams formed to: respond to tiger related conflicts; monitor conflict patterns; monitor problem tiger presence; encourage safer behavior inside the forest to minimize conflict.

Activities will include: strengthening and forming tiger response teams; conflict incidents and stray tiger presence monitoring; compensation for victims/family; compensation for livestock depredations; insurance support.

Expected outcomes:

- ☐ Improved relationships between FD and local communities.

- ☐ Reduction of retaliatory killing of tigers
- ☐ Reduction of human and livestock killing

Objective 5. To reduce tiger and prey species poaching and consumption

Community-led anti poaching/consumption teams formed or developed upon existing conflict tiger response teams to: gather intelligence on poaching and consumption activities; and to support the FD, police, Bangladesh Rifles (BDR) and Rapid Action Battalion (RAB) in the arrest of offenders.

Activities will include: forming community-led anti-poaching/consumption teams; joint training with community-led teams, FD, BDR, police, RAB; developing a mechanism for the general public to report crime; poaching and consumption monitoring programs.

Awareness campaigns to: make people (especially local communities, GO, NGO) aware of the need for tiger, prey and habitat conservation; stigmatize poaching and consumption; link socio-economic advantages of Alternative Income Generation (AIG) to conservation.

Expected outcomes:

- ☐ Better protection of tiger and prey populations from poaching
- ☐ Community stewardship of tiger conservation

The AIG component will take 8 years, while the other components will comprise of 3-5 year programs.

Habitat protection

Objective 6. To deploy an effective and efficient cadre of wildlife conservation field staff to conserve tigers and tiger habitat

Create an adequate, trained wildlife conservation cadre with logistical support for effective and efficient patrolling and monitoring of tigers and tiger habitat. Currently, staff trained in wildlife conservation can be transferred to forestry-related posts. The lack of adequate boats, fuel allowances, and guard posts hamper patrolling.

Activities include: retention of staff within WNCC; addition of about 10% technical staff; providing logistical support including fast boats with fuel

allowances, communication devices, guard posts and housing with essential facilities; providing improved technology-based monitoring and protection (Management Information System

Technology (MIST), radio-tracking, effective patrolling); providing incentives and risk insurance for hardship and high risk posts; and coordination with police, coast-guard, local administration, local communities, and media.

Expected outcomes:

- ☐ Better protective measures for conservation of tiger habitat in the Sundarbans
- ☐ Better protection of tiger and prey populations from poaching and other killing
- ☐ Better monitoring of tiger and prey populations
- ☐ Better understanding of tiger ecology, behavior and population demographics
- ☐ Improved collaboration and coordination with police, coast guard, other stakeholders, including with India. The program will take 3 years after it is launched to reach full maturity.

Trans-boundary collaboration with India on illegal trade.

Objective 7. To establish an institutionalized system to curb cross-border trade and poaching of tigers and other wildlife

Create a mechanism for trans-boundary collaboration to curb cross-border poaching, smuggling and trade of tigers/parts and other wildlife.

Expected outcomes:

- ☐ Cross border trade and smuggling of tigers/parts and other wildlife reduced significantly
- ☐ Poaching threats to tigers in the Sundarbans reduced

The program will take 2 years after it is launched to reach full maturity.

3. Policy Framework needed to achieve objectives

- ☐ Inter-Ministerial Policy decisions are needed to strengthen collaboration with the police, coast guard and local administrations.
- ☐ Inclusion of wildlife crime in the current cross border law enforcement Memorandum of Understanding (MOU) between Bangladesh and India is

needed.

- ☐ Ministry of Forest and Environment decision to retain expertise and skills within a dedicated wildlife conservation unit.
- ☐ Update co-management guidelines, policy, and rules.
- ☐ Revised Wildlife Conservation Act 2010 to be enacted and with associated Rules.
- ☐ Protocol to address and mitigate tiger-human conflict.

4. Capacity constraints

- ☐ Lack of technical skills in MIST and remote sensing and research.
- ☐ Inadequate technical staff in WNCC; add only 10% to numbers to effectively cover the area (in Territory Forest Divisions).
- ☐ Lack of skills for community engagement and wildlife crime enforcement.
- ☐ Little support for new model of community conservation management committees, councils, community-based anti-poaching and patrolling teams, additional Tiger Response teams.
- ☐ Cultural change and other skills within FD, especially related to proposed reorganization.

5. Stakeholders

Key stakeholders are: policy makers, GOs (local, regional, and central), bank/financial institutions/funders (national and international), local people/communities/forest users, law enforcement agencies (police, coast guard, BDR, NGOs, judiciary, media).

6. Performance Indicators

Key measurable indicators will be chosen from the following suite based on (further) project development:

Institutional capacity building:

Indicators for this component can be developed for each activity and be defined in terms of: a) whether the activity has been completed, or b) the numbers of meetings/staff trained and so on; e.g., decision-making power devolved to mid-tier management (e.g. Assistant Conservator of Forest (ACF)), numbers of sanctioned posts filled properly and on time, enforcement of existing government rule that no officer can be kept on

current charge for more than 6 months, no cadre/non-cadre conflict (within power of government to solve it), training matrix developed, number of relevant staff sent on training.

Community engagement and habitat protection: number of people engaged in AIG, number of people who enter the forest, household use of forest resources (especially fuel wood), timber extraction, number of community members in co-management committees, number of local government/admin involved in management, amount of benefits arising from shared management, number of offenses/offenders (detected through MIST), number of Tiger Response Team (TRT) and ant poaching teams, number of tigers/prey poached, or poaching incidents, local people's attitudes towards wildlife, numbers of tigers and people killed in conflict.

Research on tiger ecology and monitoring:

- Tiger and prey population – relative abundance, distribution, adult/juvenile demographic trends.
- Habitat Condition – using degradation indicators to be developed.

5.5.6 Project Title: Sundarbans Tiger Project Activities and Results**5.5.6.1 Year: 2005-2006****5.5.6.2 Finance by: *Final report to the USFWS and the Save the Tiger Fund*****5.5.6.3 Executive summary**

The Sundarbans Tiger project is a Forest Department initiative, done in cooperation with the University of Minnesota that aims to facilitate the effective conservation of wild tigers (*Panthera Tigris*) in Bangladesh. Through funding from the United States Fish and Wildlife Service (USFWS) Rhinoceros Tiger Fund, and the National Fish and Wildlife Foundation's save the Tiger Fund, the project is carrying out research, capacity building and conservation awareness activities. Two female tigers have been radio collared and a pilot study has been conducted on a prey assessment methodology. Twenty Forest Department staff gained experience in various aspects of tiger capture, immobilization and monitoring. A handbook for Forest Department staff has been made to give instruction in animal sign recognition, field equipment use and how to work safely in the jungle. A *Tiger Response Team* has been created to deal with tiger-human conflict. A project web site had been made to raise conservation awareness. Film footage has been collected for two Forest Department programs; one that covers the project activities and another with a more general overview of tiger conservation issues in the Sundarbans.

Table 5.5**Logic framework of completed project activities**

Activity	Project Output	Post-Project Outcome
I. Telemetry study	I. Two female tigers fitted with GPS collars II. Information collected on home range size, habitat selection, prey selection and behavior III. Training of Forest Department staff in capture, immobilization and monitoring techniques	I. Increased understanding of resource requirements and population status for improved management strategies II. Forest department staff capable of capturing and monitoring wild tigers
II. Pilot prey survey	I. Refinement of prey	I. Formulation of a long-

	abundance estimation methodology	term prey monitoring strategy.
III. Field training of Forest Department staff	I. Government personnel able to use basic field equipment and recognize common animal sign	I. Increased skill base for conducting monitoring programs
IV. Formation of a Tiger Response Team and associated hotline	I. Improved capabilities of Forest Department to deal with tiger-human conflict	I. Improved relations between Forest Department and local communities II. Decrease in unnecessary human suffering III. Decrease in animosity towards and retaliatory killings of tigers
V. Development of field skills handbook	I. Pocket sized information resource for all Forest Department staff working in the Sundarbans	I. Increased understanding of tiger conservation issues II. Improved ability to use basic field equipment, recognize tiger sign and work safely in the jungle III. Increased motivation for carrying out duty
VI. Filming project activities	I. Compilation of film footage for Forest Department programs	I. Development of 2 programs that will improve conservation awareness, improve skill base in Forest Department staff and raise profile of the department
VII. Presentations on project activities	I. Positive media national and international media coverage of tiger conservation efforts in Bangladesh II. Improved awareness of tourists, school groups,	I. Improved public support for tiger conservation II. Additional funding opportunities to aid completion of long-term project goals

diplomats and local
communities

**VIII. Formation of the
Sundarbans Tiger
Forum**

- I. Improved communication
between stakeholders**
- II. Exchange of ideas, skills
and resources**

- I. More focused and
successful conservation
efforts**

**.IX. Development of project
web site**

- I. Improved national and
international awareness of
tiger conservation issues**
- II. Transparency of project's
objectives, activities and
achievements**

- I. Improved public profile of
Forest
Department**
- II. Increased support for
tiger conservation in the
region**

5.5.6.4 Results

5.5.6.4.1 Immobilization

Two tigers were successfully captured and fitted with GPS-radio collars. The first tiger snared (named Jamtola Rani or JR) was female, and captured at the Jamtola area on the 22nd of April 2005. It was darted at 6:58 p.m. with 600mg of Zolatil.

All its upper incisors were either worn down to stumps or totally broken off. Two lower incisors and the right lower canine were also missing. Although thin, the rest of the body seemed to be in relatively good condition. All claws were intact and, apart from three small kinks in the tail, the tiger showed no signs of previous injuries.

The tiger weighed approximately 75 kg and measured 234 cm from nose to tail along the curves. Hair and tissue samples were taken for genetic analysis and photos were taken of the tiger's stripe pattern for future identification. A GPS collar was attached and the tiger's temperature was continually monitored as it slowly recovered from the effects of the drug. It was difficult to give accurate estimates of a tiger's age from an examination of its teeth. However, compared to other tigers of known age examined by the investigator, a conservative estimate for the captured tiger would be around 14 years or older. She recovered slowly but steadily through the night. The first "head up" was

recorded at about 1:30 p.m. She then went through intermittent bouts of sleep until her walked away from the capture site at 10:00 a.m.

A second female tiger (Chaprakhali Rani or CR) was captured on the night of the 2nd of

March, 2006. Judging by teeth wear it was between 10-12 years old.

She weighed an estimated 110-125 kg, and measured 228 cm from nose to tail tip along the curves. Her body was in good condition; all claws were intact and the only sign of previous injury was an old 15 cm long scar on her right shoulder, and a missing upper canines. The tiger recovered well from the immobilization, leaving the capture site at 8:30 a.m.

5.5.6.5. Discussion and Recommendations

5.5.6.5.1 Tiger Capture

Valuable lessons were learnt regarding how to capture tigers living in a mangrove habitat. As this was the first project of its kind in this setting, there was from the outset considerable experimentation with trapping methodology. The research team had to quickly learn from each new experience and adapt their approach. For example, the high salinity of the soil quickly rusted the snare wires if they were left in the ground for too long. Likewise, the snare springs lost their strength if set for weeks on end. The result was faulty equipment that considerably decreased chances of tiger capture. At the beginning of the study snares were set out around live cows; later we shifted to setting out baits without placing snares in the vicinity. Snares were set after a cow was killed. In nearly every case of baiting, some kind of corral was set up around the cow so that the tiger would have limited options of approach. Snares were put at the entrance/exit points and in some instances along nearby trails or scent trees. From our experience we concluded that (1) in general tigers living in the Sundarbans were somewhat wary of killing cows at first sight, (2) female tigers were less likely than males to take the baits, and were also more easily disturbed from a kill, and (3) tigers were wary of approaching both live and dead bait, but (4) there was considerable variation in tiger behavior; some would never kill the bait while others always did. Considering the alternatives (box traps, different bait types etc), however, the cow-snare combination still appears to be the safest and most reliable capture method currently available.

5.5.6.5.2 Home Range Analysis

It is interesting to note that both collared tigers have very small home ranges (average 14.75 km²) relative to all other published data on tigers across the species range. In comparison, female home range sizes recorded from Nepal were 14-51 km². Although more tigers need to be collared in different areas of the Sundarbans, these preliminary data suggest that the mangrove habitat type holds one of the highest tiger densities in the world. Furthermore, if these small home range sizes are typical over the Sundarbans, then this mangrove habitat may support one of the largest remaining wild tiger populations.

Small populations are very sensitive to even low levels of poaching or environmental stresses, so it is the last relatively large populations like the Sundarbans population that represent the tiger. Best chances of survival into the future. As such the Sundarbans should be considered a high priority for tiger conservation efforts and resources.

Research in the 2006-2007 seasons will focus on (1) radio collaring tigers from different habitat types, (2) calibrating variance in khal track counts and (3) developing a rigorous technique for estimating absolute prey abundance.

Analysis of the telemetry data will use Fixed Kernel Polygons (FKP) to investigate home range size and utilization. Second and third order habitat selection will be investigated using the type

III compositional analysis function available in the BIOTAS software package. This is a multivariate technique that compares expected to observed distribution of point data occurring in differing coverage types. Compositional analysis uses individual animals as the sampling unit rather than they estimated location. Habitat selection for tigers will be tested for using each tigers. Daily locations and their 95% FKP. Three 95% home ranges will be used: total 95% FKP, total dry season 95% FKP, and total wet season 95% FKP. In this way selection of different vegetation types and other ecological strata (such as prey density, salinity and human disturbance levels) between seasons will be analyzed. A minimum sample size of 6 tigers is required for this type of analysis.

To better understand the social organization of tigers and to provide preliminary data on the ratio of male to female home range size, we will also attempt to collar 2 males tigers. We recommend that this is an initial goal of the project,

rather than a limit; the best tiger research and conservation projects in the world are the Terai Arc Landscape Project in Nepal, where 37 tigers have been collared and the Siberian Tiger Project in Russia, where 33 tigers have been collared.

5.5.6.5.3 Prey assessment

The circular plots set up along transect lines proved easier to set up and check than the larger square plots. Pellet groups were detected in cleared plots after 10-20 days. We need to develop this technique by determining the spatial variance within and between transects in the same geographic locality and similar forest type. The tidal and general water level fluctuations in the Sundarbans place constraints on the time period available for conducting pellet count surveys. The best time of year to carry out this type of work is February and March, when inundation is at its lowest.

After a pilot study in late 2006 and early 2007 we will begin a Sundarbans wide prey survey in mid-February 2007. Five strata, representing the major vegetation types, will be sampled. A total of 160 transects (2,400 plots) will be established, with equal number of transects (32) in each vegetation type. In subsequent years we will stratify sampling based on variance estimates across different vegetation classes. Eight clusters of four transects will be randomly distributed along the navigable waterways throughout each vegetation type. Then the starting points for each transect will be randomly selected within 500 m from the cluster center and not more than 100 m from the nearest waterway. Each transect will run perpendicular to the nearest waterway. If the transect line is blocked by another khal or other obstacle, then a new direction (90° from the original bearing) will be taken.

An existing herd of captive chital, kept at Karamjol (Chadpai range, Sundarbans), will be used to determine defecation rate. The deer are fed on vegetation that wild chital utilize in the mangroves.

Each day the enclosure will be cleared of old pellet groups, and the next day the number of new pellet groups will be counted. The number of pellet groups per day will be divided by the number of deer to give pellet groups/deer/day. The variation in this statistic will be quantified by repeat counts. We assume that the behavioral and environmental constraints on the captive herd will not affect the deer's metabolism to such an extent that they produce very different

quantities of pellet groups from what they produce in the wild. The ~ 20 chital in the captive herd includes representatives of both sexes and all major age classes. The mean defecation rate and its variance will be used to estimate deer density from the pellet count transects conducted in the wild.

5.5.6.5.4 Monitoring the Tiger Population

Every two years a selection of khals will be surveyed for the presence of tiger tracks. Encounter rate of tiger tracks along khals measures relative abundance of tigers and has the potential of being a cost effective and robust means to monitor changes in tiger abundance (Hayward et al. 2002). Sampling units will be compartments or sub-compartments (larger compartments will be split up along major river courses so that sampling units are approximately 50 km²). The navigable waterways in each sample unit will be surveyed for tiger tracks, the frequency of which (track sets/km of khal) will be used to compare different areas or times, and to deduce relationships between various ecological variables (salinity, vegetation type, etc). This monitoring design will provide an early indication of areas that may require additional management. The degree of change in tiger abundance that can be detected will be dependant on (1) the suitability of the sampling design, (2) the relationship between track rate and tiger numbers, and (3) the variance in track rate. These factors will be investigated during the course of pilot surveys and will incorporate tiger home range size data from the radio telemetry study.

5.5.6.5.5 Sundarbans Tiger Conferences

It is desirable to work towards a trans-boundary approach to tiger conservation in the Sundarbans. To facilitate this, a conference between forest officers from India and Bangladesh will be held in Kolkotta, India in February 2007. The meeting objectives will be to exchange information, standardize field methodology, and plan trans-boundary tiger conservation initiatives.

5.5.6.5.6 Capacity Building

There are two levels of capacity building that need to be targeted; (1) ground level Foresters, Forest Guards and Boat men, and (2) higher level officers (ACF.s and above). The training program for ground level staff needs to be continued to enhance the Forest Department's ability to conduct effective research, monitoring and tiger-human conflict mitigation programs. The current

organization of the Forest Department means that staff is often transferred between posts after 1-2 years. It would improve management capabilities of staffs that show ability and motivation for working with tigers are retained in positions that allow them to use their growing experience in that field. Long-term tiger conservation would also benefit from continuing further education programs for Forest Department officers. Two Deputy Conservators of Forests are currently enrolled as PhD candidates at the University of Minnesota, and there are 1-2 ACFs that have good potential for graduate level work. Funding needs to be secured to support these officer's studies.

For problem tiger management, 3-4 Forest Department staff needs to be trained in immobilization techniques. This can be done by combining field experience with attendance of immobilization workshops conducted by wildlife capture experts. Such a workshop is currently being planned for Thailand in 2007. Although there will be core teams of staff with specialized skills, it is also necessary to improve general capabilities and motivation of all ground level staff working in the Sundarbans. The *Forest Department's Sundarbans Handbook* will provide information on tiger conservation, data collection, safety, and legislation. This will provide the base line information required for Sundarbans staff to carry out their work effectively. The video being produced for the Forest Department will support certain aspects of the books content, and provide additional motivational material. The book will be distributed for free, and the program will be shown at all the Sundarbans patrol posts. A pre and post book/video distribution survey will measure any increase in knowledge or motivation.

5.5.6.5.7 Conservation Awareness

The web site has received positive feedback from government officials, tiger conservationists, students and the public in general. The challenge is to develop the *Tiger Library* section and

Discussion Forum sections so that it can act as a substantial resource for all those interested in tiger conservation or for that matter anyone working in the Sundarbans.

Since working on tigers is politically sensitive, it is necessary to communicate to the general public the approach being taken and the rationale behind it. The key lesson learnt during the course of this study is that a pro-active approach to

supplying information through the media (by writing articles or contacting sympathetic journalists) helps to portray the work and reputation of the Forest Department in a positive light. So far, the media response had been largely positive, and communication between the Forest Department and the press has been improved through meetings and timely release of information. The international press has also welcomed Bangladesh government's efforts to lead the way in tiger conservation in the region. Public support is essential for the relevant ministries to carry out this type of research and to develop future management strategies. Filming of the government's conservation efforts for both national and international audiences should be encouraged, as this will further increase awareness and support.

Conservation awareness is also facilitated through education material. School text books and syllabuses that incorporate tiger biology and general the Sundarbans ecology would help produce future generations of tiger scientists, managers and conservation advocates. At present there is no substantial texts covering these issues; the information regarding tigers and the Sundarbans is either very limited or scattered amongst a small number of reports and journal articles. The project aims to compile and produce a text book for use in secondary schools comprehensively covers the ecology and conservation of the Sundarbans and its biodiversity. Contacts have already been made with some people that have a relevant field of expertise and who can potentially contribute content. Book structure is being developed, and writing will start in 2007.

5.5.7 Project title: Aquaculture for nutrition and supplementary income for the rural poor in the Sunderbans, India

5.5.7.1 Year:

Project Duration:	2 years
Proposed Start Date:	1 st January 2008
Proposed Finish Date:	31 st January 2009

5.5.7.2 Financed by:

Funding request (totals for each year)

Year 1	Year 2	Year 3	Year 4	Total
US\$ 6,000	US\$ 4,000			10,000

Funding support from contributing agencies/individuals (totals for each year)

Year 1	Year 1	Year 1	Year 1	Total
2000	1000			3000

5.5.7.3 Project Summary

5.5.7.3.1 Need

The project area belongs to the Sunderbans; the largest mangrove delta area in the world, one third of it belongs to India having an area of about 10,000 km². Half of it is inhabited by more than 4 million poor people having an annual income of less than US\$300 per family. Due to the lack of electricity there is no industry in the area and the source of production belongs to agriculture, animal husbandry and fishery. Increase in population has caused encroachment of pasture and other available land for agricultural production, which has caused tremendous set back for the animals. Due to high rate of application of chemical fertilizers, the soil quality is depleted resulting in great fall in income in agriculture in the area. Along with poverty, there is a severe protein scarcity among the inhabitants, which affects specially the women and the children.

Each household has more than one pond; nevertheless the rate of fish production is low due to poor capacity of the farmers and lack of supply of good quality fingerlings. There is a high demand of fish in the local market of Calcutta. Fish being an appropriate source of protein in the local area, fishery possesses a high potential for development, which can be related to the existing ponds in the area, Joygopalpur Gram Vikash Kendra (JGVK) is an NGO devoted to support and promote rural development in the Sundarbans, one of the poorest regions of India. The project area is burdened by poverty, child malnutrition and lack of education. The activities of JGVK are aimed at alleviating poverty on household and community level, and include agriculture, animal husbandry, fishery, education, home industry, health etc.

The experimental trial was very successful and proved that a great but underutilized potential for increased pond poly culture exists in the project area. The average production in 30 ponds was app. 2 t/ha of which prawn contributed 10% and mola 10%. The homestead ponds are very suitable for semi-intensive pond poly culture, and JGVK participants of poor rural farmers were highly motivated to continue to develop aquaculture as a highly profitable production which at the same time contributes importance to improve the local food supply. The research team from BAU contributed important to training of JGVK staff in basic pond management and in monitoring the production performance. The result of the experimental introduction of the integrated carp-mola culture was that production technology (species combination, stocking density, management practices) was highly appropriate for the area and the available resources, and the fish production was satisfactory with regard to survival. However, it was concluded that a major constraint for improving the total productivity was availability of carp fingerlings of high quality as it was noted that the growth of all carp species was below the expected growth rates compared to similar production conditions in Bangladesh. The available fingerlings were apparently of poor physical and/or genetic quality.

To continue and expand small-scale integrated pond polyculture in the JGVK area as an integrated part of the overall aim of poverty alleviation, the following needs were identified to be crucial:

- i) The JGVK staff needs further training in pond management in order to provide technical support to the farmers

- ii) There is a great need for establishing a local hatchery for production of quality seeds to be provided to local fingerling producers.

5.5.7.3.2 Objectives

The overall objective of the project applied to be supported is to alleviate poverty in the project area through expanded aquaculture production among poor farmers. To reach this overall aim the specific objectives are defined:

- i. To improve the capacity of 10 JGVK staff and 100 beneficiaries (poor farmers) for optimizing the pond management of semi-intensive integrated carp-mola ponds to reach a production of 3-4 t/ha.
- ii. To establish a small local hatchery to secure local availability of quality carp fingerlings
- iii. Secure supply of fingerlings to the local consumers through a number of local fish farmers.

5.5.7.3.3 Methods and Outputs

Table 5.6
Methods and Outputs

Objectives	Methods/Activity	Outputs	Timeline
Capacity building	Organization and capacity building of the personnel, nursery farmers & beneficiaries	Capacity building of: 70 beneficiaries for fishery in their own ponds, 20-30 nursery farmers	Jan-Apr 08 Jan-Mar 09 April 08
Preparation & production of juveniles	Chinese system	About 200 kg of juveniles will be produced	Apr-Jul 08. Apr-Jul 09.
Production and distribution of the fish fries along with monitoring	A big part of the juveniles is sold to the nursery farmers, who supply the small fish programme	1000 kg fries with the nursery farmers 10 tons of fish from the ponds and 15 tones of vegetables with the beneficiaries.	May-Dec 08 May-Dec 09

5.5.7.3.4: Project outcomes and adoption

The purpose of this section is to identify the community benefits that might be expected from the project if its outputs are achieved.

5.5.7.3.4.1 Social benefits

From the expected output, the involved beneficiaries will be socially benefited from improved health condition in general caused by the protein/nutrient supply and the women especially pregnant/mothers will be benefited as lack of protein affluence affects the women most. This improved health condition will cause improved social equality for the women in the families and in the society, through their organization units like SHGs, VCs etc.

5.5.7.3.4.2 Economic benefits

Due to low productivity and depleting productivity in agriculture the poor families have been affected very hard in the Sundarbans. There is a great need of improving their livelihood through increased production. Most of the families with a small homestead have at least one pond which at present bears very low productivity. As fish is a very good source of protein and bears high price in the market, with the ponds that already exist, the possibility of economical benefit is very high.

5.5.7.3.4.3 Environmental benefits

Due to destruction of the local fish habitats and intensive harvesting of the mother fish, a number of fish species have already become extinct. With secured production of the fish in confinement in the ponds, there will a great deal of release of pressure on the local area where there will be space for regeneration of the environment.

5.5.7.3.4.4 Enhancement of capacity

A very important part of the project is increasing capacity both for the organization JGVK as well as for the farmers living in the area. This will have an inspiring effect to the others for improving their productivity through improved capacity too.

5.5.7.3.4.5 Continuation of the activities after Awe withdraws its support:

Our initial plan is to supply a few thousand farmers to start with. But soon after we will have to increase the production to reach the huge numbers, which

implies increasing the capacity of the hatchery. This will be done in collaboration with the support we have from the fishery experts from Bangladesh and India. The cost of it will be met from the profit that will be kept from the increased production in the ponds.

There is very little profit with paddy cultivation, so the Government is encouraging the local people to cultivate fish and helping them to excavate their ponds, a part of the water could also be used for irrigation. We are encouraged by the Government to work with these farmers to increase their fish production, which we have received capacity and experience in collaboration with the KVL (Royal Veterinary Agriculture University) in Denmark and BAU in Bangladesh. We are preparing to undertake experiments with paddy cum fish cultivation to demonstrate the local farmers, which is profitable and which will improve the rate of income of the poor farmers and supply of nutrition as well. Therefore there are many scopes of fishery in the near and distant future.

**5.5.8 Project Title: Development and Climate Change in Bangladesh:
Focus on Coastal Flooding and the Sundabans**

5.5.8.1 Year: 2003

**5.5.8.2 Organised By: Shardul Agrawala, Tomoko Ota, Ahsan Uddin
Ahmed, Joel Smith and Maarten van Aalst**

5.5.8.3 Financed By: Government of Bangladesh

5.5.8.4 Executive Summary

This report presents the integrated case study for Bangladesh carried out under an OECD project on Development and Climate Change. The report is structured around a three-tiered framework. First, recent climate trends and climate change scenarios for Bangladesh are assessed and key sectoral impacts are identified and ranked along multiple indicators to establish priorities for adaptation. Second, donor Portfolios in Bangladesh are analyzed to examine the proportion of development assistance activities affected by climate risks. A desk analysis of donor strategies and project documents as well as national plans is conducted to assess the degree of attention to climate change concerns in development planning and assistance. Third, an in-depth analysis is conducted for coastal zones, particularly the coastal mangroves –

the Sundarbans – which have been identified as particularly vulnerable to climate change.

Climate change poses significant risks for Bangladesh, yet the core elements of its vulnerability are primarily contextual. Between 30-70% of the country is normally flooded each year. The huge sediment loads brought by three Himalayan rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding. The societal exposure to such risks is further enhanced by Bangladesh's very high population and population density. Many projected climate change impacts including sea level rise, higher temperatures (mean temperature increases of 1.4°C and 2.4°C are projected by 2050 and 2100 respectively), vapor-transpiration losses, enhanced monsoon precipitation and run-off, potentially reduced dry season precipitation, and increase in cyclone intensity would in fact reinforce many of these baseline stresses that already pose a serious impediment to the economic development of Bangladesh. A subjective ranking of key climate change impacts and vulnerabilities for Bangladesh identifies water and coastal resources as being of the highest priority in terms of certainty, urgency, and severity of impact, as well as the importance of the resources being affected.

Bangladesh receives around one billion dollars of Official Development Assistance (ODA) annually. Analysis of donor portfolios in Bangladesh using the OECD-World Bank Creditor Reporting System (CRS) database reveals that between 22-53% of development assistance (by aid amount) and 22-37% of donor projects (by number) are in sectors potentially affected by climatic risks. However, these numbers are only indicative at best, given that any classification based on sectors suffers from over-simplification – the reader is referred to the main report for a more nuanced interpretation. Donor country strategies and project documents generally lack explicit attention to climate change. Likewise, there is no national policy in place yet to comprehensively address climate change risks. At the same time however this report also reveals through a more in-depth analysis that despite this lack of explicit mention, a number of adaptations that climate change might necessitate are indeed already underway in Bangladesh, particularly since the mid-1990s, as part of regular development activity through several government-

donor partnerships. A wide array of river dredging projects have been completed to reduce silt and facilitate better drainage at times of flooding as well as to boost dry season flows to critical areas such as the Sundarbans. However there are remains an ongoing challenge with regard to their durability and sustainability. For example, measures such as dredging of waterways are not a one time response but require periodic repetition. Similarly flow regulators on coastal embankments require constant monitoring and maintenance for the lifetime of such structures. Monitoring and maintenance in turn requires continued government and donor interest as well as participation of the local population far beyond the original lifetime of the project.

There are also some examples of development policies and priorities in Bangladesh that might potentially conflict with climate change responses. In particular, policies to encourage tourism and build tourism infrastructure in vulnerable areas of the coastal zone, particularly the Khulna region, might need to take into account the projected impacts of climate change to reduce the risk of mal-adaptation. Meanwhile, plans to encourage ecotourism in the fragile Sundarbans might risk adding one more stress to a fragile ecosystem that will likely be critically impacted by sea level rise and salinity concerns.

The Bangladesh case study also highlights the importance of the trans-boundary dimension in addressing climate change adaptation. The effect of water diversion upstream on dry season flows and salinity levels in the Sundarbans was in fact comparable to (if not higher than) the impact that might be experienced several decades later as a result of climate change. Adaptation to climate change might therefore not just be local but might require cross-boundary institutional arrangements such as the Ganges Water sharing treaty to resolve the current problems of water diversion. Finally, climate change risks should also not distract from aggressively addressing other critical threats, including shrimp farming, illegal felling of trees, poaching of wildlife, and oil pollution from barge traffic, that might already critically threaten the fragile ecosystems such as the Sundarbans even before significant climate change impacts manifest themselves.

5.5.8.5 Climate change and the Sundarbans

Linked to the problem of coastal flooding is the potential impact of climate change on the Sundarbans which straddle south-western Bangladesh and the adjoining coast in the Indian state of West Bengal. With a total area of over 10,000 square kilometers, the Sundarbans constitute that world's largest contiguous mangrove ecosystem. The second largest is only about one-tenth in size. Roughly 60% of the Sundarbans fall in Bangladesh, located on the northern limits of the Bay of Bengal and the old Ganges delta.

The Sundarbans house is one of the richest natural gene pools for fauna and flora in the world. The flora contains at least 69 species, with the *Sundari* (*Heritiera fomes*) – which gives the forest its name – and the *Gewa* (*Excoecaria agallocha*) being the dominant species that provide timber for paper and wood products. A total of 425 species of wildlife have been identified in the Sundarbans, including 42 species of mammals, 300 species of birds, 35 reptiles, and 8 amphibian species. The most notable – the Royal Bengal Tiger – is endemic to the forest. In recognition of this richness in biodiversity, both the Indian and the Bangladesh Sundarbans were declared world heritage sites by UNESCO.

Traditional lifestyles were in fact reasonably well adapted to these unique characteristics of the Sundarbans. Human dwellings were built on raised platforms, and farmers cultivated salinity and flood tolerant rice during the monsoon in land protected by temporary dykes when the abundance of freshwater had greatly reduced salinity levels. The dykes were dismantled post-harvest, opening the land to tidal movements. Meanwhile fishing of salt tolerant varieties was the principal source of livelihood during the dry season when salinity levels were high.

These traditional lifestyles have been altered in recent decades on account of a number of factors. A high rate of population growth has led to the ecosystem supporting an ever-growing population. Poaching of wildlife and illegal felling of timber are among the most severe environmental threats. A number of species such as the Javan rhinoceros and the water buffalo have already disappeared. Industrial development in the region and opening up of access to trade has also imposed increased demands on forest resources, particularly timber. The growing barge traffic and lax environmental

enforcement have also led to a number of oil spills which continue to adversely impact the ecosystem.

Recent decades have also seen two major infrastructural developments – one local and the other in neighboring India – that have caused a major change in the dynamics of the ecosystem, and consequently local livelihood patterns. The first ironically was intended as an adaptation to coastal flooding – a series of coastal embankments that were built by the Government of Bangladesh in the late 1960s. However, as discussed in Section 7.2, the flow regulators in these embankments were either not built according to design and/or not properly maintained thereafter, which over time led to drainage congestion and water logging starting in the early 1980s. The second development was the construction of the Farakka barrage upstream in the Indian state of West Bengal in 1974 that diverted water and reduced dry season flows and led to significantly enhanced salinity levels in the dry season.

The inundation and salinity changes interrupted the traditional livelihood practices discussed earlier. However, at the same time they offer an ideal opportunity for shrimp farming which exploded as an export oriented cash industry starting in the mid-1980s, boosting local incomes 21. On the other hand however, shrimp farming encouraged farmers to artificially inundate lands with brackish water during periods of low salinity, causing severe damage to the forest cover. The depletion of forests in water logged shrimp areas also increased pressures in other parts of the Sundarbans for fuel wood and timber, enhancing the rate of forest depletion. The thin wire mesh that is used for shrimp collection meanwhile is also resulting in the capture of larvae of other species, which are then discarded, thus causing the depletion of the stock of other fish species.

Meanwhile high dry season salinity levels, in part the result of water diversion upstream in India, have also adversely impacted agriculture production, besides increasing the environmental stress on the forest cover. The south-western region of Bangladesh, including the Sundarbans forest areas have already witnessed how surface salinity penetrate with decreasing flow condition in the lower Ganges distributaries systems. Reports indicate that, following the drastic diversion of surface flow in the Ganges in 1975 there has been a gradual rise in salinity in the entire Ganges Dependent Area (GDA). As

a consequence of saline penetration the 1 ppt isohaline line during the peak low flow season (March) has reached as far as Kamarkhali Ghat, a location which was free from surface salinity hazard in the pre-Farakka period. Around Khulna, a divisional town located some 146 km upstream from the Bay, the salinity has increased from 380 micro-mhos in the pre-Farakka period to about 29,000 micro-mhos in the post-Farakka period.

Salinity ingress also causes an increase in soil salinity, especially when farmers irrigate their lands with slightly saline surface water at the beginning of the low flow period. Reported that, soil salinity levels south of Khulna and Bagerhat towns ranged between 8 to 15 dS/m during the low flow season. It is also reported that, several sub-districts (such as Kachua, Mollahat, and Fultali) south of the Sundarbans — known to be non-saline in the pre-Farakka period — have begun to develop soil salinity during the low flow seasons of 1980s. The anticipated results of salinity ingress will be, at a minimum, of the same order for climate change induced low flow regime compared to similar effects shown by deliberate withdrawal of flows at Farakka barrage.

5.5.8.6 Climate change impacts on the Sundarbans

The potential impacts of climate change on the Sundarbans will only be superimposed on the baseline stresses discussed above that are already posing a critical threat to the ecosystem. Following from the scenarios outlined in Section 3, climate change is expected to have a significant effect on the flow regimes of the major rivers in Bangladesh, including the Ganges. Since the viability of the Sundarbans rests on the hydrology of the Ganges and its tributaries which supply the fresh water influx, climate change is expected to have significant impact on the Sundarbans. In addition to the altered hydrology, sea level rise will also have adverse impacts on the forest, directly through enhanced inundation and indirectly by enhancing saline intrusion in river systems.

The climate change scenarios reviewed in Section 3.2 indicate that there is general agreement across climate models on increased precipitation during the monsoon season. Greater rainfall runoff would provide increased freshwater discharge in all the major distributaries of the Ganges supplying freshwater to the Sundarbans — the Gorai, the Modhumati and

Bhairab system on the Bangladesh side and the Hoogly on the Indian side. Generally, increased flow regime in the distributaries of the Ganges would push the saline front outward towards the sea. Such a changed freshwater dominated hydrological condition during the monsoon in the absence of countervailing influences would help freshwater loving species such as the *Sundri*, especially in the marshaling and polyamine regions.

Simultaneously however, a rise in sea level would also occur under climate change which would cause increased backwater effect in the major distributaries of the Ganges and tend to push the saline front further inland. The final location of the saline front during the monsoon will therefore be the result of two opposing effects: enhanced freshwater flows and enhanced backwater effect, and is hard to predict precisely. The backwater effect would also reduce the discharge of freshwater flow from the northern reaches of the tributaries of the Ganges resulting in a relatively prolonged inundation of the forest land. Increased rainfall intensity – which is also anticipated in the region – would cause enhanced erosion upstream and result in increased availability of sediments, particularly along the Ganges and its distributaries. The latter effect in combination with prolonged flooding episodes would increase the rate of sedimentation/siltation in the back swamps and creeks inside the forest area. Such a change would be relatively more pronounced in the Bangladesh side of the forest and may slightly offset permanent inundation of the forest floor due to continued increase in sea level rise.

The effects of climate change on the Sundarbans would be considerably more critical during the dry season that extends from November to April. Climate models predict a decrease in precipitation during this period which might further reduce freshwater flows, which will encourage enhanced withdrawals upstream for irrigation. This reduction in freshwater inflows into the Sundarbans could be exacerbated by increased evapo-transpiration losses and water use on account of rising winter temperatures. Reduced freshwater flows coupled with sea-level rise would consequently further enhance the dry season salinity levels in the Sundarbans.

The reduction in freshwater flows would only deteriorate with time and the lowest water levels would be expected in March. As a response to reduced flow regime the salinity front would penetrate inland both inside the

forest areas and in the entire south-western areas of the country. Similar ingress of salinity is also expected on the Indian side of the Sundarbans. The effect of sea level rise on salinity ingress is modeled here using the salinity model of the Institute of Water Management (IWM), Bangladesh. Considering about 23 cm of SLR, isohaline lines penetrate inland, as shown in Figure 9. Significant penetration has been indicated for the threshold salinity of 1 ppt. or higher for the rivers supplying freshwater in the western and central parts of the Sundarbans: Betna, upper Bhairab and Kobadak.

High intensity cyclonic storm surge, induced by a general rise in sea surface temperature, is also likely to have compounding effect on salinity intrusion along the coastal areas of Bangladesh, including the Sundarbans. A simple frequency distribution of all observed cyclonic activities in the Bengal delta suggests that these events usually occur twice per annum: in late May and in early November. Cyclones are usually formed in a complex process where the sea surface water temperature is exceeded beyond the threshold value of 27°C. Since climate change will cause an increase in mean sea surface temperature, it may be expected that the excess heat energy will be dissipated in the form of increasing number of high intensity cyclones. Unfortunately, such high intensity cyclones are often associated with high storm surges. It may be argued that intensity of storm surges is likely to be increased under climate change scenarios, particularly in the later part of the 21st century. Cyclonic storms would cause severe damages to the forest, its inhabitants and resources. A high intensity event in 1986 devastated the Sundarbans, drowned thousands of its magnificent animals including the threatened species, the Bengal Tiger. The wind associated with that particular cyclone also devastated vegetation of a large part of the forest. Influenced by climate change, high intensity storm surges would inundate high levees and back swamps that do not get submerged with saline water and thereby would be affected by salinity.

Since the composition of vegetation has profound effect on distribution of forest fauna, a change in forest succession would in turn affect the long-term sustainability of the ecosystem. Considering the timeframe of such changes

and the land-use patterns inland, it is highly unlikely that forest species would have sufficient time or room to migrate inland in response to these changes.

5.5.8.7 Adaptation Options for the Sundarbans

The most useful adaptation aiming at saving the Sundarbans from sea-level rise induced submergence would be to modify the threats of permanent inundation. Since most part of the projected sea level rise would occur from tectonic subsidence, it would not be quite possible to stop the processes involved. However, efforts must be made to figure out ways to enhance sedimentation on the forest floor, by means of guided sedimentation techniques. If such approaches appear to be technically feasible and economically viable at a pilot level, efforts must be made to undertake projects in order to save the forest. Controlled and guided sedimentation will have a balancing influence on subsidence process and could help delay permanent inundation of the forest floor.

The second most important adaptation strategy will be to reduce the threats of increasing salinity, particularly during the low flow period. This may involve a range of physical adaptations to offset salinity ingress, including: (a) increasing freshwater flows from upstream areas; (b) resuscitation of existing river networks towards improving flow regime along the forest; and (c) artificial enhancement of existing river networks to facilitate freshwater flow regime along the rivers supplying freshwater to the western parts of the forest.

For the sustenance of the forest in its natural state a previous study has recommended that about 240 cusec water should be allowed to flow through the Gorai river system, particularly during the critical dry period of April (Mirza, 1998). The actual amount of water flowing along the Gorai River in 1995-96 was about 52 cusec, which was far below that the recommended flow regime. The Gorai River is an important source of freshwater supply to the southwest region (SWR) of Bangladesh and is the only remaining major spill channel of the Ganges River flowing through the region where the Sundarbans is located at its southern most part. Dry season Gorai flows have been particularly affected by the building of the Farakka barrage on the Indian side. The most visible impact has been in the form of bringing morphological changes along the Gorai — since 1988, the river has been completely disconnected from the

Ganges during every lean season. As a result only the base flow of the Gorai river system, contributed predominantly by seepage, was able to reach the Sundarbans during the dry season.

Following the signing of the Ganges Water Sharing Treaty (GWST) with India in 1996, the flow regime of the Ganges within Bangladesh has slightly improved. In order to increase the flow from its current level will require enhancing regional cooperation amongst co riparian countries to augment flow regime of the Ganges, and the creation of storage capacity within the Ganges basin on the Bangladesh side so that a sustained flow regime can be maintained in Gorai and other rivers throughout the lean season.

5.5.8.8 Measures Undertaken to Enhancing the flow Regime in the Sundarbans

The implications of reduced dry season fresh water flows and salinity increase in the Sundarbans as a result of water diversion upstream have been severe enough for the GOB to take actions to ameliorate the situation, without giving any considerations to future implications of climate change on the Sundarbans forest. The steps taken in the past cannot, therefore, be considered as a planned adaptation to climate change, although they are certainly synergistic with climate change responses.

As a first step to enhance flow regime of the Ganges and its distributaries, Bangladesh and India negotiated the Ganges Water Sharing Treaty (GWST) in 1996. According to the GWST, Bangladesh would receive a maximum flow of 58,180 cusec (1,648 cusec) water in January, and a minimum of 32,623 cusec (924 cusec) water in April. Despite a few early hick ups towards implementation of the Treaty, flow regime in the Ganges improved significantly in the lower riparian Bangladesh compared to the pre-Treaty period.

Simultaneously, the GOB implemented a two-phase project to resuscitate Gorai and restore its flow conditions by dredging the mouth of the river. The project follows a pilot phase undertaken\ during 1999-2001. The objective of the initial (feasibility) phase of the Gorai River Restoration Project (GRRP) was "to prevent environmental degradation in the SWR, specifically around Khulna, the coastal belt and in the Sundarbans, by undertaking restoration of the Gorai river and hence ensuring freshwater flow in the wet season and augmenting these flows during the dry season" (DHV-Harkening and Associates, 2000).

Pilot-scale dredging was carried out during 1998-1999 and 1999-2000. Based on the favorable findings of the initial phase, a number of engineering interventions have now been recommended:

- Flow divider
- Ganges/Gorai revetment
- River training works along the Gorai and restructuring of river training works
- Dredging of clay layers in the Gorai off take
- Installation of bottom vanes.

The pilot study concluded by stating "it is probably opportune to implement such works in the future, when the firm need therefore has been established, or when suitable conditions prevail for their implementation" (DHV-Harkening and Associates, 2000). The overall objective of GRRP-implementation project – undertaken by the Bangladesh Water Development Board (BWDB) was to implement the recommendations of GRRP study, and thereby ensure freshwater flows along the Gorai river system covering an area of about 16,100 km². The Feasibility Study for the GRRP identified significant ecological and environmental benefits from providing a minimum flow of 60 m³/s, particularly by facilitating freshwater availability to the Sundarbans forest. The project envisaged other benefits arising from reduced Stalinization, increased agriculture and other in-stream values such as aquatic biodiversity, freshwater fisheries and navigation. The Project was considered to be technically and economically justifiable. The GRRP was completed in January 2002 at a cost of about US\$58 million. The engineering option which considered river training works in combination with occasional maintenance dredging has been found reliable and uncomplicated. The project activities provided for a significant recurrent cost saving over recurrent dredging options.

The BWDB is now undertaking a project, called Re-excavation of the Kobadak River, at a cost of about US\$5 million. The river used to supply freshwater directly into the central part of the forest. In course of time it has lost its water conveyance capacity due to gradual sedimentation and human encroachment particularly during the dry season. The re-excavation project is aimed at resuscitation of the river and re-excavation is taking place in three major districts north of the Sundarbans. The re-excavation will continue till 2004 and it is expected to enhance freshwater flows along the river servicing the forest.

Another river, the Betna, has also been considered for re-excavation by the BWDB. Betna is the only major river that used to provide with freshwater in the lean season to the western parts of the forest. The project began in 2001-2002 season and expected to be completed in 2003 at a cost of US\$4 million. The project is expected to increase freshwater flow in the western parts of the Sundarbans and reduce surface salinity.

5.5.8.9 Potential Adaptation Benefits from Planned and Ongoing Activities

In addition to the above mentioned projects and activities, a few others are currently underway or in the pipeline. The GOB has undertaken a major study for the entire GDA — called the Study on Options for the Ganges Dependent Areas (OGDA) — which identified a few options for environmental restoration of the Sundarbans forest. Although this was not a conscious effort to promote long-term adaptation to climate change, the study has now become an input to the recently undertaken National Water Management Plan.

The objective of the OGDA study was to develop technically feasible and socially acceptable options for environmental restoration and enhancement of the entire GDA by utilizing the water obtained through the Ganges river following signing of the GWST. In spite of the fact that the study never meant to pay special attention to the improvement of freshwater flow regime and controlling salinity of the Sundarbans forest, its options provided apparent solutions to the core problems. The study developed a number of options for diversion and distribution of the Ganges flows, with a focus on supplying adequate freshwater in the lean season.

The study stated that, the dry season flows of the Ganges can be diverted into different parts of the GDA by pumping, through restoration/dredging old distributaries of the Ganges or by raising the Ganges command level with the help of a barrage. The study highlighted the potential and/or scope of these different options for augmentation of the flows in the internal rivers by diverting the Ganges waters in the following ways:

- *River restoration*, entailing quick dredging of Gorai and other distributaries rivers of the Ganges. This option also called for a clear assessment of requirements for maintenance dredging and incorporation of some river training works.

□ *Central pumping*, that would enable maintaining a flow regime in the distributaries system of the Ganges River by lifting freshwater using pumps and releasing it into the existing and/or excavated river networks in the downstream. Such an option was regarded as technically feasible, but the study called for examining economic viability.

□ *Barrage* option called for construction of a barrage on the Ganges to store freshwater enabling raised command levels in the lean season. This option appears promising, especially when combined with either of the previous two options.

The OGDAs study recommended as many as seven choices by combining the above mentioned major options. The OGDAs options have been incorporated into the recently formulated NWMP. The NWMP along with a 25 year implementation plan was currently placed before the Bangladesh National Parliament for discussion and approval.

The GOB is also undertaking an implementation project titled Integrated Coastal Zone Management Plan (ICZM). Instead of embarking on any specific project activity, the ICZM has got the official mandate to establish a process that would enable all the stakeholders in the coastal zone to implement their activities in a coordinated fashion towards improving the natural resources of the coastal zone and maximizing benefits for the poor people — those eking out a living based predominantly on natural resources. The major focus of the ICZM project is to help alleviate poverty. In doing so, the project aims to enhance livelihood opportunities of the poor, for which reducing vulnerability of the resource base to climatic variability and change must be considered as an important means. The terms of reference for the Project Development Office (PDO) for implementation of ICZM require the integration of adaptation responses to climate change. Although the detailed plan of various activities under the ICZM programmed are not yet finalized, an interview with the team leader of the ICZM project revealed that integration of possible adaptation issues for the entire coastal zone including the Sundarbans might be considered under the Action Plan that is currently under preparation. ICZM-PDO has already expressed interest in undertaking a programmed on climate change for the entire coastal region, focusing on enhancing adaptation activities to reduce adverse impacts of climate change on coastal resources

and people's livelihood. Subject to endorsement by the Ministry of Water Resources, the activity would begin in later part of 2003. It is envisaged that, the project would integrate the activities recommended by the OGD A study and subsequently by the NWMP. This would certainly help increase freshwater flows along the distributaries of the Ganges which are the freshwater lifelines of the Sundarbans.

The ICZM project has conducted a number of stakeholder dialogue at the grassroots and identified the major elements of vulnerability of livelihood of the local poor. As identified by the local people, the most common elements of vulnerability along the coastal zone are linked heavily with biophysical resources. In most cases, the identified bio-physical resources are found to be perturbed significantly by the current climatic variability. Under climate change regime several elements of vulnerability of the poor people would only get deteriorated.

There are however a number of measures available to offset some of these impacts. In addition to measures that reduce salinity (through enhanced freshwater flows), the forest resources in the Sundarbans themselves may be enhanced through species enrichment, increasing surveillance and management capabilities of institutions and personnel involved, and establishing a mangrove arboretum. The Sundarbans Biodiversity Conservation Project (SBCP) funded by the GEF and ADB is now being implemented by the Department of Forest (DOF) at a cost of about US\$77.5 million. The main objective of the project is to develop a sustainable management and biodiversity conservation system for all resources of the Sundarbans Reserve Forest (SRF). SBCP was by no means intended to address adaptation to climate change for the forest and its resources. But the activities that would help achieve its specific objectives would also help achieving goals of conservation of the forest biota. For example activities under 'Field Forest Management' such as forest rehabilitation, enrichment plantation, assisted natural re-generation and conservation of aquatic species would contribute to the enrichment of forest biota making them more resilient to additional climatic stresses. Furthermore, wildlife management programme is expected to provide protection to the valuable threatened species and improvement of habitat for species such as tigers, deer, other mammal species, reptiles, birds, snakes,

amphibians. The component of public awareness rising would enable enhanced voluntary surveillance by the communities living at the outer periphery of the forest and check poaching of threatened and endangered species. For example, it is expected that local community based organizations (CBO) and non-government organizations (NGO) would be involved to actively take part in in-situ conservation of rare and endemic marine turtles. Given the high vulnerability of the forest associated with climate change and sea level rise, it is most likely that the SBCP and its follow up projects would supplement adaptation activities towards conservation of the forest and its resources.

5.5.8.10 Concluding Remarks

Bangladesh is critically vulnerable to climate induced hazards, but the core elements of its vulnerability are primarily contextual. It is probably the only country in the world with most of its territory lying on the deltaic flood-plain of three major rivers and their numerous tributaries. Between thirty to seventy per cent of the country is normally flooded each year. The huge sediment loads brought by these Himalayan Rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding. The low coastal topography contributes to coastal inundation and saline intrusion inland. Bangladesh also lies in a very active cyclone corridor that transects the Bay of Bengal. The societal exposure to such risks is further enhanced by its very high population and population density, with close to 800 persons per square kilometer in vulnerable areas such as the coastal zones. Very low levels of development and high levels of poverty (between 33 and 40%) add to the social sensitivity to any external hazards. Meanwhile traditional adaptation via seasonal migration to less vulnerable areas within the Indian subcontinent was probably curtailed significantly half a century ago with the creation of a discrete geopolitical entity (East Pakistan), which subsequently became Bangladesh. The Internationalization of the region probably also contributed to water sharing conflicts, most notably the building of the Farakka barrage in India that led to the diversion of dry season flows, which exacerbated salinity concerns in the Bangladesh Sundarbans.

Many projected climate change impacts including sea level rise, higher temperatures and evapo-transpiration losses, enhanced monsoon precipitation and run-off, potentially reduced dry season precipitation, and increase in

cyclone intensity would in fact reinforce many of these baseline stresses that already pose a serious impediment to the economic development of Bangladesh. By the same token, many actions undertaken to address the baseline or contextual risks in Bangladesh are also synergistic with the so called adaptations that might be required as climate change impacts manifest themselves. There is therefore a need to clearly address whether climate change impacts are simply one more reason to lower contextual vulnerability via business as usual economic development activity, or whether adaptation to climate change might require suitable modifications in such projects or highlight the need for entirely new activities, and if so, what such activities might be. Thus far there has been no clear articulation on this important issue, despite the disproportionately high number (and somewhat duplicative nature) of conferences and donor funded projects on climate change that have taken place in Bangladesh over the past decade. New climate oriented projects in Bangladesh might therefore require a higher threshold of "value added" in the light of the considerable body of knowledge and past experience that has already been accumulated.

This report (like some others before it) indicates a general lack of explicit attention to "climate change" in many government plans and donor project documents in Bangladesh. At the same time however this report also reveals through a more in-depth analysis that despite this lack of explicit mention, a number of adaptations that climate change might necessitate are indeed already underway in Bangladesh through several government-donor partnerships. In particular, considerable progress has been made since the mid- 1990s in implementing such projects. A wide array of river dredging projects have been completed to reduce siltation and facilitate better drainage at times of flooding as well as to boost dry season flows to critical areas such as the Sundarbans. The Ganges Water Sharing Treaty has been signed with India to boost dry season flows and reduce the threat of salinity, and more sophisticated cyclone early warning systems and protection shelters are being developed. All these measures are likely to contribute to reducing the vulnerability of Bangladesh to climate change impacts.

However, there are also some examples of development policies and priorities in Bangladesh that might potentially conflict with climate change responses. In

particular, policies to encourage tourism and build tourism infrastructure in vulnerable areas of the coastal zone, particularly the Khulna region, might need to take into account the projected impacts of climate change to reduce the risk of mal-adaptation. On the other hand, plans to encourage ecotourism in the fragile Sundarbans might risk adding one more stress to a fragile ecosystem that will likely be critically impacted by sea level rise and salinity concerns.

With regard to structural adaptations such as coastal embankments and salinity reduction, even though it is true that many of these measures have already been integrated in development projects and policies in Bangladesh, there remains an ongoing challenge with regard to their durability and sustainability. For example, given the high influx of sediments from the Himalayan Rivers each year, measures such as dredging of waterways are not a one time response but require periodic repetition. Similarly flow regulators on coastal embankments require constant monitoring and maintenance for the lifetime of such structures – in fact it was the poor maintenance of such regulators in the original embankments established in the 1960s that cause widespread flooding when they became clogged by the 1980s. Monitoring and maintenance in turn requires continued government and donor interest as well as participation of the local population far beyond the original lifetime of the project. This point is echoed by the project director of the Coastal Embankment Rehabilitation Project who observed “The Operation and Maintenance (O&M) component appears to have been relegated. Political and institutional support from national to local level has been in favor of rehabilitation instead of preventative maintenance. The project’s sustainability is apparently seriously deficient”. Structural adaptations therefore need to be matched by efforts to facilitate financial and institutional adaptation – sustained interest on the part of the government and donors, and the participation of local populations to help monitor and maintain infrastructural projects.

The Bangladesh case study also highlights the importance of the trans-boundary dimension in addressing climate change adaptation. The effect of water diversion as a result of the Farakka barrage on dry season flows and salinity levels in the Sundarbans was in fact comparable (if not higher) than the impact that might be experienced several decades later as a result of climate change. Adaptation to climate change might therefore not just be local but

might require cross-boundary institutional arrangements schemas the Ganges Water sharing treaty to resolve the current problems of water diversion. Finally, climate change risks should also not distract from aggressively addressing other critical threats, including shrimp farming, illegal felling of trees, poaching of wildlife, and oil pollution from barge traffic, that might already critically threaten the fragile ecosystems such as the Sundarbans even before significant climate change impacts manifest themselves.

5.5.8.11 Review of Selected Development Projects/Programmers

Many donors, including the USA, the Netherlands, the UK, the ADB, and New Zealand have supported studies on climate change vulnerability and adaptation in Bangladesh, between 1989 and 1996. The most recent major study, which has reviewed most of the previous results, was supported by the World Bank.

5.5.8.11.1 World Bank: *Bangladesh Climate Change and Sustainable Development* (2000)

The World Bank report *Bangladesh Climate Change and Sustainable Development* (2000) aimed to mainstream adaptation in the regular development strategies and operations in Bangladesh. It reviewed possible climate change impacts in Bangladesh, but particularly focused on an overview of adaptation options for various sectors, including fairly specific suggestions for some of them. In addition, it includes a review of sixteen development activities (mainly by the ADB and the World Bank, and also by the Netherlands and DFID) in the light of adaptation to climate change. This review considered two aspects: vulnerability of the projects themselves, as well as opportunities to reduce Bangladesh's vulnerability in a broader sense. Its main finding was that most of the activities reviewed do not consider climate change impacts or adaptation to such impacts. In addition, it reviews the National Water Management Plan (NWMP), and offers specific suggestions to improve the NWMP.

5.5.8.11.2 CIDA/CARE Bangladesh Reducing Vulnerability to Environmental Change Project

CARE Bangladesh is conducting a project in Bangladesh's six coastal districts, working with 6000 rural households to improve resilience and reduce

vulnerability to climate change. This project, which is just starting, is funded from the Canadian Climate Change Fund (CCCCF). A detailed project document was not yet available for the current review, but the main objectives will to build local capacity to disseminate environmental change information and forecasts (including 600 farmer schools) and to extend proven grassroots techniques and measures to address climate change impacts.

5.5.8.11.3 GEF/ ADB Biodiversity Conservation in the Sundarbans Reserved Forest Project

The Sundarbans, a 3600 sq km cluster of coastal islands stretching from Bangladesh into India, are one of the world's largest remaining areas of mangroves. It has been recognized as an important Ramsar Wetland site, and UNESCO has declared it a World Heritage Site, mainly because of its exceptional biodiversity, with a wide range of flora and fauna, including the Bengal Tiger. Monsoon rains, flooding, delta formation, tidal influences, and plant colonization all make the Sundarbans a highly dynamic environment. The area has been a reserve since the 1870s, preventing permanent human occupation of the reserved forest. Nevertheless, the human population in the area, which is concentrated in the buffer zones around the three official wildlife sanctuaries, depends for a large part on the resources of the reserved forests, either directly or indirectly. In recent decades, a range of mostly human-caused problems, generated by population growth and expansion of human activities, threaten the sustainability of the ecosystems as a whole, and wildlife stocks in particular. Particular problems include over extraction of wood and other natural resources, habitat modifications due to dying trees and increased permanency of fishing camps within the reserved forests, potential species extinctions, poaching, lack of community participation in sustainable resource use programs, and lack of multicultural management capacity.

A large project is underway to protect the rich biodiversity of the Sundarbans and enhance the rural livelihoods of the local population, through sustainable natural resource management. Activities include (i) improvements in the organization and management of the reserve; (ii) incorporation of biodiversity conservation considerations in fisheries and forestry, management of wildlife resources, and integrated conservation planning; (iii) increasing local support for biodiversity conservation by local communities through education,

awareness activities, and ecotourism development, and (iv) establishment of biodiversity monitoring systems. The project is funded by a GEF grant (implemented through the World Bank) and the ADB, with co-financing from the Palli Karma-Sahayak Foundation, the Nordic Development Fund, the Netherlands, as well as the Bangladesh government, NGOs, and local beneficiaries.

The World Bank Climate Change study concluded that the Sundarbans are at high risk from climate change. While most of the proposed activities under the Biodiversity Conservation in the Sundarbans Reserved Forest Project will still pay off, the long-term viability of the reserve may require additional efforts. In response to the findings of the study, stakeholders involved in ecosystem conservation in the Sundarbans agreed to incorporate the results in the Biodiversity Conservation in the Sundarbans Reserved Forest Project (Huq, 2002, Rahman and Alam, 2003). Aside from strengthening existing efforts to better manage the reserve, the World Bank study also suggested that a minimum flow through the Ganges-Mathematic system is required to sustain the Sundarbans, with implications for the (already controversial) Ganges barrage, and the management of the Gorai river; issues which fall outside the scope of the GEF/World Bank/ADB project.

5.5.8.11.4 UNDP Empowerment of Coastal Fishing Communities for Livelihood Security (2000-2005)

The project has three main objectives: (i) empowerment of communities, (ii) enhancement of socioeconomic capacity through savings, credits and income generation activities, and improved access to extension and social services, and (iv) improved capacity to cope with natural disasters. It also aims for sustainable conservation and management of coastal marine and estuarine fisheries resources and habitats. Hence, the project is likely to decrease the vulnerability of these communities and ecosystems to climate change. Nevertheless, the project description contains no reference to climate change as a risk to any of these project components.

5.5.8.11.5 World Bank/GEF/DFID Aquatic Biodiversity Project

Project Information Document (1999)

557The project notes that the fisheries sector accounts for 3% of total GDP, and 5% of the national workforce, which increases during the flood season. Fish supplies account for about 60% of animal protein intake in Bangladesh. However, per capita consumption of fish has substantially decreased since the 1970s, implying a significant loss of welfare. One of the reasons for a decline in inland open-water fisheries yields is the loss of biodiversity caused by, among others, flood control and road projects that interfere with natural breeding and life cycles of fish (the government is mitigating negative impact of flood control and road infrastructure on floodplain fisheries through a program of floodplain stocking and fish pass construction). The project aims to increase fish and shrimp production for domestic consumption and exports, consistent with sustainable resource management and with special emphasis on rural poverty alleviation, employment generation, improved capacity of local users to manage aquatic resources in a sustainable and equitable fashion, and conservation of aquatic biodiversity. One of the project components aim to improve inland open-water fisheries management through the development of sustainable, community-based institutions and supporting them in undertaking a program of adaptive management of their fisheries resources using technical measures such as stock enhancement of floodplain fisheries, restoration of fisheries habitats, establishment of fish sanctuaries, and construction of fish passes. Other elements aim to improve smallholder shrimp production, develop and apply an appropriate fisheries extension strategy, and prepare studies and strategic planning for the development and long-term sustainability of the fisheries sector. The (relatively brief) Project Information Document does not mention climate change, but it appears that the project will make the sector more resilient to environmental variability, and can help to balance the negative impacts of flood mitigation infrastructure with the needs for suitable fisheries environments and livelihoods.

Comments of the Sundarbans Forest about the development:

In answer to 5th question (*i.e.* how the development works of the forest is done?) about the development works of the forest out of the five Forest Expert (FE), everybody has made individual comments. Such as one of them has mentioned that whether they had got fuel (oil) travel allowance, and residence it is possible to follow management plan with enhance camping system. Another two have mentioned that it is possible of the forest prosperity to materialize the management plan accurately. Rest of the two ROs has mentioned that if they could follow the direction of management plan, it is possible of forest prosperity. It is very clear that opportunity will be provided to enhance the prosperity of the forest.

In reply to 5th question (*i.e.* how the development works of the forest is done?) out of the total of two DFO both of them have given positive view about the development works of the forest. Out of two one has emphasized on instructions of the management plans, and another has given emphasis on functions of the management plan of the development of the forest.

In answer to 5th question (*i.e.* How the development works of the forest is done?) about the development works of the forest out of the four ROs, everybody has made individual comments. Such as one of them has mentioned that whether they had got fuel (oil) travel allowance, and residence it is possible to follow management plan with enhance camping system. Another one has mentioned that it is possible of the forest prosperity to materialize the management plan accurately. Rest of the two ROs has mention that if they could follow the direction of management plan, it is possible of forest prosperity. It is very clear that opportunity will be provided to enhance the prosperity of the forest.

In answer to 5th question (*i.e.* How the development works of the forest is done?) the table shows that in regard to the development works of the forest six forest rangers have made different comments. Among them two have said that the development works of the forest is doing according to the regulation and rules. Another one has said that directing through regulation. Among the

six FRS, one has said that the development works of the forest is done by observation. Another one has said that the development works of the forest is done according to regular searching and awarding the people. Only one of them has said that the development works of the forest is done according to the attachment of unusual job for the relevant people except forest.

In answer to 5th question (*i.e.* How the development works of the forest is done?) the table shows that in regard to the development works of the forest four respondents have mentioned that it will protect the pirate. Only two of the total sixteen respondents have not mentioned any comments. And other respondents have made different comments. One has mentioned it will lead accurately. Another one has mentioned that it will control accurately. Another one has mentioned that enhance the camping system. Ultra modern aromatic firearms and overall swift traffic and supply of fuel. One has mentioned that Manage good government trawler, trained driver and trained mechanic and to enhance camping, trained manpower. One has made comment that regular camping and make conscious the people who are related with the Sundarbans to use forest grown property. Another one emphasized on to make budget and camping. Only one has mentioned that it will protect the pirates and control the theft of wood. While another one has mentioned that it will protect the pirate and forecast about the natural disaster.

5.6 Lack of Institutional Capacities

Lack of information and monitoring are the most immediate obstacles in taking up a sensible tiger management plan. The Ministry of Environment and Forestry does not have a wildlife cell. The Forest Department in Khulna does not have Specific responsibility towards information collection relating to wildlife conservation. Lack of direction, lack of trained and experienced staff coupled with lack of logistics and equipment is considered main impediments too information collection.

Comments of the Sundarbans Forest about the strength and weakness:

In reply to 6th question (*i.e.* what are the strength and weakness of present the Sundarbans Forest management system?) in regard to the strength and weakness of present the Sundarbans Forest management three of the total

fifteen forest guards have said that intensive supervision of forest department cannot protect the pirate. Two of them have said that intensive security system, continue camping system in the forest zone are the strength and attack of pirates are the weakness of the present the Sundarbans Forest management system. One has said that the negative aspects are there are no sufficient employee, transport and fuel. Another one has said that the negative aspect is lack of honesty. One has made no comment.

In reply to 6th question (*i.e.* what are the strength and weakness of present the Sundarbans Forest management system?) six of the total twenty-eight forest boat men have made no comment. Three of them have mentioned some weakness of present the Sundarbans forest management system. They have said that intensive supervision of forest department cannot protect the pirate. Another six of them have said that security condition continues camping system in the forest and attack of pirates are the weakness of present the Sundarbans forest management system. Eleven of them have said that strict security in the forest department is positive side. But it cannot protect the pirate. Another two have said that old rifles, old ammunition and firearms, transport-like trawler problem boat in the condition of armless, food, water, and treatment are the weakness of present the Sundarbans forest management system.

The present chapter has presented various programmes undertaken by different governmental and non-governmental organizations in order to develop Environmental Impact Assessment of Development Activities in the Sundarbans in Bangladesh. All these along with the government's policies have created the context for the development the Sundarbans, and how it affects their development have been presented in the following chapter though making necessary analyses and interpretations base on available data.

Chapter 6

ENVIRONMENTAL IMPACT ASSESSMENT OF SUNDARBANS

CHAPTER SIX

Environmental Impact Assessment of the Sundarbans

6.1 Introduction

The EIA of the study area was carried out following the GOB approved EIA Guideline, collection of secondary data should be done through literature review. The multi-disciplinary EIA team should visit the area for intensive consultation with the forest expert and stakeholders. The Sundarbans issues of physical as well as environment should be studied through professional observation of the multi-disciplinary EIA team numbers backed up by feed back from the local people during the field visits. The Sundarbans issues should be taken care through secondary information and field observations. Environmental impact should be carried out to collect information on basis of the may be primary and field survey data.

6.2 Environmental Impact Assessment (EIA) is a formal process used to-

Examine the environmental consequences of proposed development project, programme and policies and suggest relevant management action.

Environmental Impact Assessment (EIA) involves- study of the probable changes in the physical and biological as well as socio-economic environment which may result from the proposed development activity or project and formulating a suitable environment management plan to minimize adverse effects and to enhance positive effects.

EIA is not meant for examining adverse consequences only. It should also look into the possible positive effects of development activities and identify ways of enhancing them by further modifying the project.

6.3 Need for an EIA

Many projects or developmental activities have limited success-

- i. Local people oppose projects that do not benefit them much;
- ii. Projects may also deplete and damage valuable natural resources;
- iii. EIA minimizes adverse impact of project;

- iv. EIA is a tool that helps decision-makers develop better projects;
- v. EIA is not meant to stop projects;

6.4 Definition of Environmental Impact Assessment

Environmental impact assessment (EIA) can be defined as the systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programs, or legislative actions relative to the physical chemical biological, cultural, and socioeconomic components of the total environment. The primary purpose of the EIA process, also called the "NEPA process" is to encourage the consideration of the environment in planning and decision making and to ultimately arrive at actions which are more environmentally compatible. To serve as an example of incorporating environmental and other issues in decision making, the public interest factors considered by the U.S. Army Corps of Engineers in the Clean Water Act Section 404 permit program include con serratation, aesthetics, wetlands, fish and wildlife values, floodplain values, navigation, recreation, water quality, food and fiber production, mineral needs, economics, general environmental concerns, historic properties, flood hazards, land use, shore erosion and accretion, water supply and conservation, energy needs, safety, and property ownership.

Barrett and Therivel have suggested that an ideal EIA system would (1) apply to all projects that are expected to have a significant environmental impact and address all impacts that are expected to be significant; (2) compare alternatives to proposed project (including the possibility of not developing the site), management techniques, and mitigation measures; (3) result in clear EIS which conveys the importance of the likely impacts and their specific characteristics to non-experts as well as experts in the field; (4) include broad public participation and stringent administrative review procedures; (5) be timed so as to provide information for decision making; (6) be enforceable; and (7) include monitoring and feedback procedures.

In the United States, the EIA process was initially perceived to be within the domain of venous federal agencies because the NEPA was primarily directed toward federal actions. However, with the subsequent broadening of definitions relative 10 actions to encompass both permits and undertakings involving

funding the range of institutional and private organizations involved in the preparation of EISs considerably expanded. In addition to federal agencies over 30 states have the equivalent of the NEPA at the state level or other requirements with many of these laws being closely after the EIA requirements of the NEPA? Perhaps the most stringent law is the California Environmental Quality Act. Which requires the preparation of environmental impact reports on both public and private activities? Numerous regional planning organizations, such as councils of government and local municipalities have also implemented EIA type requirements in conjunction with land use planning and zoning considerations.

Practitioners associated with the EIA process include governmental agency personnel at federal, state and local levels engineering planning and environmental consulting firms and private companies that have developed an in house staff capability for the planning and conduction of environmental impact studies. Professionals involved in the EIA process include engineers, planners, biologists' geographers' landscape architects and archaeologists.

6.5 Methodology of Environmental Impact Assessment

Impact may be considered as a result of interaction between the project and the environment. Impacts are essentially changes in the environment. Thus:

Project + environment = change environment

Significance of an impact is depending on:

- i. Number of people affected
- ii. The duration of an effect
- iii. The proportion of a natural resource which is damaged or consumed
- iv. Relationships with the others components of the project or other projects in the region, and
- v. Intensity or severity of the impact.

Several methodologies have been developed for assessing the impacts of development activities on the environment.

These are as follows:

- i. Ad-hoc
- ii. Checklists
- iii. Matrices
- iv. Net works
- v. Overlays
- vi. Environmental index using factor analysis
- vii. Cost\ benefit analysis
- viii. Simulation modeling workshops

6.5.1 Impact Monitoring

- (a) Study of base line data
- (b) Seeing that impacts do not exceed the legal and other specified standards and guidelines
- (c) Providing early warning of potential environmental damage.
- (d) Check compliance with mitigation measures specified in the report and
- (e) It sects impacts and indicators.

6.5.2 Evaluation of BA Process

- (a) Assesses performance of environmental protection programs.
- (b) Complements the environmental monitoring process.
- (c) Draws conclusions from monitoring the data.

6.5.3 Overall Assessment

After the evaluation of effects, during the planning stage assessment can be formulated.

- (a) List of each significant effects with quantification.
- (b) Comparing their relationship with each other.
- (c) Deriving conclusion on overall environmental integrity of the project and on feasible modifications to the project plan.
- (d) Carrying out the present recommended environmental monitoring program as a part of project operation and maintenance.

Numerous techniques and methods have been used in proposed and on going developmental activities on the environment. These methodologies display a variety of frame work, data, format, man power monitoring and time resource requirements. Every EIA study requires various methodologies.

6.6 Methods of Environmental Impact Assessment

A. Ad-hoc Method

There are several methods and techniques available to evaluate the impacts. Ad-hoc method is the simplest method. It can be performed without any training. It merely presents impacts with- out any compression. This will help in case of IEE impacts. This method has the following drawbacks.

- i. It gives no assurance about compliance of all impacts.
- ii. It lacks consistency in analysis.
- iii. It is inherently inefficient as it does not study the impact in detail. Because of these impact drawbacks it is not recommended for detailed EIA. This can be used when no expertise and resources are available.

B. Checklists

These are strong in impact analysis and identification. These are consistent in nature. Impact assessment is an important and fundamental function of an EIA. The simple and descriptive check lists merely identify the possible potential impacts without any rating. Hence this method is more applicable at IEE stage.

The Oregon checklist goes a step further and provides an idea of the nature of impacts by means of the rating of impacts as long term directive. This is also not much useful in detailed elks. Such checklists help in identifying impact and also interpretation and evaluation. The checklist is not useful in identifying diverse impacts. Again there exist different checklist methods The EIA system considers secondary effects which could not be considered by checklist methods. Scaling and weighing of checklists are capable of quantifying the impacts.

i) Significance of Checklist Method

The Checklists serve as a reminder of all possible relationships and impacts out of which a set relevant to specific study may be chosen. Several such checklists have been developed and published as guidelines, However it is always possible that an important local factor may be left out of the generic checklists that appear in EIA manuals.

The checklists help people in responsible positions to become more aware of what they should be looking for when assessing a proposed project.

C. Matrices

Matrices provide the cause effect relationship between various project activities and their impact on environmental components. Matrices provide graphic display of impacts weights assigned to environmental components and consequently impacts with actual guarantee of facts during operation. Aggregation of numerical impacts through suitable transformation function is possible through matrices. Matrices are also strong in identifying impacts unlike checklists since they can also inform higher order effects and interactions. These help in communicating results in an easily understandable format to audience. But these cannot compare the alter natives in a single format. Having set up the activity – component linkages of "suspected impact relationship" it is possible to do some more speculation regarding:

- i. Adverse or beneficial impacts
- ii. Size of the impact (High, moderate or negligible)
- iii. Duration of the impact (short term, long term or continuous or sporadic)
- iv. Nature of the impact (reversible or irreversible)
- v. Present understanding of the impact (*i.e* adequate, not adequate or even impossible)

All the above are basically impact attributes or impact characteristics.

D. Networks

These identify direct and indirect and higher order impacts. These are able to identify and incorporate mitigation and management strategies into planning stages of a project. These are suitable for expressing ecological impacts, but are of lesser utility in considering social, human and aesthetic aspects. This is because weighing and rating are not features of network analysis. Networks usually consider only adverse impacts of the environment and hence decision making in terms of cost benefit of a development project to a region is not amenable to network analysis. Since networks can incorporate several alternatives into their format, the display becomes very large. Networks are

capable of presenting scientific and factual information but provide no evaluation for public participation.

E. Impact Identification Method

The scoping and EIA exercises done previously shall have identified the important issues which remained unresolved at that stage. Taking these findings into account, the EIA should formally identify impacts for detailed assessment. The following methods can be used to identify impacts.

- i. Compile a list of key impacts, such as changes in water quality, wildlife, wildlife habitat, landscape views, social and cultural systems etc of the Sundarbans
- ii. Name all the "source" of impact of the Sundarbans (e.g. Top dying, Shrimp culture, Oil spelling, construction etc. List of possible "receptors" in the environment, (e.g. communities, crops, salinity, migration, etc.) by the surveying the existing environment and the affected of the Sundarbans.

F. Impact Prediction

- i. The purpose of or impact prediction exercise is to estimate the extent of changes and to quantify them as far as practicable.
- ii. Prediction scientifically characterizes the cause and effects of impact and its secondary and synergistic consequences for the environment and the community.
- iii. For prediction we need to use data on physical, biological, socio-economic and anthropological aspects and resort to experimental techniques. In quantifying impacts it may be employ mathematical model, economic models, experiments or expert judgments.
- iv. All prediction techniques, by their nature, involve some degree of uncertainty.

G. Impact evaluation

The prediction would provide us with an idea of the extent of changes in the environment, in quantities or qualitative terms. But then we must see if these changes matter at all. This exercise is called evaluation; and it determines whether they are significant enough to warrant mitigation.

This judgment of significance is based on one or more of the following consideration:

- i. comparison with laws, regulations or accepted standards;
- ii. reference to pre-set criteria such as protected sites, features or species of Sundarbans;
- iii. acceptability to local community of the study area;
- iv. severity of the impact (reversible or irreversible);
- v. prevalence (eventual extent of impact);
- vi. duration and frequency of the activity causing adverse impact;
- vii. risk (probability of serious environmental effects of the Sundarbans);
- viii. importance (local , regional, national , international, truism, world heritage);
- ix. mitigation (are solutions available to prevent or reduce severity of adverse impact to acceptable level)

6.7 Mitigation Measures

There is a need to have a clear idea of the Sundarbans and surrounding area. The elements for which mitigation measure were taken:

- i. Sitting
- ii. Layout designs
- iii. Resource substitutions
- iv. Resource minimization
- v. Process
- vi. Access control
- vii. Monitoring hazards etc.

A wide range of measures are available to prevent, reduce, remedy on compensate for each of the adverse impacts evaluated as significant possible mitigation measures include:

- i. Changing processes of the development activities.
- ii. Changing pattern of shrimp culture.
- iii. Introducing oil spelling pollution control in the in and around of the Sundarbans sea.
- iv. Personal training, public education and social services.
- v. Landscaping, forestation, green belt.

To reduce adverse impacts there is a need to develop an action plan. This may include, besides technical measures the following:

- i. Integrated management scheme of the Sundarbans
- ii. Monitoring plan
- iii. Emergency response plan

6.8 Review of an EIA Report

The purpose of the review of the EIA report decision in respect of the following:
Whether the site clearance could be given to the project in the case of the orange and red categories of the Sundarbans the respondents (physical, biological and socio-economic), and if so;

Why conditions may be prescribed for compliance by the project proponents during design, construction and operation.

These following questions may lead to an effective review of EIA study:

- i. Are the beneficial and adverse impacts properly explained?
- ii. What are the risks (probability of occurrence and magnitude of consequences) of adverse impacts; are they properly evaluated.
- iii. What impacts would the developmental project have on environmentally sensitive areas, endangered species and their habitats, and on recreational and aesthetic areas?
- iv. Are any of the alternative sites suggested in the report, considered suitable from an environmental angle, though it may increase the cost of the project?
- v. Which are the unavoidable adverse impact.
- vi. Are the concerns expressed by likely affected people genuine, and has the project.
- vii. EIA addressed these concerns adequately.
- viii. Are the mitigation measure, as proposed, reasonably feasible and are they likely to be implemented.

6.9 Environmental Impacts Analysis Method

This part assesses the pattern of the Sundarbans Forest impact on Environment of the Sundarbans in the study area. The pre and post of the Sundarbans data of the Forest at the point of Forest Station has been used for the analysis of the environmental impacts and the pre-post Forest changes have been examined for finding environmental impacts of the Sundarbans in

Bangladesh portion. These observed data have been represented on the statistical method to make a table and calculated mean, minimum, maximum and percentage for the analyzed and interpretation the empirical relationship of the study area.

6.10 Environmental Impact Assessment

Environmental Impact Assessment (EIA) is a formal process which was used to examine the environmental consequences of proposed development projects, programme and policies and suggests relevant management actions of the study area (LGED 1997). The EIA method proposed by LGED (1992) has been used for the assessment of the identified impacts of the research work. The methodology was based on Environmental Evaluation System (EES) developed by Battle Columbus Laboratory in the United States, and simplified and adopted by LGED for Bangladesh context. Due to the absence of database in Bangladesh, the existing environmental condition was used as the reference level. The positive and negative changes in the environmental conditions, resulting from the undergoing activities *i.e.* Sundarbans Channel parameter of the Forest had been noticed. As the Sundarbans of the Forest and its Impact on Environment have already been introduced, the present impacts, positive or negative, have been indicated the present reference values and require comparing with the previous values.

6.11 Quantification of Environmental Impacts

The beneficial and adverse changes in environmental parameters resulting from the introduction of the Sundarbans parameters of the forest had been expressed in both qualitative and quantitative terms. Both types of impacts had been plotted in 11-point scale (-5 to 0 to + 5) LGED (1992) to quantify the environmental alteration. Figure 6.1 shows the correlation between qualitative statement and proposed quantitative values of environmental changes resulting from the intervention of the Sundarbans Characteristics of the Forest (Bangladesh portion) and its Impact on Environment in the study area.

Therefore, the environmental aspects are a multidisciplinary approach an ELA team comprising of several members from concerned fields usually analyze and determine the magnitude of the impacts. But in this research work, the researcher himself with consultation with his research supervisor had to

develop logic for each for each environmental parameter to determine the magnitude of the impacts to fit and plot in his 11-point scale

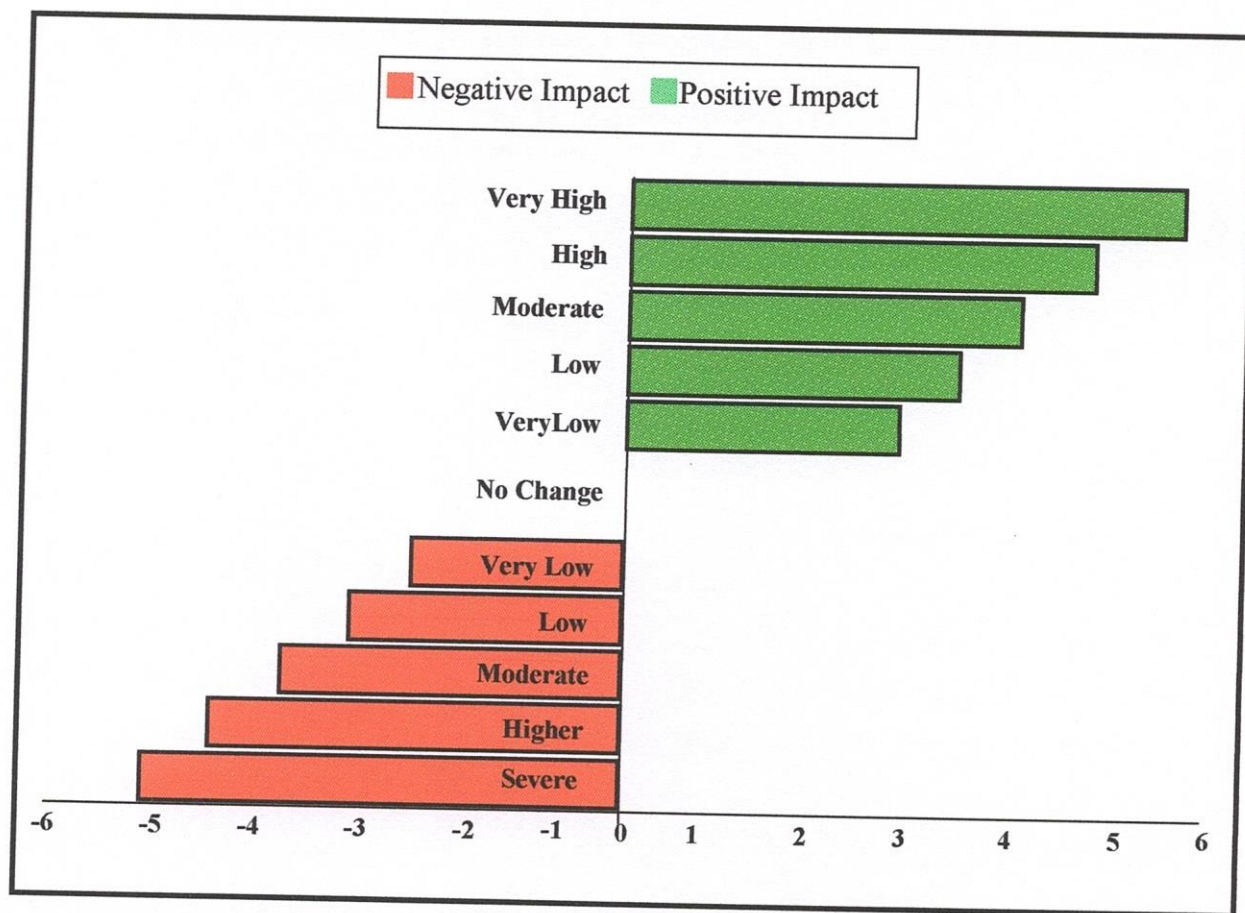


Figure 6.1

Quantification of Environmental Impacts

6.12 Enhancement Measures Impacts of the Sundarbans in the Study Area

i) EIA Team

Ten Forest Experts (FE), two Divisional Forest Officers (DFO), four Range Officers (RO), six Forest Rangers (FR), sixteen Deputy Forest Rangers (DFR), eleven Foresters (F), fifteen Forest Guards (FG), and twenty eight Forest Boat Men (FBM) of the Sundarbans forest were interviewed to know causes of forest degradation, weakness of present management and their mitigation in sustainable way.

Thirty-three Forest Wood Cutters (FWC), thirty- five Forest Bawali (FB), thirty Forest Mawali (FM) and thirty five Local People (LP) of the Sundarbans forest around the Sundarbans were interviewed to get the peoples.

6.13 Environmental Baseline in the Study Area

The environmental baseline condition in the area was prepared based of the Sundarbans investigations, field visits, and consultation with local people. The baseline should include description of Shrimp culture, top dying, wood extraction, and oil spilling from super tank and ship and socio-economic condition including identification of problems in respect of these resources. A series of field visits should be carried in the study area. The main objective of these visits is to identify the Important Environmental and Social Components IECs through a scoping process including scoping sessions. The visits should also aim at discussion with local people as suggested in the EIA guidelines about the Sundarbans.

6.13.1 Baseline information

Baseline information includes physico- Chemical, bio-logical and human aspect of the Sundarbans area-

- i) physico-Chemical: This includes information on land, soil quality, surface water, ground water etc.
- ii) Biological information includes on terrestrial and aquatic flora and fauna populations and their communities;
- iii) Human aspects information includes healthy and safety, socio-economics etc.

6.13.2 Baseline Information collections

- i) Reviewing all available secondary material on the Sundarbans and environmental settling of the Sundarbans.
- ii) Performing field reconnaissance of the Sundarbans.

Additional data were obtained through primary sources which included:

- i) Field monitoring
- ii) Field survey

i) Primary data collections

- i) Field work: Data were collected by adopting standard of sampling and analysis in accordance with the procedure carried out by agencies.
- ii) Informal interviews: to assess the Sundarbans situation informal interviews made with relevant person and communities which are affected by developmental activities of the Sundarbans.
- iii) Site visits: Site visit was helped to identify many of the important environmental components like to be affected by the developmental activities of the Sundarbans. These include soil characteristics, land degradation, land type, vegetation, water regime, quality of life etc.

6.14 Environmental and Social Impact Assessment of the Sundarbans Area

Information on the proposed interventions was collected from the feasibility study team. An environmental impact of the proposed interventions on the IECs was assessed through several sets of activities. The future-without-project (FWOP) condition was generated through trend analysis and consultation with the local people. This should reflect conditions of IECs in the absence of any project intervention. Changes of the Sundarbans expected to be brought about due to project interventions was assessed to generate the future-with-project (FWIP) condition. The distinction between the Forest conditions was presented as the environmental and social impacts of the project. This includes both positive and negative impacts, which was considered in the preparation of the environmental management plan.

Table 6.1
Environmental Impact Assessment (EIA) of Developmental Activities
Impacts on Sundarbans

Developmental Activities	Positive			Negative		
	Low	Medium	Highest	Low	Medium	Highest
Shrimp Culture	—	—	—	—	Medium	—
Top Dying	—	—	—	—	Medium	—
Wood Extraction	—	—	—	—	Medium	—
Oil Spilling of Ship	—	—	—	Low	—	—

6.15 Environmental Management Plan of the Sundarbans Area

The environmental management plan (EMP) was prepared suggesting mitigation measures for minimizing the effect of the negative impacts, enhancement measures for increasing the benefit of the positive impacts, compensation plan for compensating the negative impacts that can not be mitigated and an environmental monitoring plan for monitoring changes taking place through implementation of the study area. Cost estimate for implementing the EMP should also be suggested for addition in the study area of the Sundarbans condition.

An Environmental Management plan (EMP) is implementation plan for mitigation, protection and enhancement measures which are recommended in the EIA.

The EMP should ensure that resource are used with minimum efficiency top dying mitigation, sustainable shrimp culture, selected tree extraction, biodiversity protection and recovered to maximum extent possible:

- i) Reduction of top dying through the use of sustainable development;
- ii) The strategy for minimizing shrimp culture;
- iii) Etc.

6.16 Mitigation plan in the Study Area

Measures aimed at minimizing the impact of the negative impacts was suggested in the mitigation plan. The negative impacts of the proposed interventions, assessed at the environmental and social impact assessment stage, was picked up for inclusion in the mitigation plan. The mitigation measures are those, which are prescribed to reduce for each of the adverse impact as significant. The following mitigation measures have been proposed for the sustainable and eco-friendly the Sundarbans Bangladesh portion in the study area (Table 6.2).

Table 6.2

Adverse Environmental Impacts of Shrimp culture in the Sundarbans and their Mitigation Measures

Actions Affecting Environment	Potential Environmental Impact	Recommended Mitigation Measures
1. Shrimp culture	i. Changed topography ii. Submergence of adjacent homestead and garden areas iii. Contamination of ponds	i. To be used least amount of top soil for dike construction ii. To be Made dikes wide enough to practice agriculture iii. To be taken protective measures to prevent entry of saline water
2. Fry collection	i. Reduction of fish biodiversity	i. To be regulated wild fry collection from natural sources ii. To be motivated only catching of mother shrimp and target fries. iii. To be established hatcheries for Bagda shrimp culture in the Sundarbans areas iv. To be ensured quality management of hatchery process v. Personal training, public education and social services
3. Loss of agricultural land for shrimp culture	i. Reduction agricultural production ii. Reduced employment in agriculture iii. Changed livelihood some of a farmers' group iv. Permanent or temporary migration of some people	i. To be implemented "donation" for shrimp culture ii. To be used improved Traditional Method of shrimp culture iii. To be rehabilitated the affected people iv. To be cultivated salt tolerant crops v. Schemes for green belt around the affected areas of the Sundarbans

Table 6.3

Adverse Environmental Impacts of Top dying in the Sundarbans and their Mitigation Measures

Actions Affecting Environment	Potential Environmental Impact	Recommended Mitigation Measures
2. Top dying	i. Top dying of Sundri trees ii. Root rot and resultant die back of Sundri trees iii. Sad and heart rot associated with top dying Sundri trees iv. Massive mortality of Sundri trees due to change in site condition	1. To be elevated freshwater forest 2. To be elevated moderately saltwater forest

Table 6.4

Adverse Environmental Impacts of Wood extraction in the Sundarbans and their Mitigation Measures

Actions Affecting Environment	Potential Environmental Impact	Recommended Mitigation Measures
3. Wood extraction	i. Destruction of habitats of flora and fauna ii. Loss of biodiversity	1. To be protected cutting of trees massively 2. Selected trees to be cut

Table 6.5
Adverse Environmental Impacts of oil spilling from ship in the
Sundarbans and their Mitigation Measures

Actions Affecting Environment	Potential Environmental Impact	Recommended Mitigation Measures
4. oil spilling from ship	1. Water became oily. 2. Shrimps and other fishes could not live safely in oily water. 3. The water areas of the Sundarbans became hazard due to oil spilling from ship	1. To be protected from the oil bearer ship in the Sundarbans areas

6.17 Enhancement Plan in the Sundarbans

Measures aimed at increasing the benefit of the positive impacts of the proposed interventions was suggested in the enhancement plan. The positive impacts, assessed at the environmental and social impact assessment stage, should be picked up for the enhancement plan. The following enhancement measures have been proposed for the sustainable and eco-friendly the Sundarbans (Bangladesh portion) and its impact on Environment in the study area.

6.18 Compensation Plan

Negative impacts for which mitigation measures can not be suggested should be picked up for the compensation plan that should indicate monetary compensation to be done the Sundarbans area.

6.19 Monitoring Plan

Monitoring plan should consider the important environmental, the Sundarbans components likely to be impacted by the Forest. The monitoring plan should include suggestions on data to be collected, processed, analyzed and

interpreted to detect changes taking place in the impacted area. Location and frequency of data collection on each indicator along with institutional arrangement of environmental monitoring should be suggested in the monitoring plan. The following monitoring measures have been proposed for the sustainable and eco-friendly the Sundarbans (Bangladesh portion) and its impact on Environment in the study area.

Table 6.6
Monitoring Plan of the Sundarbans in the Study Area

Monitoring Parameters	Monitoring Schedule
1. Water Salinity	Test the water Salinity every month
2. Soil Salinity	Test the Soil Salinity every six month
3. Top Dying	Test the Top Dying every year
4. Oil Pulsation	Test the Oil pulsation every month
5. Fish Biodiversity	Test the Fish Biodiversity every month

6.20 Detailed Impact Assessment

Ten Forest Experts (FE), two Divisional Forest Officers (DFO), four Range Officers (RO), six Forest Rangers (FR), sixteen Deputy Forest Rangers (DFR), eleven Foresters (F), fifteen Forest Guards (FG), and twenty eight Forest Boat Men (FBM) of the Sundarbans forest were interviewed to know causes of forest degradation, weakness of present management and their mitigation in sustainable way.

Thirty-three Forest Wood Cutters (FWC), thirty- five Forest Bawali (FB), thirty Forest Mawali (FM) and thirty five Local People (LP) of the Sundarbans forest around the Sundarbans were interviewed to get the peoples.

6.20.1 Forest Expert opinion of the Sundarbans Forest

Ten Forest Experts (FE) of the Sundarbans Forest to collect information about Environmental Impact Assessment of Development Activities in the Sundarbans

In answer to 7th question (*i.e.* what are the different types of expenses incurred for the forest?) most of the Forest Experts (FE) have mentioned the name of the following transportation like-ship or boat and/or vessels, which are, incurred expenses of the forest, in general.

Especially, out of ten Forest Experts have mentioned the different types of expenses, which incurred for the forest such as vessels for traveling by water and fuel (oil). And only one has mentioned that communication of ship or boat river way and communication of vessels by river.

In answer to 8th question (*i.e.* what is your idea about the role of the forest in our economy?) about the role of the forest in general, and the Sundarbans in particular, in our economy each of the ten Forest Expert (FE) have mentioned different types of contributions. Mr. Altaf Hossion has said that the Sundarbans protects the people from cyclone spate, by creating lifebelt with fulfill the demand of forest grown wealth of the country. While, Dr.Md.Ashraful Alam has mentioned that the contribution of forest is almost 2% in GDP. Accurate management and by buying more forest materials and increasing revenue income, it is possible to develop the socio-economic conditions of the people of our country as well as the people of the adjacent areas of the Sundarbans. One of the rest two Forest Experts has mentioned that create post for the people by collecting and using forest grown property. And the last Forest Expert has said that prosper of the people by collecting forest grown property and creating job in the forest. From the above-mentioned information, it is notable that our forest can play a vital pivotal role in our economy, if the prospects are implemented.

In reply to 10th question (*i.e.* How far the Bawali and Mawali are benefited by the forest?) about the Bawali and Mawali beneficiary by the forest out of total ten Forest Expert (FE), one has given no answer. And rest of them has given different answer. One of the three has made comments that the Bawali and Mawali live on from received earning. Another Forest Expert has made comments that woodcutter and Mawali pay government revenue and their collected materials sell in the market and they lead their life. The last Forest Expert has said that they live on/ lead the life only. **(Appendix-6.2.1)**

In reply to 11th question (*i.e.* what about the suggestion for sustainable development of the Sundarbans Forests?) about the suggestion for sustainable development of the Sundarbans Forests out of ten Forest Experts (FE), two of them have given there is no alliance at all to get up in the new building. Rest of the eight has said that if management materials are implemented according to the plan to ensure sustainable management and also it is possible to sustainable management.

6.20.2 Divisional Forest Officers opinion of the Sundarbans Forest

Reciting two divisional Forest Officers (DFO) of the Sundarbans Forest to collect information about Environmental Impact Assessment of Development Activities in the Sundarbans

In response to 7th question (*i.e.* what are different types of expenses incurred for the forest?) both the DFO have mentioned that water vehicles and fuel oil are the expenses incurred for the forest.

In answer to 8th question (*i.e.* What is your idea about the role of the forest in our economy?) out of the two DFO, one has told about the role of the forest in our economy is to same the human settlement from the cyclone and water tidal, to create employment opportunity and to supply of forest product in the market. And another officer has told that the forest plays a vital role in our economy such as, create employment for the different kind of people, develop socio-economic condition including collecting of forest goods according to management plan.

In reply to 10th question (*i.e.* How far the Bawali and Mawali are benefited by the forest?) both of the two DFO have told that the forest benefits the Bawali and Mawali by earning their livelihood.

To make 11th question (*i.e.* Please state the yearly earnings from the forest?) about the yearly income from the forest, one DFO has replied that in the fiscal year 2009-2010 the income was Tk. 30465873 of the Sundarbans West and another FFO has replied that in the FY 20009-10 the income was Tk. 36700000 of the Sundarbans East.

In answer to 12th question (*i.e.* What might be the yearly revenue expenses for forest management?) when the two DFO was asked about the yearly revenue expenses for the forest management, one of them has told that the budget allotment of the year 2009-10 was Tk. 45870430. And another FFO has told that the budget allotment of the same year was Tk. 34400000.

To make 13th question (*i.e.* what is the organization chart of its management?) about the organization chart of its management, two DFO have mentioned the order as such -divisional forest officer-range officer-revenue station-patrol camp. But another DFO has mentioned the order extendedly selling depot of the Sundarbans east. **(Appendix-6.2.2)**

In answer to 14th question (*i.e.* what about the suggestion for sustainable development of the Sundarbans Forest?) was about the suggestion for the sustainable development of the Sundarbans forests. And in answer to the question one of them has made some comments such as management plan is prepared by the stock assessment of total resources and main annual increment. And another DFO has given suggestion that sustainable management will be ensured if the forest resources and functions are directed according to the management plans and directions.

6.20.3 Range Officers comments of the Sundarbans Forest

In answer to 7th question (*i.e.* what are the different types of expenses incurred for the forest?) most of the Range Officers have mentioned the name of the following transportation like-ship or boat and/or vessels, which are, incurred expenses of the forest, in general. Especially, out of four three-range officers have mentioned the different types of expenses, which incurred for the forest such as vessels for traveling by water and fuel (oil). And only one has mentioned that communication of ship or boat river way and communication of vessels by river.

To answer to 8th question (*i.e.* what is your idea about the role of the forest in our economy?) about the role of the forest in general and the Sundarbans in particular, in our economy each of the four Range Officers has

mentioned different types of contributions. Bipul Krishno Das, has said that the Sundarbans protects the people from cyclone spate, by creating silterbelt with fulfill the demand of forest grown wealth of the country. While, Md. Shabuddin has mentioned that the contribution of forest is almost 2% in GDP. Accurate management and by buying more forest materials and increasing revenue income, it is possible to develop the socio-economic conditions of the people our country as well as the people of the adjacent areas of the Sundarbans. One of the rest two range officers has mentioned that create post for the people by collecting and using forest grown property. And the last Range Officer has said that prosper of the people by collecting forest grown property and creating job in the forest. From the above-mentioned information, it is notable that our forest can play a vital pivotal role in our economy, if the prospects are implemented.

In reply to 10th question (*i.e.* How for the Bawali and Mawali are benefited by the forest?) about the Bawali and Mawali beneficiary by the forest out of total four range officers, one has given no answer. And rest of them has given different answer. One of the three has made comments that the Bawali and Mawali live on from received earning. Another RO has made comments that woodcutter and Mawali pay government revenue and their collected materials sell in the market and they lead their life. The last Range Officers has said that they live on/ lead the life only. **(Appendix-6.2.3)**

In answer to 11th question (*i.e.* Please state the yearly earnings from the forest?) about the yearly earning from the forest two of the Range Officers out of four have given no answer. But the rest of the Range Officers have made the following comments. One of them has said that the yearly income from the forest is between three to four crore of taka. Another RO has made comment that in Khulna range revenue income was around Tk. 15100000 in the 2009-2010 fiscal years.

In reply to 14th question (*i.e.* what about the suggestion for sustainable development of the Sundarbans Forests?) about the suggestion for sustainable development of the Sundarbans Forests out of four Range Officers, two of them have given no answer. Rest of the two has said that if management

materials are implemented according to the plan, it will ensure sustainable management and also it is possible to sustainable management.

6.20.4 Forest Rangers comments of the Sundarbans

In answer to 7th question (*i.e.* what are the different types of expenses incurred for the forest?) the table shows that six forest rangers have mentioned almost same types of expenses incurred for the forest. Half of them have said that vehicles, fuel oil is the different types of expenses incurred for the forest. Another one has said that water vehicles and fuel oil are the main expenditure for the forest. Only one has emphasized one man power and one has said that the expenditure is abundant.

In answer to 8th question (*i.e.* what is your idea about the role of the forest in our economy?) the above table we can say that out of six, three of the forest rangers have said that the role of the forest in our economy is enough. Another one has said that the role of the forest in our economy is very important. Rest of the two, one has mentioned details description about the role of the forest in our economy. He has said that saving people from cyclone and flood and enhancing their employment opportunity, revenue increases from wood and forest assets, revenue increasing in tourism management and maintaining natural balance. On the other hand, one has made brief comment. He has said that there is some role of the forest in our economy.

In answer to 10th question (*i.e.* How far the Bawali and Mawali are benefited by the forest?) the table shows that in response to the question about the beneficiary for the Bawali and Mawali by the forest five of the six forest rangers have made somehow same comments Four of the them have said that the benefication of the Bawali and Mawali by forest is enough to lead their life. One has said that the benefication of the Bawali and Mawali by the forest is carrying their life. Another one said that it is enough to maintaining income

In answer to 11th question (*i.e.* Please state the yearly earnings from the forest?) the table indicates that in response to the question about the yearly earnings from the forest all of the forest rangers have kept silent. In other

words, they have not given any answer. So it can be said here that they have no knowledge about the earnings from the forest per year.

In answer to 12th question (*i.e.* what might be the yearly revenue expenses for forest management?) the table shows that in response to the question about the yearly revenue expenses for forest management all of the forest rangers have made no comments. In this type of answer express the inefficiency of the officers, in general, and the forest rangers in particular.

In answer to 13th question (*i.e.* what is the organization chart of its management?) from the table we have got a clear picture about the organization chart of its management. In response to the question, three fourths of forest rangers have made same answer. And they have said that the organization chart of its management is the organization of chart of the Sundarbans. Range office → station office → camp. Another one has said that the organization chart of its management is divisional range officer-station-camp. Only one of the six forest rangers has made no comments (**Appendix-6.2.4**).

In answer to 14th question (*i.e.* what about the suggestion for sustainable development of the Sundarban Forests?) the table indicates that in answer to the question about the suggestion for the sustainable development of the Sundarbans Forests all of the forest rangers have made no comments. It is noted here that the forest rangers are very much inefficient in this field.

6.20.5 Deputy Ranger's opinion of the Sundarbans Forest

In answer to 7th question (*i.e.* what are the different types of expenses incurred for the forest?) the above table we can see that in respect of the different types of expenses incurred for the forest, majority (eleven) of the deputy rangers have mentioned that fuel oil is the main expense, which is incurred for the forest. Another two deputy rangers have mentioned that fuel, transportation and manpower are the expenses, which are incurred for the forest. Only one has mentioned that transportation, communication and fuel are the expenses. Another one has mentioned that the expenses incurred for the forest is build

house create forest orchard/garden. Only one has mentioned an exception issue like there is no expenditure expects salary of the government employees.

In answer to 8th question (*i.e.* what is your idea about the role of the forest in our economy?) the above table we can show that in response to the question about the role of the forest in our economy that half *i.e.* eight of the total sixteen deputy rangers have said that the role of the forest in our economy is sufficient. Two of the rest deputy rangers have said that the role of the forest in our economy is good. Another two of the deputy rangers have said that the role of the forest in our economy is enough. The rest four-deputy rangers have made different comments. One has said that forest property has a great role in our economic prosperity. Another one has said that roles of forest are highly co-related with economic prosperity. One has made an exceptional comment; he has said that forest plays many vital roles from our childhood to grave. One of them has mentioned detail comments about the role of the forest in our economy. He has said that forest is the local based service centre for the economic prosperity. Forest fulfills all kinds of essential demand to the people. Man can get the supplies of oxygen and all things from forest, which need from his birth to death. In general sense, forest plays a pivotal role on all spheres of our life and economic life as well.

In response to 10th question (*i.e.* How far the Bawali and Mawali are benefited by the Forest?) about the beneficiary of the Bawali and Mawali are got by the forest, twelve of the total *i.e.* sixteen deputy rangers have said that wood cutters and Mawali get benefit from forest to lead their life. Rest of the two Deputy rangers have said that they are benefited a lot and got enough benefit but it is not possible to ensure sufficient security because godfathers help the pirates.

In answer to 11th question (*i.e.* please state the yearly earnings from the forest?) the table shows that in response to the question about the yearly earnings from the forest majority *i.e.* fourteen deputy rangers out of sixteen have said nothing. Rest of the two one has said that the yearly earnings from the forest is around one crore taka and another one has said that the yearly earnings from the forest is around one and half crore taka.

In answer to 12th question (*i.e.* what might be the yearly revenue expenses for forest management?) about the yearly revenue expenses for forest management out of sixteen Deputy Ranger's majority *i.e.* fifteen have said nothing in their reply. Only one Deputy Ranger has said that the revenue expenses for forest management are around Tk. 500000-600000 per year.

In answer to 13th question (*i.e.* what is the organization chart of its management?) the above table it is shown that in response to the question about the organization chart of its management most of the Deputy Rangers have said that the organization of chart of the Sundarbans Range office → Station office → Camp. And rest of the four Deputy Rangers has said nothing about the organization chart of its management.

In answer to 14th question (*i.e.* what about the suggestion for sustainable development of the Sundarbans Forest?) The table shows that in reply to the question about the suggestion for sustainable development of the Sundarbans forest total sixteen Deputy Rangers have made their comments. Among them only four have suggested that if the management is done according to rules it will be benefited. Another only three Deputy Rangers have suggested that it will need a sustainable management. Five of them have made no comments. One has said that it should be introduced new management plan and cut trees by selection. Another one has said that we should cut the tree by selecting and a proper management of other properties. Between of the rest two one has said that there is no alliance at all to get up in the new building and another has said that protection of the pirates attack, protest of tiger attack protect wood and other forest grown materials from smugglers(**Appendix-6.2.5**).

6.20.6 Foresters opinion of the Sundarbans

In answer to 1st question (*i.e.* Age) the table shows that among the eleven foresters around half *i.e.* five are between the age group 50-52 years. Three of them are between the age group 40-49 years. Two of them are between the age group 25-28 years. Only one of them is aged at 34 years. It is noted here that the foresters are in various age groups.

In answer to 3rd question (*i.e.* How can overcome these problems?) the table shows that in response to the question about overcome the problems about the causes of forest degradation and biodiversity reduction total of eleven foresters, most of them *i.e.* eight have said that these problems can overcome naturally. Other three have made different comments. One of them has said that to over come these problems it is necessary that it will be conscious of the people about the law of increase the number of employee, another one has said that it can remove through supervise other problems. Only one has made details comments; he has said that it is necessary to make boundary of the forest, make profession of the local people of the forest zone, and make consciousness of the people about the importance of forest grown property.

In answer to 4th question (*i.e.* what types of plants, animals and birds species are declining? please specify the causes and how can protect then) the table shows that in response to the question about what types of plants, animals and birds species are declining, out of eleven foresters, seven of them have mentioned the name of Sundry tree. Two of them have mentioned the name of Sundry and different birds. Rest of two have mentioned various species of plants, animals and birds such one has mentioned Sundry, tiger, crocodile, modontak, stark, saltiness of water and illegally bird hunting, another one has mentioned that tiger, crocodile and different species of deer, Modontak, because destruction of the residence of wild life and life and illegally hunted, they will be protected by creating fearless forest.

In answer to 5th question (*i.e.* Do you have enough manpower and logistic support to protect the Sundarbans Forest? If no, Please specify) the table shows that in respect of the question about being have enough manpower and logistic support to protect the Sundarbans Forest. All of the foresters, which are eleven in numbers, have claimed that there are no enough manpower and other logistic support to protect the Sundarbans forest. They have specified they have mentioned manpower, logistic support, speedboat, trawler/launch, car (jeep), fuel oil, and safe office space, wireless. Safe drinking water etc. is needed for conservation of Sunday.

In answer to 6th question (*i.e.* what are the strength and weakness of present Sundarbans Forest management system?) the table shows that regarding to the strength and weakness of present the Sundarbans Forest Management System, out of eleven Foresters, eight have pointed out that the strength of the forest is intensive super vision and the weakness as follows the forest department does not control the pirates. Another one has pointed out that there are need strong vessels, and fuel oil and there are crisis of pure water and proper treatment. Only one of them has pointed out the strength as follows-the positive aspects are reduction of political impact on it and it has been supplied some modern firearms. One of them has made no comments.

In answer to 7th question (*i.e.* what types of plantation do you suggest to restore the forest coverage in degraded area?) the Table shows that in reply to the question about the types of plantation to restore the forest coverage in degraded area, eight of the total Foresters have said that plantation of new trees. One of them has said that Rain tree. Koiai, Babla, Chambul, Akashmoni etc. are needed to restore the forest coverage in degraded area. Only one has made no comment. Another one has said that Shirish, Mehgoni; Korai, Chambul and Babla etc. are needed to restore the forest coverage in degraded area.

In answer to 8th question (*i.e.* Do you want to involve local people in plantation programme of degraded area? What will be the sharing system?)The table we see that while the foresters are asked whether they want to involve local people in plantation programme of degraded area they all have made no comment.

In answer to 9th question (*i.e.* How can you make the natural resource collection sustainable?) the table shows that in reply to the question about the procedure to make the natural resource collection sustainable nine of total eleven foresters have mentioned that if we cut the trees by selection we can make the natural resource collection sustainable. One has said that we should maintain the rules. Another one has said that through selection-cum-improvement system.

In answer to 10th question (*i.e.* how many tourists enter into the Sundarbans per year? Are these numbers adequate? If, not, Why?) The table we see that in answer to the question that how many tourists are entered into the Sundarbans per year and are these numbers adequate, nine of the total foresters have said the number is adequate though they have not mentioned any specific number. Only one has mentioned that number and said 28-31 thousand, it is not enough, this sector does not improve because, increases of revenue and increases of hire of transport. Another one has said that the number is unknown (**Appendix-6.2.6**).

In answer to 11th question (*i.e.* what are the main attraction of tourist in the Sundarbans) the table shows from question K that six (54.55%) foresters have said that the main attraction of tourist in the Sundarbans is tiger and deer. Two (18.19%) of them have said that the main attraction of tourist in the Sundarbans is tiger, deer and crocodile. Only one (9.09%) of them has said that the main attraction of tourist in the Sundarbans is tiger, Crocodile monkey and sundry trees etc. Another two (18.19%) of them have said that the main attraction of tourist in the Sundarbans is tiger, deer, crocodile, monkey etc. So, it is obvious, that the main attraction of tourist in the Sundarbans is tiger and deer.

6.20.7 Forest Guards opinion of the Sundarbans

In answer to 1st question (*i.e.* Age years) the table shows the distribution of total guards in the Sundarbans forest according to their ages. Majority of the respondents according to 60% of total belong to 40-50 age group and 26.67% of the total fall in 30-40 age groups followed by age group of 20-30 forming 06.67% of the total. Where as only 06.66% of the total falls into 50-and above age group.

In answer to 3rd question (*i.e.* How can overcome these problems?) about over coming the above problems thirteen (75%) of the fifteen forest guards have said that these problems can over come naturally. Only one (1.50%) has said nothing in reply to the question. Another one has made

details comments, and has said that boundary of the forest make profession of the local people of the forest zone and makes consciousness of the people about the importance of forest grown property to overcome the problem.

In reply to 4th question (*i.e.* what types of plants, animals and birds species are declining? Please specify the causes and how can protect them) about the various types of plants, animals and birds species are declining, seven of the total fifteen forest guards have mentioned that Sundry, Gewa, crab etc. trees are declining due to the saltiness of water. Another one has said that as a preventive measure we should reduce minimum guest birds. Only one has made details comments. He has said that tiger, deer, crocodile and various species of bird and fish, are declining because of destruction of the residence and hunting them.

In reply to 7th question (*i.e.* what types of plantation do you suggest to restore the forest coverage in degraded area?) about plantation of various plants to restore the forest coverage in degraded area five of the fifteen forest guards have said that new tree plantation is necessary. Another three have specifically mentioned rain tree, Mehogoni, Akashmoni; Sundari, Kewra, Poshari, Bine etc. are needed to restore the forest coverage in degraded area.

In reply to 8th question (*i.e.* Do you want to involve local people in plantation programmed of degraded area? what will be the sharing system) about involvement of local people in plantation programmed of degraded area all of the forest guards have given negative answer. And in response to the sharing system they have made no comments.

In reply to 9th question (*i.e.* How can you make the natural resource collection sustainable?) about making the natural resource collection sustainable thirteen forest guards have said if the trees cut by selection. Another two have made no comments.

In reply to 10th question (*i.e.* how many tourists enter into the Sundarbans per year? Are these numbers adequate? If not, why?) Such as how many tourists enter into the Sundarbans per year. There have said that they have not known object numbers. They have added that there are need more tourists to improve

our economy. Two of them have said that the number is sufficient, though have not mentioned any specific number. One has said that there is no sufficient management for the tourists. Another one has said that the number is around 1000-15000 people, but it is not sufficient. Though one has not mentioned adjacent number but he has pointed out the causes and said there are no good trawler rest house and the management of car parking and repair of jetty (Appendix-6.2.7).

In reply to 11th question (*i.e.* what are the main attraction of tourist in the Sundarbans) about the main attraction of tourists in the Sundarbans all of the forest guards have mentioned some trees and animals, such as tiger, deer, crocodile, monkey, bird chital etc and tree natural beauty as well.

6.20.8 Forest Boat Men opinion of the Sundarbans

In reply to 1st question (*i.e.* Age (years)) about the age of the forest boatmen. Shows the distribution of total boatmen in the Sundarbans forest according to their age. Majority of the respondents according to 42.86% of total belong to 40-50 age group and 28.57% of the total fall into 30-40 age group followed by age group of 50 and above forming 25% of the total. Whereas, only 03.57% of the total fall into 20-30 age groups.

In reply to 3rd question (*i.e.* How can overcome these problems?) to overcome these above problems eight of the total twenty eight forest boat men have made no comment. Another eleven have said that these problems can be solved naturally. Only six of total twenty eight forest boat men have made different and details comment in reply to the question about the solution of the problems mentioned above. One has said that it will be reduced illegal feelings. Another one has said that more guard will be recruited with small vessels of wood engines. Last one has said that by supplying fuel oil and transport, and makes people conscious by advertisement through T.V. and radio

In reply to 4th question (*i.e.* what types of plants, animals and birds species are declining? Please specify the cause and how can protect them)

about what types of plants animals and bird's species are declining. Around all of them have said that sundry trees, poshuur, dhuldol, tiger, deer, monkey, kakra, modontak, kite, crocodile, struck, river gull, and some other species of bird are declining. Majority of them have mentioned the cause as natural. They have made comments to protect the declining causes reduce the crisis of food, protect the illegal hunting, make mass-conscious ness, increase food supply and over all stop- illegal entry. Only one has mentioned that the condition of treatment must increase.

In reply to 5th question (*i.e.* Do you have enough manpower and logistic support to protect the Sundarbans Forest? If no, please specify) about manpower and logistic support to protect the Sundarbans forest, all the forest boatmen have made same comments. They have said that manpower, logistic support, speed boat, trawler/launch, car/jeep, wire-less safe office space, safe drinking water supply they have not meant that manpower and logistic support are not enough and sufficient. So the above specific elements are urgently needed to protect the Sundarbans forest.

In reply to 7th question (*i.e.* what types of plantation do you suggest to restore the forest coverage in degraded area?) some forest boat men have made comments and mentioned specific names of tree and other answered in general. Nine of the total twenty eight FBM have said that new tree plantation is needed to restore the forest coverage in degraded area. Four of them have mentioned that plantation of Bine, Kewra, Poshur, Kakra, Goran, Coconut, Kodom, Rain-tree, Shishu, Babla, Korai, Mehgoni, Hill Maragos tree etc. are needed to restore the forest coverage in degraded area.

In response to 8th question (*i.e.* do you want to involve local people in plantation programmed of degraded area? What will be the sharing system?) All the twenty eight FBM have made comments that we do not want to involve local people in plantation programmed of degraded area. And in the sharing system they have made no comments.

In reply to 9th question (*i.e.* How can you make the natural resource collection sustainable?) ten of them have said that to make the natural resource

collection sustainable if cut by selection fourteen of them have said that by collecting accurately we can make the natural resource collection sustainable. One has said that to make the natural resource collection sustainable. One has said to make the natural resource collection sustainable, government law would be strict. Another one has said that to make the natural resource collection sustainable, we should inform and make conscious the Bawali and Mawali to collect accurately. And only one has emphasized on management system and said by proper management we can make the natural resources collection sustainable.

In reply to 10th question (*i.e.* how many tourists enter into the Sundarbans per year? Are these numbers adequate? If not, why?) Three of them have said that the number is adequate though they have not mentioned any specific number. Another thirteen of them have made no comments. Six of them have said that sufficient number of tourists enter into the Sundarbans per year. Seven of them have said that these numbers are not sufficient and need more and more tourists. Only one has made clear answer and said that nearly 25-30 thousand tourists enter into the Sundarbans per year. But this number is not sufficient because of, increasing government revenue, besides, forest robber and pirate. None of them mentioned accurate number except one (**Appendix-6.2.8**).

In reply to 11th question (*i.e.* what are the main attraction of tourist in Sundarbans) almost all of the FBM have mentioned same information. They have said that tiger, deer, monkey, crocodile, Chital, animals and fish, snake and birds, trawler of wood, mangrove, foreign ship, sundry etc. are the main attraction of tourist in sundarbans. Only one has made no comment.

6.20.9 Forest Wood Cutters opinion of the Sundarbans

In answer to 1st question (*i.e.* Age (years)) in case of age of the forest woodcutters of the Sundarbans we can show from their information that the age group between 40-50 years are in maximum of them *i.e.* 15. On the other hand, the age group between 50-60 years is in the 2nd position, *i.e.* 11 and 20-30

years 20-30 years are in the same number i.e. each are six and one only. So, we can conclude that majority of the wood cutters are young.

In answer to 2nd question (i.e. Education) in case of education of the forest woodcutters from their own information we can show that around half i.e. 18 of total 35 have class I-V educations. On the other hand, ten have only signature knowledge. Only four has S.S.C pass education and one have S.S.C & above.

In answer to 3rd question (i.e. Annual income (Tk.) from woodcutting) in case of annual income (in Tk.) from woodcutting we see from the table that the total 33 woodcutters annual income is 30000 only. From the table we see that the highest and lowest income of the woodcutters is 40 thousand and 10 thousand respectively. We see that income of the woodcutters vary in an irregular way because of their residential variation.

In answer to 4th question (i.e. Last five years income from woodcutting) from the above table we see that last five years income from woodcutting is increasing year to year. Though the wood cutters have informed variously. It is normal because they do not live in the same area. So their income may vary. We see that in the year 2006 the average income of the 33 woodcutters was Tk. 15.76 (thousand). But in the year 2010 it became increase and that was Tk. 19.97 (thousand).

In reply to 5th question (i.e. what are you doing in other session? If you work in other place, please specify the type of work and annual income?) All of the woodcutters have mentioned that they work in other place. And specifically they have worked in various professions. Three of them have worked only catching fish and their annual income is between 10000-20000 taka in various districts. Twenty seven of them have worked in catching fish and kakra, and their income is between 20000-30000 taka in various districts. Two of them catch fish kakra and collect honey and their income is between Tk. 30000-40000 per year. Only one of the total 33 woodcutter's works in other session like business of jackfruit and catch fish and his annual income is Tk. 20000 only.

In reply to 6th question (*i.e.* what types of plants animals and birds are decreasing in the Sundarbans? Why? How can you protect them?) Twenty seven of total 33 FWCs have said that sundry tree, deer, bird, monkey etc. plants, animals and birds are decreasing in the Sundarbans because of lack of supervision. It can be protected by plantation, by proper treatment and by supervision properly. Other five of them have said that sundry trees are being died. They have not mentioned any cause. But they have mentioned that it will take step to treatment. Only one of them has made no comments. And others answer is very much vague.

In reply to 7th question (*i.e.* Do you observe any remarkable change in the Sundarbans Forest during your working period?) all of them, except one; have said that they do not observe any remarkable change in the Sundarbans Forest during their working period. Only one has said that trees die and that he observes in the Sundarbans Forest during his working period.

In reply to 8th question (*i.e.* Do you have full safety measure during work in the Sundarbans? If, no, How can improve the safety measure?) all the forest woodcutters have mentioned that they do not have full safety measure during their work in the Sundarbans because they fear from tiger, snake, crocodile and pirate also. Only one of them has said like India, provide electricity round human body. Almost all of them have said that protect from the tiger, snake, crocodile and the pirate. Only one has said that it can improve by life insurance and other opportunity.

In reply to 10th question (*i.e.* what are the suitable methods of tree harvesting? Of them, which method is favorable for regeneration of forest?) All the forest woodcutters have not mentioned the various names of suitable method of tree harvesting. But all of them have mentioned the name of method, which is favorable for regeneration of forest, and that is selective felling method.

In reply to 11th question (*i.e.* how many types of tree are you harvesting? Please, specify the volume in percentage and use?) All the forest woodcutters have said that they stop tree harvesting except Goran tree. They use Goran

tree as fuel, if we say specifically 80 mound of Goran users are four of FWCs. In the same way 70 mound of Goran users are eight of FWCs. And 60 and 50 mounds of Goran users are 10 and eight of the FWCs. Only one forest woodcutter uses Goran 38 mounds.

In reply to 12th question (*i.e.* what are the strength and weakness of the present Sundarbans Forest management?) all of the forest woodcutters have made almost same comments. Twenty seven to the total 31 forest woodcutters have said that strict security of the forest department is the strength of the present Sundarbans forest management. But failure of controlling the pirate is the weakness of the present the Sundarbans forest management. Five of them have said that supervision of forest department is the strength of the present Sundarbans forest management. But there is no effect if the wood theft is the weakness of the present Sundarbans forest management. But the failure of protecting the pirate is the weakness of the present Sundarbans forest management. But theft of wood is the weakness of the present Sundarbans management. **(Appendix-6.2.9)**

6.20.10 Forest Bawali opinion of the Sundarbans

In replying to 1st question (*i.e.* Age (years)) about the age of forest Bawali, shows the distribution of total Bawali in the Sundarbans Forest according to their age. Majority of the respondents according to 31.42% of total belong to 40-50 age group and 25.71% of the total fall into 30-40 age group followed by age group of 50-60 forming 25.71% of the total. Where as only 08.58% and 08.58% of the total falls into 20-30 and 50 and above age groups respectively. It is crystal clear that there are various types of age group forest Bawali in the Sundarbans area.

In answer to 2nd question (*i.e.* Education) educational qualification of the forest Bawali of the Sundarbans Forest is very marginal. Sixteen of them are signature knowledge. Another twelve of them are only class five passes. One of them is S.S.C. pass. Rest of them is between class six to eight.

In replying to 3rd question (*i.e.* Annual income (Tk.) from Goal pata cutting) about the average annual income (Tk.) from Golpata cutting around

that 40% of the Sundarbans Bawali have income in between Tk. 20,000 to Tk. 25,000. 28.57% of them have income of at best Tk. 15,000-20,000. 17.15% of them have income from Tk. 10,000 to Tk. 15,000. 6.67% of them have income from Tk. 5,000 to Tk. 10,000 and Tk. 25,000 to Tk. 30,000. Only 02.86% of the total respondents have income of Tk. 30,000 at least.

In replying to 4th question (*i.e.* Last five years income from Goal pata cutting) about the last five years income from Golpata cutting, there are various amount of money. Some one has said that they earn around Tk. 8000 in the year 2006, and it is the lowest income. On the other hand, someone has said that they earn around Tk. 20000 in the same year. Some of them have mentioned that they earn around Tk. 15000 in the same period. In this way the income of the forest Bawali of the Sundarbans gradually increased in the next years. And the average income from Golpata cutting is 13.63, 14.80, 15.71, 17.23 and 17.74 in year, 2006, 2007, 2008, 2009 and 2010 respectively / accordingly. It is noted that the income is shown in average is gradually increased. So, we make comment that the Sundarbans management system is run smoothly.

In response to 5th question (*i.e.* what are you doing in other session? If you work in other place, please specify the type of work and annual income) about the activities of the forest Bawali of the Sundarbans Forest in other season/session, almost all the forest Bawali has mentioned same information. If we analysis their comments we see that they have mainly engaged in other season in catch fish, kakra, and honey collection. And majority of them earn Tk. 20000-25000 per year. Though there are a significant number of Bawali who earn Tk. 25000-30000 per year. There are also a mentionable number of Bawali who earn only Tk. 5000-1000 and 10000-15000 per year.

In fine, we can say that the forest Bawali are engaged in catch fish, kakra and collection or the work related to these activities like business of fish and kakra and day laborer of catching fish work related to these activities like business of fish and kakra and day laborer of catching fish and kakra and collecting honey.

In replying to 7th question (*i.e.* what are the suitable methods of tree harvesting? Of them, which method is favorable for regeneration of forest?) about the suitable methods of tree harvesting and of them which method is favorable for regeneration forest, the forest Bawali have not mentioned various method of tree harvesting rather all of them in general mention one method and that is selective felling. In common sense, we can say, all the forest Bawali harvest tree in selective felling.

In response to the question about the types of tree the forest Bawali of the Sundarbans forest are harvesting, a significant number of Bawali have mentioned that tree harvesting is band up to 2010 years. In answer to the specification the volume in percentage and use almost 70% of them have made comment that total collection of Goran tree as fuel and it is 10-120 mound used of fuel. Rest of the forest Bawali of sumdarbans forest have mentioned that they use below 100 mound of Goran fuel of total collection of use of fuel.

In reply to 8th question (*i.e.* how many types of tree are you harvesting? Please, specify the volume in percentage and use) of the strength and weakness of present the Sundarbans forest management all of them, except one have mentioned that strict security of the forest department is the main strength of present the Sundarbans forest management. On the contrary, the forest department cannot protect the pirate, and the political impact on it in general, and the recommendation of the chairman and member, in particular, on it are the main weakness of present the Sundarbans forest management (Appendix-6.2.10).

6.20.11 Forest Mawali opinion of the Sundarbans

In replying to 1st question (*i.e.* Age (years)) about the age of the Sundarbans forest Mawali half of them are in 30-40 years age group. On the other side two of them are 28 years old and another nine of them are in 50-60 years age group. Another eight of the total 30 forest Mawali are in 40-50 years group. In brief, we can say that the Mawali are young enough to act their respective activities.

In answer to 2nd question (*i.e.* Education) in response to the educational status of the the Sundarbans forest Mawali the overall quality getting information from them is very poor. Because around 70 %(13) of the total 18 Mawali are only signature knowledge. On the other side, only twelve of them are class five passes.

In replying to 3rd question (*i.e.* Annual income from honey collection?) about the annual income (Tk.) from honey collection, almost 70% (21) of the total 30 Mawali have said that they earn Tk. 15000-20000 per year, from collecting honey. Another five of them have mentioned that they earn Tk. 10000-15000 from collection honey every year. Only four of them have said that they earn Tk. 20000-25000 from collecting honey.

In replying to 4th question (*i.e.* Last six years income in honey collection?) about the last six years income in honey collection there are various amount of money, a significant number of Mawali have said that they earn around Tk. 8000 in the year 2005 and it is the lowest income. On the other hand, another significant number of mawali have said that they earn around Tk. 13000 in the same period of time. Other of them has said that they earn around Tk. 9000-12000 in the same span of time. Similarly, the income of the forest Mawali of the Sundarbans gradually increased in the next years. And the average income in honey collections Tk. 9.40, 13.70, 14.00, 16.83, 15.87 and 18.63 in the year 2005, 2006, 2007, 2008, 2009 and 2010 accordingly. It is noted here that the income is shown in average gradually increased. So, we can make comments that the Sundarbans management system is run smoothly.

In reply to 5th question (*i.e.* what type's security do you have in forest?) about the various types of security in forest for the Mawali, half of them have mentioned that they have needed various kinds of security in plane language. Another ten of them have mentioned that get different security by the people of the forest department. Only five of them said that they get security by the people of the forest department. So, it is noted that on the one side they have some security on the other side they get some security from the forest department.

In replying to 6th question (*i.e.* what problems do you face during honey collection?) about the problems the forest Mawali have to face during honey collection most of them have mentioned that fear of tiger, attack of pirate, snake, wild animals, collecting money in illegal way, honey bee, etc. are the main problem they have to face during honey collection. And they have not mentioned any solutions. On the other hand, only three have mentioned that the problems they have to confront are mainly pirates, snake, honeybee and tiger. And they have mentioned that it will be solved immediately.

In reply to 7th question (*i.e.* How can improve the honey culture in the Sundarbans?) about the measurement of the improvement of the honey culture in Sundarban, the Mawali have made different comments in their own point of view. Seven of the total Mawali has said that by Mawali training we can improve the honey culture in the Sundarbans. Four of them have mentioned that if there are more flowered trees then it is possible to improve the honey culture in the Sundarbans. Two of them have made no comments. Two of them have said it is naturally improved. Only two have said that by encouraging the Mawali through providing loan in a simple condition.

In response to 8th question (*i.e.* what are doing in other season? Please specify the work and annual income?) About the activities of the forest Mawali of the Sundarbans forest in other season, almost all the forest Mawali have mentioned same information. We see that majority portion of time they have mainly engaged in other season in catch fish, kakra and collecting Golpata, Goran fuel etc. And their income during the same period the range between Tk. 15000-25000 per year. Though they have the opportunity to earn some money through other way but their income is so poor. And they have to face severe / acute problems to run their smoothly.

In response to 9th question (*i.e.* Do you need any permission from Forest Authority?) about the permission from forest authority all the forest Mawali have made comments that they have to take permission from the forest authority enters into the forest for collecting honey.

In reply to 10th question (*i.e.* How much do you pay for one season?) about how much money the Mawali have to pay for one season to the forest

authority, all the Mawali have answered that they have to pay Tk. 3000 for honey and Tk. 2000 for wax for one season. It is no need to mention here that this act is very rude and oppressive to the poor honey collectors or the Mawali.

In response to 11th question (*i.e.* what types of plants, animals and birds are decreasing? Why?) about the various types' plant animals and birds are decreasing twenty-four of the total 30 Mawali have said that no above mentioned fauna and flora are decreasing. Only five of them have said that the deer and bird become reduce. And another one has said that the fauna and flora are decreasing but he has not mentioned any specific name.

In reply to 12th question (*i.e.* How can overcome this problem?) about solution of the problem mentioned above, twenty of them have made no comments. Only five has said that by proper supervision we can overcome the problems. Another five has said that supplies adequate arms and provides proper treatment and finally make suitable environment. **(Appendix-6.2.11)**

6.20.12 Local People opinion of the Sundarbans Forest

In replying to 1st question (*i.e.* Age (years)) about the age of local people of the Sundarbans forest 10 of the total 35 are in 30-40 years age group. Similarly twenty of them are in 40-50 to 50-60 years age group. Only three of them are in 20-30 years age group. And another two of them are in 60 & above age group.

In response to 2nd question (*i.e.* Education) the educational status of the local people of the Sundarbans forest, the overall quality getting information from them is not so poor. Because only four of them are merely signature knowledge. Another seven are passed class five. Fourteen of them are reached up to class nine. And another nine of them are passed S.S.C. One of them is graduate. And there are also one post graduate of the local people of the Sundarbans forest.

In replying to 3rd question (*i.e.* Annual income) about the annual income of the local people is Tk. 80000-90000 in general. Twelve of them have earned Tk. 80000-90000 per year. Only four of them have earned Tk. 120000 every

year in particular. Two of them have earned below Tk. 80000 annually. This income rate is not so poor.

In reply to 4th question (*i.e.* Do you want to protect forest and animals? How?) about the protection, all of the local people have made comments that they try their best to protect the forest and the fauna and flora of the Sundarbans.

In answer to 5th question (*i.e.* what are the main causes of forest cutting and animal hunting?) of the man causes of forest cutting and animal hunting all the local people of Sundarbans forest have mentioned several causes. They have mentioned that inadequate laws, lack of implementation of the existing laws, inadequate forest guards and corruption of U.P.Chairman and member etc. are the main causes of forest cutting and animal hunting.

In replying to 6th question (*i.e.* How can overcome these? Please give suggestions?) of overcome the problems, the local people of the Sundarbans forest have mentioned different comments and suggestions. About 60% (20) of the total 35 local people have said that by strict law we can overcome these problems. Five of the local people of the Sundarbans forest have said that by strict supervision the authority of Sundarbans forest can overcome this problem. But they have not given any suggestions; two of them have mentioned that by make the mass people conscious about these problems. Only one of them has said that these problems will be solved naturally. And another has said that strict law and proper supervision can solve these problems. Two of them have said that it will be better if there is forest guard. One has emphasized on the growth of population. Another one has said that strict security and other job can overcome these problems. Only one has said that it is necessary for the forest department to have a separate court to overcome these problems. These are the suggestions from the local people of the Sundarbans forest.

In reply to 7th question (*i.e.* Do you want to participate in plantation programmed in the degraded forest area? How? What sharing do you like?) about participation in plantation programmed in the degraded forest area, all

the local people except one of the Sundarbans forest have said that they want to participate in plantation programmed in degraded forest. Only one has said nothing about the plantation programmed. None of the have said anything about how they participate. But among the participators i.e. 35, all of them except two, have said that they like to participate in plantation programmed in the degraded forest area. Only two of 35 have said that local people take part in 60% and government takes part 40%.

In answer to 8th question (i.e. When do you want to get you're sharing? After 10 years, after 15 years, after 20 years) when do the local people want to get sharing out of 35, 27 local people have said that they want to get their sharing after 15 years. Only one has made on comment. Another one has said that he wants to get sharing after 10 years. And only one has said that he wants to get sharing after 20 years.

In answer to 9th question (i.e. Do you actively protect the new forest under sharing system?) about the local people's activity protect the new forest under sharing system out 35 local people, 27 of them have made affirmative answer. Other two of them have made affirmative answer and also said that it need plant more trees only six of them have kept him silent.

In answer to 10th question (i.e. what is your opinion about this sharing? Will it help in reforestation?) about their opinion of the local people of the Sundarbans forest about this sharing and will it help in reforestation, one of them have made no comment. Thirty two of them have said that new plantation will help in reforestation. One of them has said that by taking care of the forest will help in reforestation. One of them has said that of stop stealing and prevents the pirate then it will help in reforestation. Rest of the local people has made different comments and suggestions. And it is very common factor that on any matter many men/women opine different opinion. The present situation is not an exception (**Appendix-6.2.12**).

In reply to 11th question (i.e. what are the strength and weakness of present forest management? Please specify?) of the strength and weakness of the present Sundarbans forest management system, 27 of the total 35 local

people have made the same comments, and they say that intensive supervision of forest department is the main strength of present forest management system. On the contrary, they say that the forest department cannot protect the pirate which is the main weakness of the forest management system. Three of them have said that strict security of the forest department is the strength of the present Sundarbans management system; and wood stealing is the weakness. Two of them have made no comments. Only one has said that the strength of the present Sundarbans forest management system is the function run by rules; and weakness is that wood cut in illegal ways and weak educational infrastructure. Another two have emphasized on logistic support, like they need oil and good arms.

Table 6.7

Distribution of total Foresters according to their Age in the Sundarbans Forest

Ages	Number of respondents	Percentage%
20-30	02	18.18
30-40	01	09.09
40-50	03	27.27
50 & above	05	45.45
Total	11	100.00

Table 6.7 shows the distribution of total foresters in Sundarban forest according for 45.45% of total belong to 50 and above age group and 27.27% of the total fall into 40-50 age group followed by age group of 20-30 forming 18.18% of the total. Where as, only 9.09% of the total fall into 30-40 age groups.

Table 6.8

Distribution of total Foresters according to their Age in Sundarban Forest

Ages	Number of respondents	Percentages%
20-30	02	18.18
30-40	01	9.09
40-50	05	45.45
50 & above	03	27.27
Total	11	100.00
Mean	43.18	
SD	10.285	
CV	23.818	
t-test	13.925**	

From the above table it is seen that at 1% level of significance the calculated value of "t" is 13.925 and the tabulated value of "t" is 2.228, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Foresters 40-50 age is a vital role play for sustainable forest development.

Table 6.9

Distribution of Total Guards according to their Age in Sundarban Forest

Ages	Number of respondents	Percentages%
20-30	01	06.67
30-40	04	26.67
40-50	09	60.00
50 & above	01	06.66
Total	15	100.00

Table 6.9 shows the distribution of total guards in Sundarbans forest according to their ages. Majority of the respondents according to 60% of total belong to 40-50 age group and 26.67% of the total fall in 30-40 age groups followed by age group of 20-30 forming 06.67% of the total. Where as only 06.66% of the total falls into 50-and above age group.

Table 6.10

Distribution of Total Guards according to their Age in Sundarban Forest

Ages	Number of respondents	Percentages%
20-30	01	06.67
30-40	04	26.67
40-50	09	60.00
50 & above	01	06.66
Total	15	100.00
Mean	41.67	
SD	6.992	
CV	16.781	
t-test	23.080**	

From the above table it is seen that at 1% level of significance the calculated value of "t" is 23.080 and the tabulated value of "t" is 2.145, which is greater than that of the tabulated value. Therefore, it suggests that there is significant

variation in their age. It is proved that Guards 40-50 age is a vital role play for sustainable forest development.

Table 6.11

Distribution of Total Boatmen according to their Age in Sundarban Forest

Ages	Number of respondents	Percentages%
20-30	01	03.57
30-40	08	28.57
40-50	12	42.86
50 & above	07	25.00
Total	28	100.00

Table 6.11 shows the distribution of total boatmen in sundarbans forest according to their age. Majority of the respondents according to 42.86% of total belong to 40-50 age group and 28.57% of the total fall into 30-40 age group followed by age group of 50 and above forming 25% of the total. Where as, only 03.57% of the total fall into 20-30 age groups.

Table 6.12

Distribution of Total Boatmen according to their Age in Sundarban Forest

Ages	Number of respondents	Percentages%
20-30	01	03.57
30-40	08	28.57
40-50	12	42.86
50 & above	07	25.00
Total	28	100
Mean	43.93	
SD	8.168	
CV	18.593	
t-test	28.460**	

From the above table it is seen that at 1% level of significance the calculated value of "t" is 28.460 and the tabulated value of "t" is 2.052, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Boatmen 40-50 age is a vital role play for sustainable forest development.

Table 6.13**Distribution of Total Wood Cutter according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	01	03.03
30-40	06	18.18
40-50	15	45.45
50-60	11	33.34
60 & above	00	00.00
Total	33	100.00

Table 6.13 shows the distribution of total woodcutter in sundarban forest according to their age. Majority of the respondents according to 45.45% of total belong to 40-50 age group and 33.34% of the total fall into 50-60 age group followed by age group of 30-40 forming 18.18% of the total. Where as only 03.03% and 00.00% of the total falls into 20-30 and 60 and above age groups respectively.

Table 6.14**Distribution of Total Wood Cutter according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	01	03.03
30-40	06	18.18
40-50	15	45.45
50 & above	11	33.34
Total	33	100.00
Mean	45.91	
SD	7.925	
CV	17.263	
Z-test	33.277**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 33.277 and the tabulated value of "z" is 1.64, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Wood Cutters 40-50 ages is a vital role play for sustainable forest development.

Table 6.15**Distribution of Total Bawali according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	03	08.58
30-40	09	25.71
40-50	11	31.42
50-60	09	25.71
60 & above	03	08.58
Total	35	100.00

Table 6.15 shows the distribution of total Bawali in Sundarbans Forest according to their age. Majority of the respondents according to 31.42% of total belong to 40-50 age group and 25.71% of the total fall into 30-40 age group followed by age group of 50-60 forming 25.71% of the total. Where as only 08.58% and 08.58% of the total falls into 20-30 and 50 and above age groups respectively.

Table 6.16**Distribution of Total Bawali according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	03	08.58
30-40	09	25.71
40-50	11	31.42
50 & above	12	42.29
Total	35	100.00
Mean	44.14	
SD	9.672	
CV	21.911	
z-test	27.000**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 27.000 and the tabulated value of "t" is 1.64, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Bawali 50 & above age is a vital role play for sustainable forest development.

Table 6.17**Distribution of Total Mawali according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	02	06.67
30-40	11	36.67
40-50	08	26.66
50-60	09	30.00
60 & above	00	00.00
Total	30	100.00

Table 6.17 shows the distribution of total Mawali in Sundarbans forest according to their age. Majority of the respondents according to 36.67% of total belong to 30-40 age group and 30% of the total fall into 50-60 age group followed by age group of 40-50 forming 26.66% of the total. Where as only 06.67% and 00.00% of the total falls into 20-30 and 60 and above age groups respectively.

Table 6.18**Distribution of Total Mawali according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	02	06.67
30-40	11	36.67
40-50	08	26.66
50 & above	09	30.00
Total	30	100.00
Mean	43.00	
SD	9.452	
CV	21.981	
z-test	24.919**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 24.919 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Mawali 30-40 ages is a vital role play for sustainable forest development.

Table 6.19**Distribution of Total Local People according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	03	08.57
30-40	10	28.57
40-50	10	28.57
50-60	10	28.57
60 & above	02	05.72
Total	35	100.00

Table 6.19 shows the distribution of total local people in Sundarbans Forest according to their age. Majority of the respondents according to 28.57% of total belong to 30-40 age group and 28.57% of the fall into 40-50 age group followed by age group of 50-60 forming 28.57% of the total. Where as only 08.57% and 05.72% of the total falls into 20-30 and 60 and above age groups respectively.

Table 6.20**Distribution of Total Local People according to their Age in Sundarban Forest**

Ages	Number of respondents	Percentages%
20-30	03	08.57
30-40	10	28.57
40-50	10	28.57
50 - & above	12	34.29
Total	35	100.00
Mean	43.86	
SD	9.790	
CV	22.322	
z-test	26.504**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 26.504 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. It is proved that Local People 50 - & above age is a vital role play for sustainable forest development.

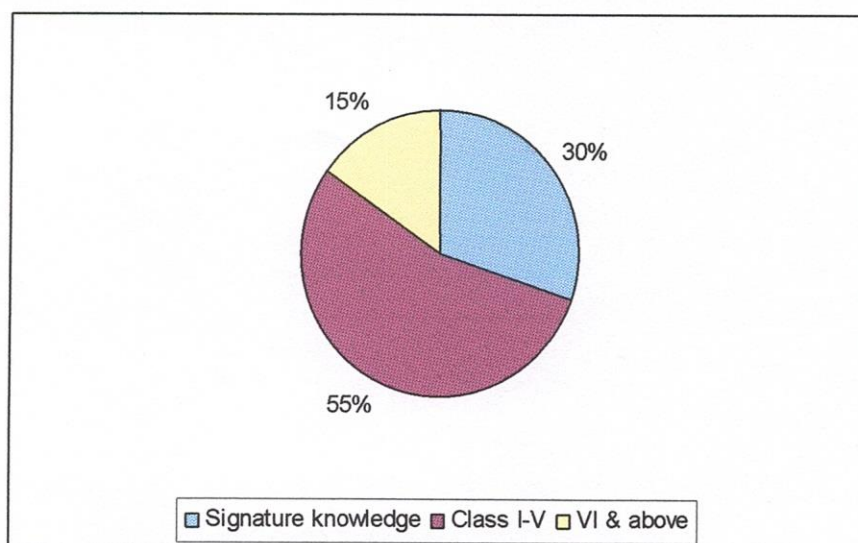
Table 6.21**Distribution of Total Wood Cutter according to their Education Background in Sundarban Forest**

Educational background	Number of respondents	Percentages%
Signature knowledge	10	30.30
Class I-V	18	54.55
VI & bellow S.S.C.	04	12.12
S.S.C. & above	01	03.03
Total	33	100.00

Table 6.21 exhibits the distribution of total woodcutter in Sundarbans Forest according to their educational background. The table depicts that 54.55% of the respondents have the educational qualifications ranging from class one to class V 30.30% of the respondents have the capacity to sign their names only. Respondents with qualifications of class VI and bellow S.S.C accounts for only 12.12. Whereas, respondents having class s.s.c. and above account for only 03.03%.

Table 6.22**Distribution of Total Wood Cutter according to their Education Background in Sundarban Forest**

Educational background	Number of respondents	Percentages%
Signature knowledge	10	30.30
Class I-V	18	54.55
VI & above	05	15.15
Total	33	100.00



Here it is seen that the number of the wood cutter from class I-V education is 55%. If the number of the wood cutter from VI & above education is greater than the I-V, it would be better for the development of the Sundarban Forest

Table 6.23

**Distribution of Total Bawali according to their
Education Background in Sundarban Forest**

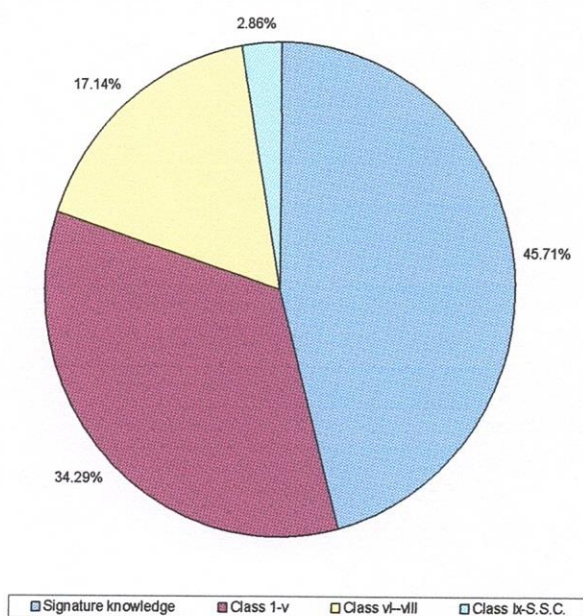
Educational background	Number of respondents	Percentages%
Signature knowledge	16	45.71
Class I-V	12	34.29
Class VI-VIII	06	17.14
Class IX-S.S.C.	01	02.86
Total	35	100.00

Table 6.23 exhibits the distribution of total Bawali in Sundarbans Forest according to their educational background. The table depicts that 45.71% of the respondents have the capacity to sign their names only. 34.29% of the respondents have the educational qualifications ranging from class one to class V. Respondents with qualifications of class VI to class VIII accounts for only 17.14. Where as, respondents having class IX to class S.S.C. account for only 02.86%.

Table 6.24

**Distribution of Total Bawali according to their
Education Background in Sundarban Forest**

Educational background	Number of respondents	Percentages%
Signature knowledge	16	45.71
Class 1-v	12	34.29
Class vi-viii	06	17.14
Class ix-S.S.C.	01	02.86
Total	35	100.00



Here it is seen that the number of the Bawali from Signature knowledge education is 45.71%. If the number of the Bawali from Class IX-S.S.C education is greater than the I-V, it would be better for the development of the Sundarban Forest

Table 6.25

Distribution of Total Mawali according to their Education Background in Sundarban Forest

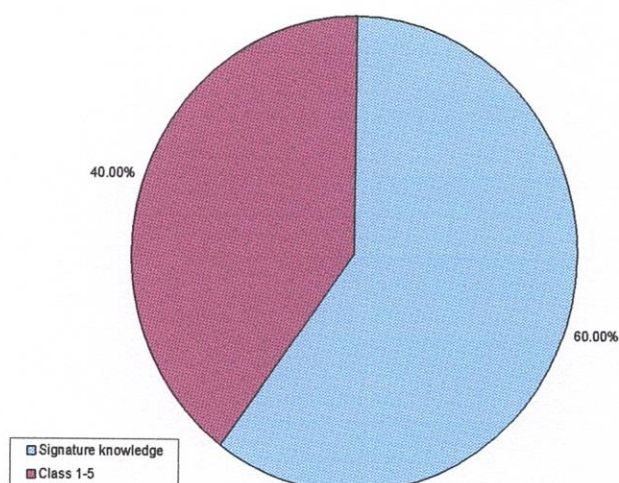
Educational background	Number of respondents	Percentages%
Signature knowledge	18	60.00
Class I-V	12	40.00
Class VI-VIII	00	00.00
Class IX-S.S.C.	00	00.00
Total	30	100.00

Table 6.25 exhibits the distribution of total Mawali in Sundarbans Forest according to their educational background. The table depicts that 60% of the respondents have the capacity to sign their names only. Whereas, respondents have class one to class V account for only 40%.

Table 6.26

**Distribution of Total Mawali according to their
Education Background in Sundarban Forest**

Educational background	Number of respondents	Percentages%
Signature knowledge	18	60.00
Class i-v	12	40.00
Total	30	100.00



Here it is seen that the number of Mawali from Signature knowledge is 60%. If the number of Mawali from Class I-V is greater than the Signature knowledge, it would be better for the development of the Sundarban Forest

Table 6.27

**Distribution of Total Local People according to their
Education Background in Sundarban Forest**

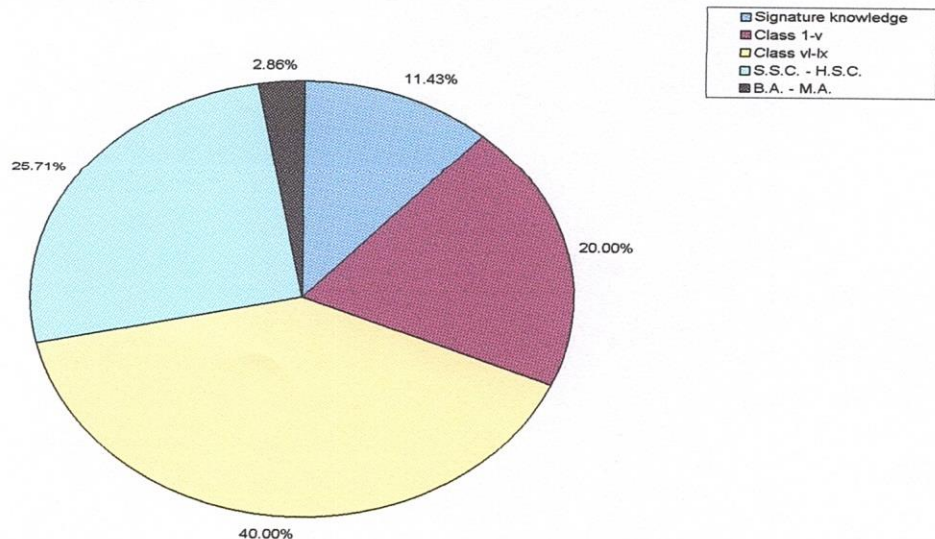
Educational background	Number of respondents	Percentages%
Signature knowledge	04	11.43
Class I-V	07	20.00
Class VI-IX	14	40.00
S.S.C.- H.S.C.	09	25.71
B.A. – M.A.	01	02.86
Total	35	100.00

Table 6.27 exhibits the distribution of total local people in Sundarbans Forest according to their educational background. The table depicts that 40% of the respondents have the educational qualifications ranging from class VI to class IX. Respondents with qualifications of class S.S.C. to class H.S.C. accounts for only 25.71%. Respondents forming 20% of total have the educational qualifications ranging from class one to V. 11.43% of the respondents have the capacity to sign their names only. Whereas, respondents have class B.A to M.A. account for only 02.86%.

Table 6.28

Distribution of Total Local People according to their Education Background in Sundarban Forest

Educational background	Number of respondents	Percentages%
Signature knowledge	04	11.43
Class i-v	07	20.00
Class vi-ix	14	40.00
S.S.C. - H.S.C.	09	25.71
B.A. - M.A.	01	02.86
Total	35	100.00



Here it is seen that the number of the Local People from class VI-IX is 40%. If the number of the Local People from S.S.C - H.S.C is greater than the VI-IX, it would be better for the development of the Sundarban Forest

Table 6.29**Distribution of Total Wood Cutter according to their Annual Income in Sundarban Forest**

Annual income	Number of respondents	Percentages%
10000-20000	09	27.27
20000-30000	23	69.70
30000-40000	01	03.03
Total	33	100.00

Table 6.29 shows the distribution of total woodcutter in Sundarbans Forest according to their annual income. The table exhibits that 69.70% of Sundarban's woodcutters have income in between Tk. 20,000 to Tk. 30,000. 27.27% of them have income of at best Tk. 10,000 to Tk. 20,000. Only 03.03% of the total respondents have income of Tk. 30,000 to Tk. 40,000 at least.

Table 6.30**Distribution of Total Wood Cutter according to their Annual Income in Sundarban Forest**

Annual Income	Number of respondents	Percentages%
10000-20000	22	66.67
20001-30000	11	33.33
Total	33	100.00
Mean	18333.33	
SD	4714.045	
CV	25.713	
Z-test	22.341**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 22.341 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their annual income.

Here it is seen that the number of the wood cutters according to their annual income from 10,000-20,000 is 66.67%. If the number of the wood cutters those who earn 20,000-30,000 is greater, it would better for the Sundarban Forest.

Table 6.31

**Distribution of Total Bawali according to their
Annual Income in Sundarban Forest**

Annual income	Number of respondents	Percentages%
5000-10000	02	05.71
10000-15000	06	17.15
15000-20000	10	28.57
20000-25000	14	40.00
25000-30000	02	05.71
30000 & above	01	02.86
Total	35	100.00

Table 6.31 shows the distribution of total Bawali in Sundarbans Forest according to their annual income. The table exhibits that 40% of Sundarbans Bawali have income in between Tk. 20,000 to Tk. 25,000. 28.57% of them have income of at best Tk. 15,000-20,000. 17.15% of them have income from Tk. 10,000 to Tk. 15,000. 6.67% of them have income from Tk. 5,000 to Tk. 10,000 and Tk. 25,000 to Tk. 30,000. Only 02.86% of the total respondents have income of Tk. 30,000 at least.

Table 6.32

**Distribution of Total Bawali according to their
Annual Income in Sundarban Forest**

Annual Income	Number of respondents	Percentages%
5000-10000	03	08.57
10001-15000	08	22.86
15001-20000	12	34.29
20001-25000	11	31.42
25001-30000	01	02.86
Total	35	100.00
Mean	17357.14	
SD	4997.959	
CV	28.795	
z-test	20.546**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 20.546 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their annual income.

Here it is seen that the number of the Bawali according to their annual income from 15001-20,000 is 34.29%. If the number of the Bawali those who earn 25001-30,000 is greater, it would better for the Sundarban Forest.

Table 6.33
Distribution of Total Mawali according to their
Annual Income in Sundarban Forest

Annual income	Number of respondents	Percentages%
10000-15000	05	16.67
15000-20000	21	70.00
20000-25000	04	13.33
Total	30	100.00

Table 6.33 shows the distribution of total Mawali in Sundarban Forest according to their annual income. The table exhibits that 70% of Sundarban Mawali have income in between Tk. 15,000 to Tk. 20,000. 16.67% of them have income of at best Tk. 10,000 to Tk. 15,000. Only 13.33% of the total respondents have income of Tk. 20,000 to Tk. 25,000.

Table 6.34
Distribution of Total Mawali according to their
Annual Income in Sundarban Forest

Annual Income	Number of respondents	Percentages%
10000-15000	08	26.67
15001-20000	21	70.00
20001-25000	01	03.33
Total	30	100.00
Mean	16333.33	
SD	2477.678	
CV	15.169	
z-test	36.107**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 36.107 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their annual income.

Here it is seen that the number of the Mawali according to their annual income from 15001-20000 is 70.00%. If the number of the Mawali those who earn 20001-25000 is greater, it would better for the Sundarban Forest.

Table 6.35

**Distribution of Total Local People according to their
Annual Income in Sundarban Forest**

Annual income	Number of respondents	Percentages%
60000-70000	01	02.86
70000-80000	01	02.86
80000-90000	12	34.28
90000-100000	07	20.00
100000-110000	07	20.00
110000 & above	07	20.00
Total	35	100.00

Table 6.35 shows the distribution of total local people in Sundarbans Forest according to their annual income. The table exhibits that 34.28% of the Sundarbans local people have income in between Tk. 70,000 -80000. 20% of them have income of at best Tk. 90,000 to Tk. 100000 and Tk. 100000 to Tk. 110000. 20% of the local people have income of Tk. 110000 and above. 02.86% of the total respondents have income in Tk. 60,000 to Tk. 70,000 and Tk. 70,000 to Tk. 80,000 at least.

Table 6.36

**Distribution of Total Local People according to their
Annual Income in Sundarban Forest**

Annual Income	Number of respondents	Percentages%
60000-70000	01	02.86
70000-80000	01	02.86
80000-90000	12	34.28
90000-100000	07	20.00
100000-110000	07	20.00
110000 & above	07	20.00
Total	35	100.00
Mean	96142.86	
SD	13043.100	
CV	13.566	
z-test	43.608**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 43.608 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their annual income.

Here it is seen that the number of the Local People according to their annual income from 80000-90000 is 34.28%. If the number of the Local People those who earn 1, 00000-1, 10,000 is greater, it would better for the Sundarban Forest.

Table 6.37 shows the distribution of total woodcutters in Sundarbans forest according to their five years average annual income. The table exhibits that 33 woodcutters have average annual income Tk. 15758 of the year 2006. Tk. 17455 of them has income of the years 2007 Tk.17758 .and Tk. 20000 have income of the year 2008 and 2009. Only Tk. 19970 of the total respondents has income of the year 2010 at least.

Table 6.38

Distribution of Total Wood Cutters according to their Average Income from Wood cutting of the Sundarban Forest

Average Income	Number of respondents	Percentages%
5000-10000	01	03.03
10001-15000	04	12.12
15001-20000	20	60.60
20001-25000	07	21.22
25001-30000	01	03.03
Total	33	100.00
Mean	17954.55	
SD	3766.607	
CV	20.979	
Z-test	27.383**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 27.383 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their average annual income.

Here it is seen that the number of the wood cutters according to their Average income from 15001-20000 is 60.60%. If the number of the wood cutters those who earn 25001-30000 is greater, it would better for the Sundarban Forest.

Table 6.39 shows the distribution of total Bawali in Sundarbans Forest according to their five years average annual income. The table exhibits that 35 Bawali have average annual income Tk. 13629 of the year 2006 Tk. 14800 of them have income of the year 2007. Tk. 15714 and Tk. 17229 have income of the year 2008 and 2009. Only Tk. 17743 of the total respondents has income of the year 2010 at least.

Table 6.40

Distribution of Total Bawali according to their Average Income from Goal Pata cutting of the Sundarban Forest

Average Income	Number of respondents	Percentages%
5000-10000	04	11.43
10001-15000	10	28.57
15001-20000	18	51.43
20001-25000	02	05.71
25001-30000	01	02.86
Total	35	100.00
Mean	15500.00	
SD	4342.481	
CV	28.016	
z-test	21.117**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 21.117 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their average annual income.

Here it is seen that the number of the Bawali according to their annual income from 15001-20000 is 51.43%. If the number of the Bawali those who earn 25001-30000 is greater, it would better for the Sundarban Forest.

Table 6.41 shows the distribution of total Mawali in Sundarbans Forest according to their six years average annual income. The table exhibits that 30 Mawali have average annual income Tk. 9400 of the year 2005. Tk. 13700 of them has income of the year 2006. Tk. 14400 and Tk. 16833 has income of the year 2007 and 2008. Tk. 15867 has income of the year 2009. Only Tk. 18633 of the total respondents has income of the year 2010 at least.

Table 6.42

**Distribution of Total Mawali according to their Average Income from
Honey collection of the Sundarban Forest**

Average Income	Number of respondents	Percentages%
5000-10000	01	03.33
10001-15000	16	53.33
15001-20000	13	43.34
Total	30	100.00
Mean	19500.00	
SD	2768.875	
CV	14.199	
z-test	38.574**	

From the above table it is seen that at 1% level of significance the calculated value of "z" is 38.574 and the tabulated value of "z" is 1.640, which is greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their average annual income.

Here it is seen that the number of Local People according to their annual income from 80000-90000 is 53.33%. If the number of Local People those who earn 15001-20000 is greater, it would better for the Sundarban Forest.

Note: ** indicates significant at 1% level; * indicates significant at 5% level and ns indicates not significant

6.21. Water

6.21.1. Water quality

6.21.1.1. Criteria for evaluating water quality

The amount and kind of salts will determine the criteria for evaluation of water for irrigation. With poor water quality, various soil and water problems may arise. Special management practices may then be necessary to maintain sustainable crop productivity. Salt concentration of water having EC of 12 dS/m can be used for growing salt tolerant and semi-tolerant crops in coarse textured soils, provided the annual rainfall is not less than 400 mm. But in fine textured soils, water with EC of more than 2 dS/m often creates salinity problems.

Table 6.43

Water quality ratings

Water quality rating	ECw dS/m	SAR (m mole/l) ^{1/2}	RSC (me/L)
SGood quality water	<2.0	<10	nil
Marginal quality water	2.0-4.0	<10	<2.5
Poor quality water	>4.0	<10	nil

Source: Irrigation and crop management with brackish water, CSSRI Bull.no.12, 1989.

6.21.1.2 Water salinity

District wise water salinity (ECW), pH, B, Ca and Mg data of different water sources such as river, cannel, pond, gher, sea, Hand tube well, STW, DTW etc. are presented.

6.21.1.2.1 Surface water

The surface water mainly comprises (i) River and cannel water, and (ii) water in shrimp cultivation field, locally called 'Gher'. In general almost all the river/canal water in southwestern part is extremely saline in dry season and not suitable for irrigation.

(i) River and Cannel water From south-west and southern part of the coastal saline area 70 water samples are collected from 11 districts. The EC range is also very wide varying from 0.16 to 36.0 dS/m. Highest EC value was observed in Maheskhali canal in Maheskhali Upazila of Chittagong district and lowest EC value is observed in Tctulia River in Bhola Sadar Upazilla of Bhola district. About 35% river water possess EC<2.0 dS/m, 6% river water possess 2.0-5.0 dS/m and 59% river water possess ≥5.0 dS/m in dry season.

Except Telutia, Meghna, Kakdon, Subidkhali, Lebukhali, Laukathi, Kukua, Gopaldi, Kajal, Tajumuddin canal under Noakhali, Bhola, Patuakhali, Barisal, Jhalakathi districts almost all the rivers remain highly saline in dry season. In Jessore district almost all the rivers remain saline. Almost all the

rivers in Jhenaidaha, Magura, Barisal and Jhalakathi are found non-saline. In Pirojpur district Patharghata canal and Baleswar River near Nazirpur upazila are found highly saline. Tikikata River in Mathbaria is found marginally saline. In Patuakhali district Tetulia, Patuakhali and Pandob rivers are found marginally saline and these may be considered as marginally suitable for irrigation. Most of the rivers and canals in northern part of Patuakhali and Borguna districts may be considered as suitable or marginally suitable for irrigation. All the rivers in northern part of Bhola district may be considered as suitable or marginally suitable. Most of the canals within the polder are found marginally suitable for irrigation. All the rivers and canals in southern part of Bhola district are found highly saline.

(ii) Gher water (water within shrimp cultivation)

From south-western part of the coastal saline area 8 water samples were collected under 4 districts. The EC ranges vary from 10.0 to 35.0 dS/m. Highest EC value is observed in Koyra upazila under Khulna district and lowest EC value is observed in Dumuria upazila of Khulna district. All the gher water possesses $EC > 10.0$ dS/m.

(iii) Ground water (Shallow and hand dug well)

28 water samples were collected from 6 districts in south-west part of the coastal saline and non-saline area. The EC ranges are also very wide varying from 0.39 to 19.8 dS/in. Highest EC value is observed in Shyamnagar upazila of Salkhira district. This water is used for brackish water shrimp cultivation. About 83% tube well water possesses $EC < 2.0$ dS/m and rest 17% tube-well water possesses > 2.0 dS/m.

iv) Ground water (Deep tube well)

24 water samples were collected from 5 districts in south-west part of the coastal saline and non saline area. The EC range is also very wide varying from 0.55 to 7.8 dS/m. Highest EC value is observed in Paikgachha upazila of Khulna district. About 50 % tube well water possesses $EC < 2.0$ dS/m and rest 50% tube well possesses > 2.0 dS/m.)

6.22 SOIL TEST

6.22.1 Soil Test Results in Bhomor Khali, Range, Khulna

Table 6.44

Soil Test Results in Bhomor Khali, Range, Khulna

M/S. TECHNO SOIL ENGINEERING							SUMMARY OF TEST RESULTS				PROJECT MULTI-STORIED FOREST BUILDING LOCATION: BHOMOR KHALI, RANGE KHULNA WEST FOREST DIVISION, KHULNA					
Bore Hole No.	Sample No.	Depth In Ft./m	West Unit Weight (pcf)	Dry Unit Weight (pcf)	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Unconfined Compressions Consolidation Test				Triaxial Direct shear Grain Size Shear Test				
								Strength (psi)	Strain at failure e (%)	Com press index (cc)	void (eo)	Cohesion CLAY (psi)	Cohesion sand (psi)	SILT (%)	CLAY (%)	S.P Gravity
01	U-1	13.0	117.85	83.65	40.85			5.54	18.00	0.320	1.08	5 ⁰	2.50			
	D-2	10.0			40	54	26							6	67	26
	D-4	20.0			39	50	22							9	68	23
	D-8	40.0												13	67	20
	D-10	50.0												16	66	18
	D-12	60.0												78	22	-

6.22.2 Soil test results in Pushpakati Range, Satkhira

Table 6.45
Soil test results in Pushpakati Range, Satkhira

SUMMARY OF TEST RESULTS								LOCATION: St. Pushpakati Range Satkhira, West Forest Division, KHULNA									
Bore Hole No.	Sample No.	Depth In Ft./m	West Unit Weight (pcf)	Dry Unit Weight (pcf)	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Unconfined Compressions Consolidation Test				Triaxial Direct shear Grain Size Shear Test					
								Strength (psi)	Strain at failure (%)	Compr ess index (cc)	void (eo)	Cohesion CLAY (psi)	Cohesion sand (psi)	SILT (%)	CLAY (%)	S.P Gravity	
01	U-1	13.0	120.30	89.90	34.48			8.34	14.00	0.220	0.880						
	D-3	15.0			40	54	27						8	67	25	2.66	
	D-5	25.0			34								9	69	22	2.67	
	D-7	35.0											10	71	19		
	D-09	45.0										29 ⁰	1.30	80	20	-	

Source: Field survey report

6.23 SALINITY

6.23.1 Soil salinity Test Result (1975-2011) in coastal areas

Table 6.46

Extent of Soil salinity during the last four decades (1975-2011) in coastal areas

Salt affected area (000'ha)				Salinity class and area (000'ha)											
				SI 2.0-4.0 dS/m		S2 4.1-8.0 dS/m				S3+S4 8. 1-16.0 dS/m			SS >16.0dS/m		
1975	2000	2009	2011	1975	2000	2009	2011	1975	2000	2009	2011	1975	2000	2009	2011
833.45	1020.75	1056.26	1065.20	287.37	289.76	328.43		426.43	307.20	274.22		79.75	336.58	351.69	
												39.90	87.14	101.92	

Source: Field survey report

$S_3 = 8.1-12.0 \text{ dS/m}$, $S_4 = 12.1-16.0 \text{ dS/m}$.

A comparative study of the salt affected area between 1975 to 2011 showed that about 0.223 million ha (26.7%) new land is effected by various degrees of salinity during about the last four decades. It was also found that about 0.0354 million hectares of new land is affected by various degrees of salinity during last 11 years only (2000-2011). Up-zila wise soil salinity classes and district wise mapping units of Soil Salinity map, 2009 are given in appendix 1 and 2.

All soils contain some water soluble salts. Plants absorb essential plant nutrients in the form of soluble salts, but excessive accumulation of soluble salts, called soil salinity, suppresses plant growth. Saline or salt affected soils are common in coastal area in tropical regions, arid and semi-arid regions. Salts in the soils occur as ions. Ions are released from weathering minerals in the soil. Soil may be saturated with soluble salts due to sea water flooding. They may also be applied in irrigation water or as fertilizers, or migrate upward in the soil from shallow ground water. When precipitation is insufficient (December-June) to leach ions from the soil profile, salts accumulate in the soil and soil salinity can result in Bangladesh.

Poor drainage and/or poor irrigation water often contribute to soil salinity. As plants absorb soil water or as water evaporates, salts from the water remain in the soil. For this reason, soil salinity will usually be greater than the salinity of the irrigation water used. Improper irrigation management increases the risk of developing soil salinity. To prevent salt buildup, enough water must be passed through the root zone to leach salts from the soil. Keep in mind that some of these salts are also essential plant nutrients.

6.23.2 Present soil salinity status in coastal areas

It is anticipated that withdrawal of fresh river water from upstream, irregular rainfall, introduction of brackish water for shrimp cultivation, faulty management of the sluice gates and polders, regular saline tidal water flooding in unprotected area, capillary rise of soluble salts etc. are the main causes of increased soil salinity in the top soils of the coastal region.

The present spatial distribution of saline soils was assessed in 2009 through ground survey following reconnaissance soil survey technique using different base materials such as aerial photographs, top-secret, Upazila Soil and Landform map, previous published Soil salinity map etc. Distribution of soils with different degrees of salinity is shown on Soil Salinity map, 2009. Out of about 1.689 million hectares of coastal land about 1.056 million hectares are affected by soil salinity of various degrees. About 0.328, 0.274, 0.189, 0.161 and 0.101 million hectares of land are affected by very slight (Si), slight (82), moderate (83), strong (84) and very strong salinity (85) respectively. Some of

the new land of Satkhira, Patuakhali, Borguna, Barisal, Jhalakathi, Pirojpur, Jessor, Narail, Gopalganj and Madaripur districts are affected by different degrees of salinity, which reduces agricultural productivity remarkably. A comparative study of soil salinity during last four decades (1973-2009) in coastal areas is shown in table 2. About 50% of the coastal lands face different degrees of inundation, thus limiting their effective use. This situation is expected to become worse further because of the effects of climate change. Cropping intensity may be increased in very slight and slightly saline areas by adopting proper soil and water management practices with the introduction of different salt tolerant varieties of crops.

Table 6.47

A comparative study of the salt affected area between 1975 to 2011 in coastal areas

Salt affected' area (000'ha)			Salt affected area increased during last 9 years (000'ha) (2000- 2011)	Salt affected area increased during last 36 years (000'ha) (1975-2011)
1975	2000	2011	35.51 (3.5%)	222.81 (26.7%)
833.45	1020.75	1056.26		

6.23.3 Salt Characteristics

Highest salt accumulation is observed in Ganges tidal floodplain. In this physiographic unit maximum electrical conductivity is recorded as 49.5 dS/m. In topsoil it varies from 0.3 to 70.0 dS/m. The amount of accumulated salt is found higher at the surface horizon. It decreases with depth and then increases again in all the pedons. The highest total soluble salts (3122 mg/L) are found under brackish water shrimp cultivation. Among the four physiographic units, the amount of accumulated salts preponderance decrease in the order Ganges tidal floodplain > Lower Meghna estuarine floodplain > Ganges river meander floodplain > Peat basin. Electrical conductivity (EC_c) of almost all the soils decreases with depth and then increases again due to influence of saline ground water. The higher EC_e value at the surface horizon followed by lower

value with depth is due to flooding with saline water or accumulation of salts through upward capillary movement of saline ground water. In shrimp cultivated areas, flooding with high saline water for a considerable time in each year causing higher soil salinity in all the horizons.

It is observed that Na^+ , Ca^{2+} , Mg^{2+} and K^+ ions are the dominant cations in different saline areas. On the other hand SO_4^{2-} and Cl^- ions are the dominant anions. In most of the saline soils the ionic preponderance decreased in the order of $\text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+$. But in the soils under prolonged brackish water shrimp cultivated areas, ionic preponderance decreased in the order of $\text{Na}^+ > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{K}^+$.

In most of the pedons and minipits the ionic preponderance decreased in the order of $\text{SO}_4^{2-} > \text{Cl}^- > \text{HCO}_3^-$ and in some pedons and minipits the ionic preponderance decreased in the order of $\text{Cl}^- > \text{HCO}_4^- > \text{HCO}_3^-$. Soluble CO_3^{2-} is found nil or trace in all the pedons. Sodium chloride salts were found more toxic than sodium sulphate in most of the cases.

As salt concentration increases, water becomes increasingly difficult for the plant to absorb. A plant can actually die from water stress or drought in a moist soil if the salt concentration becomes high enough. Other effects of salts on plants are toxicities of specific salts and nutritional imbalances. Some elements, such as sodium, chlorine and boron have specific toxic effects on plants. Plants Sensitive to these elements may be affected at relatively low salt levels in the soil can upset the nutrient balance in the plant or interfere with the uptake of some nutrients

6.23.4 Present Cropping Pattern

Present cropping pattern is mainly determined by the depth, duration and recession time of seasonal flood water, dry season soil salinity and availability of fresh irrigation water in the dry season. During field survey 60 different cropping patterns have been identified in these areas. It is evident that a considerable change in land use during this period has been occurred. During field survey 9 modern transplanted aman and 7 modern boro varieties were identified in the farmer's field. Presently, cropping intensity has increased. Early winter vegetables are intensively cultivated through relay cropping with

Transplanted aus along with the cultivation of hybrid cowpeas, hybrid tomato, hybrid khirai, hybrid chilli, hybrid raddish, hybrid watermelon in south east and southern part, particularly in Cox's Bazar sadar, Chakaria, Maheshkhali and Kalapara upazillas. Among several production problems, soil salinity in the major constraints. The problem is particularly acute in those areas where soil salinity is relatively high. Moreover, most of the vegetable crops are said to be very sensitive to saline condition and their yield decreased from 6-19% with each unit increase in salinity. Due to high soil and water salinity cropping intensity reduced considerably. Farmer's ignorance and less imitativeness are also partly responsible for less cropping intensity in this region. Mapping unit wise major present cropping pattern with area is shown. The main reason of changing crops/cropping patterns are-

- Climatic variability.
- Increased salinity and tidal surges.
- Increasing demand of early winter vegetables in the market.
- Increased demand of cash/high value crop.
- Changed/increased demand of food grains.
- Intrusions of saline water/pushing saline water in confined areas (Gher areas) for brackish water shrimp cultivation.
- Introduction of salt tolerant rice varieties.

6.23.5 Plant Responses

Symptoms of salt injury in plants resemble drought. Both conditions are characterized by water stress (wilting) and reduced growth. Severe injury caused by prolonged exposure or high salinity results in stunted plants and tissue death. Reduced growth caused by salinity is a progressive condition that increases as salinity increases above a plant's tolerance threshold.

Plants vary in their response to soil salinity. Salt tolerant plants are better able to adjust internally to the osmotic effects of high salt concentrations than salt sensitive plants. Salt-tolerant plants are more able to absorb water from saline soils. Salt sensitive plants have a limited ability to adjust and are injured at relatively low salt concentrations. Many horticultural and landscape (field)

plants are classified as sensitive or moderately sensitive to soil salinity. The plants listed are offered as representative of a salt tolerance group. The plants listed can be used to determine the salt tolerance of closely related plants or plants adapted to similar sites. The tolerance rating in is to be interpreted only as a guide in making comparisons among plants and supply generally from late seedling stage to maturity.

Specific plant tolerances are affected by climate (rainfall and temperature), soil conditions, cultural practices, and variety selection. During cool and wet weather when plant transpiration demands are low and leaching is much higher than capillary upward movement, salt injury will be less than during hot, dry weather. There is a wide variation in salt tolerance among varieties or root stocks of some species.

6.23.6 Effect of salinity on growth, development and yield on vegetables

The general effect of soil salinity on plants is called an osmotic effect. This means that salts increase the energy with which water is held in the soil. In other words, the soil must be kept wetter to supply the same amount of plant-available water as would be present within the salts. Plants then must increase the energy they expend to obtain water from the soil. They must use energy to get water that would otherwise be used for growth, flowering, or fruiting. When the soil salinity exceeds a plant's tolerance, growth reductions occur. Salinity tolerance of a crop not only varies among crops/varieties but depends upon environment and cultural practices also. Therefore, to have more realistic assessment of salinity tolerance of a given crop, the value of soil salinity at which initial yield decline begins and percentage yield decline with per unit increase in salinity is given in Table 6 for different vegetable crops only.

Table 6.48

Soil salinity (dS/m) at which initial yield decline begins and percent (%) yield increase in salinity

Name of the Crop	Soil salinity at which initial yield decline begins	Percent yield decline with per unit increase in salinity
Bean	1.0	19.0
Broad bean	1.6	9.6
Broccoli	2.8	9.2
Cabbage	1.8	6.2
Carrot	1.0	14.0
Celery	1.8	6.2
Cucumber	2.5	13.0
Lettuce	1.3	13.0
Onion	1.2	16.0
Pepper	1.5	14.0
Potato	1.7	12.0
Radish	1.2	13.0
Spinach	2.0	7.6
Sweet corn	1.7	12.0
Squash	3.2	16.0
Tomato	2.5	9.9
Turnip	0.9	9.0

Source: Technical Bulletin-1, Hisar Agricultural University

6.23.7 Induction to salt tolerance

Several methods like prolonged cultivation in increasingly saline soils, presuming soaking treatment in salt, growth substance, micronutrients and other chemicals, spraying with various regulator solutions, dipping the intact flowering or fruiting branches in salt solution and grafting on salt tolerant root stocks have been used to induce salt tolerance in different crops (Technical

Bulletin-1). Very little efforts have been made on different crops including vegetables in this connection in Bangladesh. Some successful efforts have been made in case of onion, tomato, okra, cauliflower and potato crops in different countries and the results are summarized.

Table 6.49

Salt tolerance induction in some vegetable crops

Name of the crop	Name of the chemical/growth substance	Concentration	Method of treatment	Time for treatment (Hours)
Cauliflower	Cycocel	250ppm	Root dipping for transplants	2.0
Okra	Cycocel	500ppm	Seed soaking	6.0
Onion	Cycocel	1.0%	Root dipping for transplants	8.0
Potato	Sodium salt solution or Cycocel	6.0 dS/m EC or 250ppm	Tuber soaking	2.0
Tomato	Sodium salt solution	8.0 dS/m EC	Root dipping for transplants	2.0

Source: Technical Bulletin-I, Hisar Agricultural University

6.23.8 Major agricultural constraints

Higher cropping intensity is observed in mapping unit 1 to 3. In mapping unit 4 and 5 it is considerably less due to higher soil and water salinity in dry season. Several agricultural constraints are identified in coastal saline areas. The dominant soil, land and water related constraints are mentioned below.

- Strong to very strong soil salinity.
- Limited scope of ground water and river water enlistment for irrigation.
- Severe scarcity of quality irrigation water during dry season.
- Late draining condition in early dry season in considerable areas.

- Prolonged artificial water logging with saline water for aquaculture.
- Cyclone and tidal bore.
- Heavy soil consistency.
- Presence of toxic potential acid sulphate soil in some areas.
- Relatively high flooding depth during monsoon season for HYV transplanted amen crop.
- Presence of peat soils having low bearing capacity and very late draining condition.

Mapping unit wise major constraints on agricultural productivity is presented is presented below in Table 6.50

Table 6.50

Major agricultural constraints

Mapping unit on	Major agricultural constraints on agricultural productivity
1 Non saline with some very slightly saline	▪ Very slight to slight soil salinity. ▪ Perennial water logging due to inadequate drainage facilities.
2 Very slightly saline with some slightly saline	▪ Very slight to moderate soil salinity. ▪ Scarcity of quality irrigation water during dry season. ▪ Moderately deep flooding in monsoon season and risk of flush flood. ▪ Existence of peat soil with low bearing capacity. ▪ Perennial water logging due to inadequate drainage facilities.
3 Slightly saline with some moderately saline	▪ Very slight to strong soil salinity. ▪ Scarcity of quality irrigation water during dry season. ▪ Scope of ground and river water enlistment for irrigation is limited. ▪ Perennial water logging due to inadequate drainage facilities. ▪ Prolonged artificial water logging with saline water for aquaculture. ▪ Existence of toxic buried potential acid sulphate layer. ▪ Flush flood.
4 & 5 Strongly saline with some moderately saline	▪ Slight to very strong soil salinity. ▪ Severe scarcity of quality irrigation water during dry season.

& Very strongly saline with some strongly saline	▪ No scope of ground and river water enlistment for irrigation. ▪ Prolonged artificial water logging with saline water for aquaculture. ▪ Existence of toxic potential acid sulphate soil. ▪ Cyclone and tidal bore.
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6.24 TOP DYING

6.24.1 Top dying of sundri (*Heritiera fomes*)

This is by far the most important of all the diseases and disorders occurring in the Sundarbans. Top dying has been seen to be more prevalent in compartment nos. 19, 20, 26, 28, 32, 33, 36, 37, 38, 39 and 40. Very little or no top dying is seen in the compartments nos. 53, '54, 55, 51 A, 51 B, 49, SOB, 48, 47 and 46 under Satkhira range. Top dying of sundri and dieback of the foliage and twigs of a part of the a-own appears as a decline. In case of older trees one or more of the major branches may die and then gradually other branches die and ultimately the crown is substantially reduced. In relatively younger aged sundri stands most of the affected sundri may be found to be dead and truncated. This observation is quite comparable with the data provided by ODA (Chaffey, et al 1985). However, there is currently severe top dying in some areas such as in compartments 19, 20, 36 and 37 where ODA did not find severe occurrence of top dying. From compartments 19 20 32 36 37 38 and 39 top dying trees either have already been felled.

Cracked perennial gall cankers are often seen associated with dead branches of sundri. Such trees are also attacked by borers and wood decay fungi. Death of small twigs may be due to the occurrence of gall-cankers, but trees are also seen where only small twigs and branches die and there are no gall cankers. It is not known when the initial stage of death of twigs and small branches occur. During October to December, dead twigs and branches have been seen on May hundreds of trees but in no case were dying branches seen. Further observation of January onward 'is needed to detect the early stage of symptom expression.

In still other cases, top dying trees are seen to develop very reduced, deformed and bronze color leaves of very little photosynthetic potential. With the development of such moribund leaves, such trees seem to be degenerating at a fast rate. This sort of symptoms is seen in areas where most of the pneumatophores have been buried partially in such sites massive death of trees occurs.

Sundri affected by top dying are sometimes heavily colonized by a fern *Drynana quercifolia* by mistletoe, *Dendrophthoe falcate*, or by an orchid *Sarcanthus appendiculatus*, but the incidence of these are not sufficiently abundant or consistent to suggest that they are of a primary consideration as a cause of the disorder.

6.24.2 Prevalence of Top Dying of Sundri

In the Sundarbans there are 9 blocks having 55 compartments. Top dying has been found to prevail in all the nine blocks in the Sundarbans. According to the inventory conducted by ODA in 1983/84, out of 55 compartments in the Sundarbans, in 14 compartments (viz. 6, 14, 21, 23, 25, 26, 28, 32, 33, 38, 39, 45, 46 and 47), top dying of sundri were found to be severe.

By 1991-92 severe top dying of sundri damage was prevalent in other compartments (viz 19, 20, 36 & 37) as well. Moderate top dying has been seen to be prevailing in compartments 17, 18, 31, 35, 40 & 42. Thus an increasing build up of top dying has warranted salvage extraction of top dying sundri in the Sundarbans by the Forest Department which was started during 1990-91 and by 1991-92 it was completed in compartments 32, 36, 37 and 3E. By 1993-94 salvage extraction of top dying sundri was completed in compartments 20 and 39 as well.

In general, a higher incidence of top dying occurs in the mixed gewa-sundri forest type than in the other forest types in which sundri is a major component. On the contrary, in majority of the blocks, top dying of sundri is absent in the sundri-passur and sundri-kankra forest types. The influence of different association of sundri on the incidence of top dying need further study.

6.24.3 Data generated during the present study

6.24.3.1 Extent of death of main stem in top dying sundri

At Jaliakhal, in compartment 20, one of the sites was seen to be severely affected by top dying. In that site there has been a lot of siltation as evidenced by virtual burial of the pneumatophores of most of the trees. This was particularly true in case of sundri. In that site most of the sundri have either died or are in the process of dying. But at a short distance from the site on the other side of Jaliakhal there were apparently healthy sundri stand having scattered top dead trees. It was, therefore, considered useful to assess the extent of death of main stems because of top dying in the severely affected area and that of a scattered top dying area. Another site of top dying area was found at PSP 56 on the west bank of Hangshowraj River in compartment 20. On all these three sites sundri trees were randomly examined, and in case of a top dying tree the extent of death of the main stem was visually estimated and then percent of the main stem still healthy and the portion affected by top dying (including portion already broken) was estimated and recorded for individual tree. To compare these data, actual measurement were taken of healthy portion and top dead 'portion of the main stem of 18' felled sundri trees at Gewakh top dying Felling Coupe during the present study In late 2009.

The results show that on the two top dying sites 0110% and 8331% of the main stem were found to still remain healthy and capable of producing saw logs while the remaining portions were dead and/or truncated. This visual estimation was in good agreement with the data obtained from actual measurement in which case 20% of the main stem was found to have healthy wood and the remaining 21 80% had dead stem. In the case of the worst top dying affected site 46 11% of the main stem had healthy wood while the remaining 53 89% of the stem had already dead top. This mean value of 53.89 is highly significantly greater ($P=0.001$) than the remaining three mean values obtained from top dying areas. It thus, suggests that the most severely affected site had separate factors which have really aggravated the severity of top dying as compared to other sites having scattered top dying.

6.24.3.2 Loss of wood quality associated with top dying of sundri

It has already been established that the portion of sundri stems which have been killed by top dying are subjected to invasion by decay fungi. Deterioration of wood resulting from decay renders the wood unsuitable for lumber production. Partially decayed logs are still useable for the production of hardboard. However they command a significantly lower price than do sound logs. Data were collected on the volume of individual trees affected by top dying and the resultant ratio of degraded volume. Forest Department's Sundri Top Dying Felling and Marking Registers were examined for compartments 32, 36, 37, 38 and 39. For each compartment, records from each of 25 trees, which yielded at least one saw log and had a minimum top inner bark diameter of 10 cm, were randomly selected from the records. Volume of each tree was calculated using volume regression equations developed for sundri by Chaffey *et al.* (1985). Volume loss due to bucking and undercutting, based on data collected in compartment 39 by Larsen (2009), was subtracted from each tree. This provided an estimate of potential tree volume. The volume and proportion of decayed wood was estimated for each tree by subtracting the sound volume recovered per tree as recorded in the marking and felling registers from the calculated potential volume.

Results of this study with 25 felled sundri trees from each of compartments 32, 36, 37, 38 and 39 indicate that an average of 42.72% (Range 31.91 - 43.67%) of the total wood volume recovered from these trees is degraded and become unsuitable for lumber production. Such wood is used only for production of hardboard. On an average 49.33% (range 41.35% to 62.14%) wood provided saw logs and 7.95% wood was lost due to buck cut and undercut.

6.24.3.3 Extent and occurrence of dead trees among top dying sundri

According to the marking and felling registers, a portion of the trees harvested in stands affected by top dying of sundri were totally dead. For these trees, the entire volume is assumed to be unsuitable for lumber production. A significant level of tree mortality in affected compartments would further increase the volume of degraded wood unsuitable for lumber production.

An analysis of Forest Department's Sundri Top Dying Marking and Felling Registers was made to estimate the proportion of totally dead trees which were harvested. Records from Compartments 20, 32, 36, 37, 38 and 39 were examined. These produced a total of 85 525 individual tree records.

These records indicate that the proportion of totally dead trees harvested in the compartments averaged 15.69% and ranged from 1.59% to 37.85%.

6.24.3.4 Overall yields of sound and degraded wood from areas affected by top dying of sundri in the Sundarbans as determined in 2009

Overall proportion of degraded volume, considering the proportion of tree mortality, was subsequently estimated. Sundri Top Dying Marking and Felling Registers from compartments 32 (felling series 1A), 36 (felling series 1B and 2B), 37 (felling series 1A) and 38 (felling series 1A) were used as data sources. These provided records of 22518 harvested sundri trees.

The number of dead trees harvested in each compartment was taken directly from Forest Department's Sundri Top Dying Marking and Felling Registers. Counts of the number of totally dead trees harvested and their d b h and height were available but not their volume. Volume of each totally dead tree harvested was estimated from sundri tree volume regression curves (Chaffy et al 1985) and corrected for volume loss due to under cutting and bucking (Larsen 2009) the entire volume of these trees was considered to be degraded and useable only for hardboard. Sound volume of each top dying tree harvested in these compartments was obtained directly from the above marking and felling registers.

It has been estimated that a total of 4262.18 m wood was obtainable from 22518 dying sundri trees felled in four compartments (viz 32, 36, 37 and 38). Of this total, only 1803.60 m or 42.32% was estimated to be sound and suitable for lumber production, 1571.21 m or 36.86% was direct top dying degrade and the remaining 887.30 m 20.82% resulted from dead trees badly decayed (more commonly in the sapwood and rarely in the heartwood). Such wood is not suitable for lumber production and is used for making hardboard only. Thus overall degradation for the wood was 57.68% while log production amounted to 42.32% of the total volume of 4262.36 m³.

Table 6.51

Extent of different kinds of damages observed on the major tree species during 1988-89 in the 120 permanent samples plots (PSPs) established by the Forest Department in the Sundarbans.

Tree species	Total no. of tree assessed	No. of PSPs having trees which were found to be:					Percent of tree found to be:				
		D	TD	TB	BC	UC	D	TD	TB	BC	UC
Sundri	17027	61	35	42	47	20	.36	0.21	.25	.28	.12
Gewa	27199	74	58	38	49	27	.27	.21	.14	.18	.10
Goran	1339	9	1	0	1	0	.67	.07	0	.07	0
Baen	527	2	1	1	2	0	.38	.19	.19	.38	0
Amur	458	4	3	2	7	1	.87	.66	.44	1.53	.22
Keora	431	1	1	4	1	0	.23	.23	.93	.23	0
Kankra	324	0	0	1	2	0	0	0	.31	.62	0
Passur	297	1	0	7	6	0	.34	0	2.35	2.02	0
Singra	286	4	0	0	0	0	1.4	0	0	0	0
Dagor	129	2	1	0	0	0	1.5	.78	0	0	0
Dhundul	26	0	0	1	2	0	0	0	3.84	7.69	0
Total	48043						6.0	2.35	8.45	13.0	0.44

Note : D-dead, TD-top dying, TB-top broken (i.e. truncated), BC-broken by cyclone, UC-uprooted by cyclone; Sundri-*Heritiera fomes*, Gewa -*Excoecaria agallocha*, Goran- *Ceriops secandra*, Baen-*Avicennia officinalis*, Amur -*Amoora cucullata*, Keora-*Sonneratia apetala*, Kankra-*Bruguiera gymnorrhiza*, Passur-*Xylocarpus mekongensis*, Singra-*Cynometra ramiflora*, Dagor-*Cerbera manghas*, Dhundul -*Xylocarpus granatum*.

Table 6.52

Extent of death of the main stem of top dying sundri in the compartments 19 and 20 in the sundarbans during 1993.

Compartment No.	Site	Stand's condition	Method of Assessment	No. of tree	Mean percent of stem	
					Healthy	Dead
19	Jaliakhal	Severe top dying due to situation	Visual estimation	72	46.11	53.89
19	Jaliakhal	Scattered top dying	Visual estimation	72	81.10	18.90
20	PSP56	Scattered top dying	Visual estimation	80	83.31	16.56
20	Gewakha li felling area	Scattered top dying	Actual measurement	18	78.20	21.80
Note.***- highly significantly ($p=0.001$)						

Table 6.53

Percent (%) wood loss due to top dying of sundri in the compartments 32, 36, 37, 38 and 39 in the Sundarbans during 1993.

Compartment No.	No. of Trees studied	Estimated total wood (25 trees) to top 10 cm under bark (in m ³)	Useable wood actually obtained (in m ³)	Wood loss due to buck cut and undercut (in m ³)	Wood loss due to top dying (in m ³)	% wood loss due to top dying (in m ³)	% sound wood (in m ³)
32	25	6.025	2.905	0.489	2.631	43.67	48.22
36	25	8.675	3.587	0.798	4.290	49.45	41.35
37	25	5.875	3.651	0.349	1.875	31.91	62.14
38	25	6.025	2.905	0.489	2.631	43.67	48.22
39	25	5.820	2.945	0.451	2.424	41.65	50.60
All	125	32.420	15.993	2.576	13.851	42.72	49.33

Notes: Data for Compartment No.39 were taken from Larsen (1993); Data for Compartments 32, 36, 37 and 38 on usable wood were computed from the Sundarbans Forest Division's Top Dying Felling and Marking Registers, and those of total wood volume were calculated from d.b.h. data by using volume regression for sundri provided.

Table 6.54

Extent of the occurrence of totally dead top dying trees among the trees marked and felled as top dying in the Compartments 20, 32, 36, 37, 38 and 39 in the Sundarbans during 1993.

Compartment No.	Felling Group	No. of felled top dying trees	No. of dead trees	% of tally dead trees
20	2A	11272	673	5.97
	3A	20171	2837	14.06
32	1A	4813	885	18.39
	4B	4568	1635	35.79
36	1B	1950	738	37.85
	2A	1960	155	7.91
	2B	1950	224	11.49
	4B	1960	299	15.26
37	1A	5805	92	1.59
	2B	5750	312	5.43
38	1A	8000	2721	34.01
39	All groups	17326	2849	16.44
Grand Total		85525	13420	15.69

Table 6.55

Percent(%) occurrence of sound wood (i.e. saw logs) and degrade wood (i.e. of dead trees) among top dying sundri in compartments 32, 36, 37 and 38 in the sundarbans during 1993.

Com part-ment No.	No. of trees	No. of trees yielding saw logs	No. Of dead trees	Total timber yield from saw logs (M ³)	Total wood degra de due to top dying (M ³)	Total wood yield from dead trees (M ³)	Total yield of wood (M ³)	%soun d wood as logs	%woo d degra de in trees giving saw log	%woo d degra de from dead trees	% total degra de
32	4813	3928	885	428.62	388.17	368.74	1185.53	36.15	32.74	31.10	63.84
36	3900	2938	962	483.19	577.84	162.61	1223.64	39.49	47.22	13.29	60.51
37	5805	5756	92	416.37	213.81	22.39	652.57	63.81	32.76	3.43	36.19

38	8000	5279	2721	475.49	391.39	333.56	1200.4	39.61	32.60	27.79	60.39
							4				
All	22518	17901	4617	1803.6	1571.2	887.30	4262.3	42.32	36.86	20.82	57.68
				0	1		6				

Table 6.56

Frequency of occurrence of heart rot and sap wood rot in the sundri logs stored in the Timber Yard of Khulna Hard Board Mills.

No. of samples	No. of logs in each sample	Mean percent of samples + t.se (at P=0.05)		
		Without decay	Heart rotted	Sap rotted
30	100	74.77 + 2.87	7.63 + 1.21	17.60 + 2.83***

Notes : *** = highly significantly (P=0.001) greater than heart rotted mean

Table 6.57

Determination of the extent sap wood rot, heart wood rot and beetle tunnels in top dying sundri samples collected from the compartment 38 and 39 in the Sundarbans during 1993.

Sample type	No. of sample	% of sample showing			Mean extent of damage (as % of total length of sample)		
		Sap rot	Heart rot	Insect tunnel	Sap rot	Heart rot	Insect tunnel
A	5	100	60.0	60.0	53.6**	37.9	6.2
B	14	85.7	57.1	78.6	26.3	22.5	13.0
C	15	100	40.0	86.7	41.4	24.3	23.7
D	18	88.3	44.4	66.7	31.8	28.1	23.0
ALL(A-D)	52	93.5***	50.4	78.0	38.3*	28.2	16.5

Notes: A- Top broken but no sign of decay downwards, crown with good foliage; B-Top broken, slight decay observed, crown with good foliage; C-Top dead and gradually progressing downwards; D-Top dead and almost without any foliage, stand severely affected by top dying.

Table 6.58

Comparison of the level of top dying of sundri during 1986-87 and 1988-89 in the PSPs represented in sundri, sundri-gewa, and gewa-sundri forest types in the Sundarbans.

Forest type	No. of PSPs	Year of Observation	Total no. of Sundri	Percent of PSPs having trees			Percent of trees		
				Dead	Top dead	Top broken	Dead	Top dead	Top broken
Sundri	14	1986-1987	2501	100.0	50.0	28.5	3.3	1.2	60.3
	14	1988-1989	2573	85.7	35.7	35.7	0.8	1.7	0.7
Sundri - gewa	30	1986-1987	8170	43.3	60.0	26.7	0.7	0.8	0.2
	30	1988-1989	8313	66.7	33.3	40.0	0.8	1.4	0.7
Gewa-sundri	30	1986-1987	5737	76.7	63.3	-	1.4	0.7	-
	30	1988-1989	5383	66.7	50.0	46.7	1.0	1.5	1.3

Notes : D- dead, TD - Top dying, TB - top broken (i.e. truncated)

Table 6.59

Summarized data from 12 Permanent Sample Plots and corresponding ODA plots showing the extent of different categories of top dying of sundri in the Sundarbans.

Study area	Period of study	No. of sundri trees studied	Percent distribution of sundri trees in six categories					
			G1	G2	G3	G4	Dead	Fuel wood quality tree
12 PSPs	1993	2015	79.05	11.34	4.62	2.79	1.22	-
12 ODA Plots	1983-84	479	50.18	22.48	5.13	4.73	0	17.5

Notes: 1. The Permanent Sample Plots (PSPs) studied in November 1993 were No. 3 (in Compartment 1), 13 (Compt. 32), 16 (Compt.1), 22 (Compt.12), 33 (Compt.13), 35 (Compt.24), 46 (Compt.9), 50 (Compt.5), 52 (Compt.6), 63 (Com.10), 67 (Compt.6) and 69 (Compt.4).

2. The ODA Plots Nos. of 1983-84 inventory in and around which the above PSPs were established in 1986-87 were 103, 416, 147, 165, 208, 372, 58, 33, 71, 134, 122 and 239. The presented data of ODA plots were collected during 1983-84. ** - significantly greater at $P=0.01$.

G1 - Crown unaffected, G2-twigs dying or dead but main branches unaffected/G3-main branches dying or dead but less than 50% of the crown affected, G4-main branches dying or dead and 50% or more of the crown affected, F-trees yielding only fuel wood.

Table 6.60

Extent of different kinds of damages observed on the major tree species during 2002-2003 in the 120 permanent samples plots (PSPs) established by the Forest Department in the Sundarbans.

Tree species	Total no. of trees assessed	No. of PSPs having trees which were found to be:					Percent of tree found to be:				
		D	TD	TB	BC	UC	D	TD	TB	BC	UC
Sundri	25522	95	70	78	65	35	0.37	0.27	0.30	0.25	0.13
Gewa	52340	125	80	55	85	50	0.24	0.15	0.11	0.16	0.09
Goran	2710	15	3	2	3	0	0.55	0.11	0.07	0.11	0
Baen	1060	3	2	2	3	1	0.28	0.19	0.19	0.28	0.09
Amur	900	7	5	3	12	3	0.78	0.56	0.33	1.33	0.33
Keora	870	17	15	7	3	0	1.95	1.72	0.80	0.34	0
Kankra	640	2	0	12	7	0	0.31	0	1.88	1.09	0
Passur	605	5	0	1	0	0	0.83	0	0.17	0	0
Singra	575	3	3	0	0	0	0.52	0.52	0	0	0
Dagor	252	2	1	0	0	0	0.79	0.40	0	0	0
Dhundul	51	0	0	2	3	0	0		3.92	5.88	0
Total	85525						6.62	3.92	7.77	9.44	0.64

Source: Field survey report

Note : D-dead, TD-top dying, TB-top broken (i.e. truncated), BC-broken by cyclone, UC-uprooted by cyclone; Sundri-*Heritiera fomes*, Gewa -*Excoecaria agallocha*, Goran-*Ceriops secandra*, Baen-*Avicennia officinalis*, Amur -*Amoora cucullata*, Keora-*Sonneratia apetala*, Kankra-*Bruguiera gymnorrhiza*, Passur-*Xylocarpus mekongensis*, Singra-*Cynometra ramiflora*, Dagor-*Cerbera manghas*, Dhundul -*Xylocarpus granatum*.

Table 6.61

Extent of death of the main stem of top dying sundri in the compartments 19 and 20 in the Sundarbans during 2011.

Compartment No.	Site	Stand's condition	Method of Assessment	No. of tree	Mean percent of stem	
					Healthy	Dead
19	Jaliakhal	Severe top dying due to situation	Visual estimation	92	45.3	54.70 ***
19	Jaliakhal	Scattered top dying	Visual estimation	92	82.30	17.70
20	PSP56	Scattered top dying	Visual estimation	110	84.30	15.7
20	Gewakhali felling area	Scattered top dying	Actual measurement	28	80.20	19.8

Note. ***- highly significantly ($p=0.001$)

Source: Field survey report

Table 6.62

Percent (%) wood loss due to top dying of sundri in the compartments 32, 36, 37, 38 and 39 in the Sundarbans during 2011.

Compartment No.	No. of Trees studied	Estimated total wood (25 trees) to top 10 cm underbark (in m ³)	Useable wood actually obtained (in m ³)	Wood loss due to buck cut and undercut (in m ³)	Wood loss due to top dying (in m ³)	% wood loss due to top dying (in m ³)	% sound wood (in m ³)
32	25	8.025	3.905	0.489	3.631	44.67	47.22
36	25	10.675	4.587	0.798	5.290	50.45	40.36
37	25	7.025	3.905	0.489	2.631	32.91	51.14
38	25	8.025	3.905	1.489	2.631	44.67	47.22
39	25	7.675	3.587	0.798	3.290	40.66	51.60
All	125	41.525	19.889	4.063	17.473	45.72	49.28

Source: Field survey report

Notes: Data for Compartment No.39 were taken from Larsen (1993); Data for Compartments 32, 36, 37 and 38 on usable wood were computed from the Sundarbans Forest Division's Top Dying Felling and Marking Registers, and those of total wood volume were calculated from d.b.h. data by using volume regression for sundri provided.

Table 6.63

Extent of the occurrence of totally dead top dying trees among the trees marked and felled as top dying in the Compartments 20, 32, 36, 37, 38 and 39 in the Sundarbans during 2011.

Compartment No.	Felling Group	No. of felled top dying trees	No. of dead trees	% of tally dead trees
20	2A	13250	722	5.45
	3A	22262	3050	13.70
32	1A	4950	910	18.38
	4B	4770	1740	36.48
36	1B	2185	750	34.32
	2A	2190	160	7.31
	2B	2185	250	11.44
	4B	2190	300	13.70
37	1A	6000	105	1.75
	2B	5900	320	5.42
38	1A	8200	2750	33.54
39	All groups	19500	2920	14.97
Grand Total		88272	13689	15.51

Source: Field survey report

Table 6.64

Percent ((%) occurrence of sound wood (i.e. saw logs) and degrade wood (i.e. of dead trees) among top dying sundri in compartments 32, 36, 37 and 38 in the sundarbans during 2011.

Compart-ment No.	No. of trees	No. of trees yielding saw logs	No. Of dead trees	Total timber yield from saw logs (M ³)	Total wood degrade due to top dying (M ³)	Total wood yield from dead trees (M ³)	Total yield of wood (M ³)	%soun d wood as logs	%wood degrade in trees giving saw log	%wood degrad e from dead trees	% total degrad e
32	4910	4020	890	432.62	388.17	368.74	489.53	36.15	32.74	31.10	63.84
36	4095	3100	995	390.17	677.84	165.61	1233.62	39.49	47.22	13.29	60.51
37	6205	6100	105	388.74	325.81	22.39	736.94	63.81	32.76	3.43	36.19
38	8300	5380	2920	485.19	370.39	349.56	1205.14	39.61	32.60	27.79	60.39
All	23510	18600	4910	1696.7	1762.21	1006.3	4365.23	92.32	36.86	20.82	57.68

Source: Field survey report

Table 6.65

Frequency of occurrence of heart rot and sap wood rot in the sundri logs stored in the Timber Yard of Khulna Hard Board Mills.

No. of samples	No. of logs in each sample	Mean percent of samples + t.se (at P=0.05)		
		Without decay	Heart rotted	Sap rotted
30	100	70.77 + 2.87	6.50 +1.21	16.40+ 2.83***
Notes : *** = highly significantly (P=0.001) greater than heart rotted mean				

Source: Field survey report

Table 6.66

Determination of the extent sap wood rot, heart wood rot and beetle tunnels in top dying sundri samples collected from the compartment 38 and 39 in the Sundarbans during 2011.

Sample type	No. of sample	% of sample showing			Mean extent of damage (as % of total length of sample)		
		Sap rot	Heart rot	Insect tunnel	Sap rot	Heart rot	Insect tunnel
A	5	110.00	68.00	68.00	53.6***	37.9	6.2
B	14	90.50	65.20	75.40	26.3	22.5	13.0
C	15	110.00	47.30	94.50	41.4	24.3	23.7
D	18	98.50	48.40	72.70	31.8	28.1	23.0
ALL(A-D)	52	95.5***	53.5	80.5	40.3***	30.3	17.5

Source: Field survey report

Notes: A- Top broken but no sign of decay downwards, crown with good foliage; B-Top broken, slight decay observed, crown with good foliage; C-Top dead and gradually progressing downwards; D-Top dead and almost without any foliage, stand severely affected by top dying.

Table 6.67

Comparison of the level of top dying of sundri during 2009-2010 and 2010-2011 in the PSPs represented in sundri, sundri-gewa, and gewa-sundri forest types in the Sundarbans.

Forest type	No. of PSPs	Year of Observation	Total no. of sundri	Percent of PSPs having trees			Percent of trees		
				Dead	Top dead	Top broken	Dead	Top dead	Top broken
Sundri	14	2000-2001	3240	100.0	50.0	30.2	3.08	1.54	0.93
	14	2002-2003	3875	82.7	37.5	37.5	2.13	0.96	0.96
Sundri - gewa	30	2000-2001	12200	45.3	65.0	28.2	0.37	0.53	0.23
	30	2002-2003	13350	60.8	35.0	42.0	0.46	0.26	0.31
Gewa-sundri	30	2000-2001	8920	80.2	65.2	-	0.90	0.73	-
	30	2002-2003	8850	67.5	50.0	46.2	0.76	0.56	0.52

Notes : D- dead, TD - Top dying, TB - top broken (i.e. truncated)

Source: Field survey report

Table 6.68

Summarized data from 12 Permanent Sample Plots and corresponding ODA plots showing the extent of different categories of top dying of sundri in the Sundarbans.

Study area	Period of study	No. of sundri trees studied	Percent distribution of sundri trees in six categories					
			G1	G2	G3	G4	Dead	Fuel wood quality tree
12 PSPs	2011	5040	136.2	8.45	3.95	1.80	1.30	-
12 PSPs	2003	3540	107.9	10.5	4.20	2.10	1.10	-
12 PSPs	1993	2015	79.05	11.34	4.62	2.79	1.22	-
12 ODA Plots	1983-84	479	50.18	22.48	5.13	4.73	0	17.5

Source: Field survey report

Notes: 1.The Permanent Sample Plots (PSPs) studied in November 1993 were No. 3 (in Compartment 1), 13 (Compt. 32), 16 (Compt.1), 22 (Compt.12), 33 (Compt.13), 35 (Compt.24), 46 (Compt.9), 50 (Compt.5), 52 (Compt.6), 63 (Com.10), 67 (Compt.6) and 69 (Compt.4).

2. The ODA Plots Nos. of 1983-84 inventory in and around which the above PSPs were established in 1986-87 were 103, 416, 147, 165, 208, 372, 58, 33, 71, 134, 122 and 239. The presented data of ODA plots were collected during 1983-84. ** - significantly greater at $P=0.01$.

G1 - Crown unaffected, G2-twigs dying or dead but main branches unaffected/G3-main branches dying or dead but less than 50% of the crown affected, G4-main branches dying or dead and 50% or more of the crown affected, F-trees yielding only fuel wood.



Plate 6.1 A

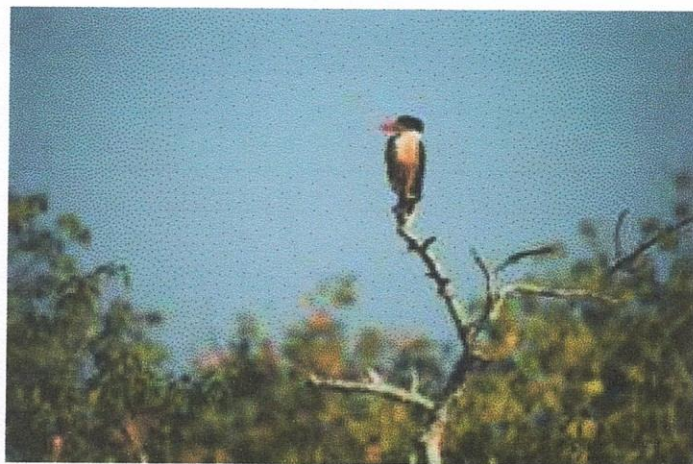


Plate 6.2 B



Plate 6.3 C
Plate A, B & C Top Dying

6.25 Shrimp Farming impacts on the Sundarbans

6.25.1 Indiscriminate killing of wild fish seed: In the absence of adequate number of functional hatcheries and with the rapid expansion of shrimp farming, the collection of wild tiger shrimp post larvae from Sundarbans / estuaries and near shore waters has tremendously increased leading to destruction of shrimp and other fin fish species. It is seen from a report of FRI that by collection of one PL of *Penaeus monsoon*, 40 other shrimp and 10 other fin fish larvae are killed which leads to serious depletion of natural population of both shrimp and fin fish, particularly in the near shore areas.

6.25.1.2 Imbalance in coastal ecology: Unplanned growth of shrimp culture in coastal areas of Khulna, Satkhira and Bagerhat districts has a serious effect on alteration of coastal ecology. Vast area of tidal land previously used for rice cultivation in Khulna and Bagerhat districts has been changed in to shrimp farm. Inundation of arable lands by saline water to cultivate shrimp has become a common occurrence.

A large number of people both male and female including children are getting increasingly engaged in fry collection. Dragging of net thousands of fry collector everyday cause river and increase salutation.

6.25.1.3 Address effect on biodiversity

About 12 fish species are considered as endangered/threatened due to their gradual disappearance as a result of change or conversion of habitat and degradation of environment.

Although, fry collection from the wild presently provides some employment, this is not significant compared to the loss it results in the form of ecological alteration, environmental degradation and change in natural balance in fish population.

In order to reduce the impact of shrimp fry collection, the Government is planning to expand its support to establish hatchery in the private sector. Establishment of shrimp estate for the private hatchery, construction of required infrastructural facilities for shrimp farm and hatcheries under private entrepreneur etc. are included in the Govt. plan. The plan also includes

demarcation of land considering its suitability for shrimp farming and the management method like semi-intensive and improved traditional to be used in particular area

6.25.1.4 Adverse effect because of removal of Mangroves

The Sundarbans mangrove forest in Khulna covers neatly 60,000 ha which is the largest single tract mangrove resource in the world. The south-eastern part, the Chakaria Sundarbans in Cox's Bazar, has a mangrove forest area of 7,500 ha. The coastal belt along Barisal, Patuakhali, Noakhali and Chittagong districts has about 0.11 m ha mangrove forest. The mangrove forest has been reduced by over exploitation, housing settlement, expansion of shrimp culture, and other developmental works in the coastal area related to cyclone, tornado, tidal bores etc.

Once the Chakaria Sundarbans had a dense mangrove forest of 18 200 ha, With the expansion of shrimp farming from 1970s over 50% of the mangroves has been cleared off for establishment of shrimp farms and now only a small patch of forest remains in the interior. The natural breeding and nursery grounds have been lost to a great extent. The clearing of mangrove forests result the vulnerability from cyclones and tidal waves, increased salinity by longer retention of saline water and greater evaporation and acidification of surface water. The conversion of mangrove forest would appear to be uneconomic if the potential yields are compared with the combined yields of the forests and the traditional fisheries both of which are now lost.

6.25.1.5 Impact of shrimp farm discharge

The semi-intensive and intensive system employs occasional water exchange. Intensive culture system which is now in a take-off stage utilizes some pond preparation, water quality management, supplementary feeding, aeration and regular water exchange.

Although noticeable environmental problems have not been observed, yet signs of increased salinity in the enclosure where the same land was used for paddy cultivation, and deposition of organic matter and nutrients are there

Proper engineering design of the pond and farm is necessary Nutrient sink' concept has to be adopted to utilize the effluent from the farm.

6.25.1.6 Impact of land use pattern for shrimp farming

As stated previously, large tidal lands are converted into shrimp farm by dyking the land. This form a large single sheet of water having no compartment. These lands are used for rice and salt production in Cox's Bazar and shrimp and rice production in Khulna, Satkhira and Bagerhat districts. Under the semi- intensive system, a cluster of ponds with manageable water area is constructed.

High rate of economic return in shrimp farming is constantly inducing the farmers to convert more and more paddy field into shrimp farm. This has resulted in over exploitation of shrimp juvenile from the wild leading to ecological imbalance, change in cropping pattern, interest conflict, leasing of land of small farmers, depriving them from their right to own land and other socio-economic and environmental consequences.

GOB is planning to demarcate land for shrimp farm and shrimp hatchery to resolve this socio economic conflicts and conservation of coastal fisheries resources.

Research and extension services are being strengthened for improving farm management practices in an attempt to mitigate the negative environmental impact as discussed above.

6.25.1.7 Impact of aquaculture on environment

Destruction of mangrove is of great consequence because shrimp farms are constructed by clearing mangrove. This also results into shrinking of grazing land and destruction of inland forest. Horizontal expansion of traditional extensive shrimp farming reduce grazing land and affect the fruit bearing trees like mango, rose apple, betel nut and coconut due to prolong retention of saline water Production of crops and green vegetables has alarmingly fallen down due to increased salinity.

Coastal embankment originally constructed for flood protection and to prevent tidal water incursion for rice production is now being used for trapping tidal water for shrimp production. Shrimp growers indiscriminately cut the embankments at several points and also open the sluice gates frequently for

intrusion of saline water inside the embankment causing harm to the standing crops. However, minimum salinity is not detrimental to land fertility. It becomes hazardous when it exceeds the minimum level. The salinity level in the coastal lands has presently increased manifolds than the minimum level.

The farmers should cultivate shrimps in scientific manner to obtain higher production and at the same time protect environment

Unavailability of hatchery produced shrimp on the one hand and expansion of shrimp culture in the coastal area on the other increased pressure on the collection of wild shrimp fry.

This chapter dealt with the presentation of data in tabular forms and the interpretations of those data by using statistical tools like mean, standard deviation, coefficient of variance, Z-test, and T-tests, and also dealt with the other issues like factors that motivated them to emerge with Environmental Impact Assessment of Development Activities in the Sundarbans. The next chapter, "Discussion of the Study" has been designed to present conceptual aspects of the study.

Chapter 7

DISCUSSIONS

CHAPTER SEVEN

Discussions

Review of the relevant literature is very essential to find out the study about Environmental Impact Assessment of Development Activities in the Sundarbans. In this regard the present study is not an exception. Several scientific studies and researchers have already conducted studies in the field of environment and environmental changes and its positive and negative impacts on human being as well as the ecology. But these studies are not directly related to Environmental Impact Assessment of Development Activities in the Sundarbans. There are some studies, which have been conducted on other issues particularly on environment and development in rural area of Bangladesh. But not related with sustainable Development or Management of the Sundarbans Forest. In addition, some related reports and periodic publications have also been helpful to enrich this study.

Management comes in a big way. Conventional state of management is questioned in many countries, because of declining productivity of state forests, growing imbalance between supply and demand of forest products, declining tree cover in state forests, and rising conflicts between Forest Department (FD) staff and local communities. Some experts argue that the main cause of deforestation is the inability of forest owners/managers to exclude various user groups from the resources, which in theory are under a well-defined property regime. Therefore, the problem is not with the property regime as such, but with its enforcement. This is relevant particularly in countries of the sub-continent, where forest fringe people continue to believe that the forests belonging to them had unjustly been taken over by the former colonial government.

In response to the question about the characteristics of management of the forest sixteen Deputy Rangers have told that the characteristics of management of the forest is to make profession of the local people and fulfill the demand of wood and / or the demand of wood in market / local people.

There is a great problem of pirates in the Sundarbans. In this regard, in reply to the question about the development work of the forest all the sixteen Deputy Rangers have mentioned that to improve the development work it will be protected the pirates. Another problem is that the mismanagement of forecasting about the natural disaster.

The Forestry Sector Master Plan of Bangladesh (1993-2012) states: "In such situations, conventional forest management will not succeed participatory forestry involving the villagers are the only recourse." The Plan regards the following definition of participation as acceptable: "In participatory forestry, the participating farmers will be involved in planning, decision-making and implementation of all its activities. Accordingly, many countries have initiated a variety of participatory models in forest management. Today, no policy maker talks of any development / resource management project without the participation of local communities. The questions are: What kind of participation? How does participation take place? What is the policy legal framework of participatory forest management?"

"Whenever national bureaucracies have taken over management role, discharged by local communities, systems of traditional governance over natural resources have broken down, and local communities were alienated and environmental resources suffered."

Thus, Agenda 21 includes a Chapter on promoting 'sustainable livelihoods' for the poor, and this builds on the positive experiences of many community-based initiatives in resource management. After spending about US \$ 1.5 billion on forestry projects in Asia between 1979 and 1990, the World Bank admits that its actions "have had a negligible impact on borrower's forestry sectors as a whole." The Brundtland Report entitled *Our Common Future* argues, "Programs to preserve forest resources must start with the local people who are both victims and agents of destruction. They should be at the centre of integrated forest management, which is the basis of sustainable agriculture." The Report also acknowledges that achieving sustainable development (SD) requires a fundamental change in the way natural resources are owned, controlled and used.

This brings in the question of linkage between management regime and property rights on natural resources. Property can be regarded as a secure claims to a resource its services. Property rights/regimes in natural resources exist in usually four forms:

- a) Private property,
- b) Open access resource, where legal rights are not clearly defined;
- c) State property, where the legal claim rests with the government, such as in land and forests; and
- d) Common or communal property resources (CPR), where individuals have claims as members of recognized groups.

During the times of antiquity, all natural resources belonged to the Crown or the Sovereign. The citizens, often in were given the *usufructs*, a use right without legal ownership. During the industrial period, increased technological power and mobility created an open system in which resource substitution and importation minimized the fears of scarcity. Resources were therefore perceived as being both absolutely and relatively abundant. During this period, according to social controls over resource appraisal and allocation gave way to *laissez-faire* and the freedom of rights of the individual. Competition set the rules and economic principles dominated the allocation process in the then-industrializing world. In the colonized world, the Western concept of rights of the individuals over that of the community was strengthened, as individuals began to but/own formerly communal properties. Currently, there is no problem with private property rights in general. However, there are serious problems with the last two categories, i.e., state property and CPR. Alienation of poor communities compounded the problem of government management, which fails to control encroachments from local and distant sources. Therefore, sustainable resource management is argued to be a function of cooperation at all levels. It is argued that this cooperation will sustain through 'effective' participation of local communities, who are the best guards against distant and more powerful encroachers.

Every action has its particular aims and objectives the ongoing study is not an exception. That is why it has some particular aims and objectives. The present research has been designated considering the following aims and objectives. To assess the present conditions and find out the real causes of loss of the natural resources of the Sundarban Forest. To assess the socio-economic condition of the local people and the people related to the Sundarbans to identify the dependency ratio on the natural resources of the Sundarban Forest. To evaluate the existing management system of the Sundarban Forest. And finally to prepare a sustainable management plan and make some recommendations for the Sundarban Forest.

Accordingly, some argue for private property rights to well-defined parcels of forestlands either through sale in the financial market or by lottery. But the experience of some countries like Indonesia, Malaysia and the Philippines indicate that large private firms, guided by a profit-making motive, could not manage forests with an objective of long term sustainability. Experiences also show that the so-called 'effective hegemony' imposed by government resource managers worsens the problem by undermining local users' responsibility to protect resources. This is vindicated by the realities in the state forests of many countries including Bangladesh. In recent years, because of environmental degradation, state agencies in the developing world are tightening zoning and other centralized restrictions on land and resource use. If past experiences are any guide, such a renewed centralized control of resources under heavy biotic pressure is utterly misplaced. But the other, Viability Model of CPR is supported by the empirical research of Bromley, Cernea, Ostrom and others. Their studies show that many communities dependent on common resources, both in developed and developing countries have devised and sustained informal/customary ways to control access to the resource and institute rules among the users. The CPR tragedy model simply conflates "common property" with "open access" resources. To viability advocates, CPR management is a question of identifying the appropriate social and institutional arrangements at the community level Michael Cernea, senior adviser to the World Bank, pointed out:

"Resource degradation in the developing countries, while incorrectly attributed to 'common property systems' intrinsically actually originates in the dissolution of local level institutional arrangements whose very purpose was to give rise to resource use patterns that were sustainable."

Sustainable development of the Sundarbans is seriously hampered because the biodiversity of this has been under threat since long. Through the ongoing study, the researcher has tried to highlight the real condition of the Sundarbans region and he has found that there are several problems in the Sundarban forest. The researcher has completed this study by taking interview through a structured questionnaire and observation. The researcher has interviewed many people of the Sundarbans forest region. The researcher has spent time with them and collected the information. In this sense, it is rational to mention here that he has followed the participant observation method to complete the study. There are two Divisional Forest Officers of the Sundarbans Forest who have given real information. Four Range Officers of the Sundarbans Forest have given necessary information. Sixteen Deputy Rangers of the Sundarban Forest have given relevant much information to carryout the ongoing study. There are eleven Foresters of the Sundarbans forest who have given information about the causes of forest degradation and biodiversity reduction. There are eight forest guards who have given information about the Sustainable management of the Sundarbans Forest. There are twenty Forest Boat Men who have also given information about the real causes of the Forest degradation and biodiversity reduction. There are thirty-one forest woodcutters who have taken part in interview and have given details information about the Sundarbans Forest. There are thirty Forest Bawali who have given interview to the researcher and have informed a lot of about the situation of the Sundarban's plants and animals and other flora and fauna. There are eighteen Forest Mawali who have taken part in the interview session with the researcher and have given a great deal of real condition of the Sundarbans Forest and techniques of honey collection. There are only thirty local people who have taken part in interview to give information about the sustainable Management of the Sundarbans Forest and about other factors related to this research.

There are many hindrances for Environmental Impact Assessment of Development Activities in the Sundarbans. All the Deputy Rangers, Divisional Forest Officers and Range Officers have mentioned that the management system does not completely run according to the rules and regulations. So it is suggested that the management system is done according to the rules of forest division and it should be introduced new management plan and cut trees of the forest by selection. If these rules and suggestions are maintained only then ensure sustainable management and finally, it is possible to sustainable development of the Sundarbans.

Literally, sustainable development refers to maintaining development over time. However, it has been suggested that there are many definitions of sustainable development currently in circulation. List just a small number of such definitions and the varied interpretations of the concept which have flowed from these different ideas. Definitions are important, as they are the basis on which the means for achieving sustainable development in the future are built. During the course of this text, it is apparent that, although there are many signs of progress, there is also much uncertainty as to the most appropriate strategies to foster sustainable change. Indeed, as suggested in the quotations in the attractiveness (and the dangers) of the concept of sustainable development may lie precisely in the varied ways in which it can be interpreted and used to support a whole range of interests or causes.

The challenges of understanding what this idea of sustainable development may mean, and how people can work towards it, are evident in a brief analysis of the most widely cited definition of sustainable development, that of the World commission on Environment and Development. This Commission was formed by the United Nations in 1984. It was an independent group of 22 people drawn from member states of both the developing and developed worlds, charged with identifying long term environmental strategies for the international community. The apparently simple definition of sustainable development forwarded by the Commission is soon seen to encompass some very challenging notions, such as those of inter generational equity, needs and limits. For example, such questions emerge as: what is it that one generation is

passing to another? Is it solely natural capital or does it include assets associated with human ingenuity or culture? What and how are the limits set - by technology, society or ecology, for example? What of the fact that, currently, needs in one place or amongst particular groups are often fulfilled at the expense of others, such as those in the developing world? Fundamentally, needs mean different things to different people and are linked to our ability to satisfy them, i.e. are closely aligned to development itself. So, society is able to define and create new needs within certain groups, without satisfying even the basic needs of others.

Furthermore, the substantial challenges of operationalising the concept of sustainable development were clear in the report of the WCED. The core issues are identified by the Commission and the necessary conditions for sustainable development in the future. A more prosperous, more just and more secure global future was seen to depend on new norms of behavior at all levels and in the interests of all. The conditions for such a future encompass all areas of human activity, in production, trade, technology and politics, for example, and encompass co-operative and mutually supportive actions on behalf of individuals and nations at all levels of economic development.

Clearly, while common sense would seem to tell us that our development should not be at the expense of that of future generations, the challenges in practice are substantial. In order to identify the challenges of implementing sustainable development actions and to realize the opportunities for sustainable development, it is necessary to understand the changes in thinking and practice from which the concept has developed. As suggests, sustainable development cannot be understood in an historical vacuum. Of particular importance are the changes in thinking about what constitutes development and how best to achieve it, and changing ideas about the environment.

In an answer they have specifically told that the yearly earnings from the forest is around Tk. 15100000. In reply to the question about the yearly revenue expenses for forest management they have told that there is a

separate budget system to maintain the expenses. But they have not mentioned any numerical data.

The great earnings from the shrimp sector are short-lived, while the real costs of shrimp culture in terms of consequent environmental run in and social disruption are long-term and astronomical. While the immediate profits from shrimp farming may satisfy a few, vast numbers of coastal residents, once dependent on healthy coastal ecosystems for fishing and farming, are being displaced and impoverished. Observers believe that his environmental and social losses would eventually eclipse profits from the shrimp sector.

Sundarbans is the most attractive tourist spot of Bangladesh. So, Sundarbans is a source of income. In this regard, in answer to a question about how many tourists are visited Sundarbans per year, the foresters have mentioned that 28-31 thousand of tourist have visited sundarbans every year. In addition 55% foresters have mentioned the main attraction of sundarbans is tiger and deer.

Economy is one of the most important social institutions of society. Economy plays a significant and pivotal role in the society. So, income level of any group of people is very important. In this sense, the researcher has analyzed the income level of the respondents. From the distribution of total woodcutter under study according to their annual income in the Sundarbans Forest, it is seen that at 1% level of significance the calculated value of Z is 22.341 and the tabulated value of Z is 1.640, which is greater than that of the tabulated value (Table-6.30). Therefore, it is suggested that there is significant variation in their annual income.

From the distribution of total Bawali, Mawali and local people under study according to their annual income in the Sundarbans forest it is seen that at 1% level of significance the calculated value of z is 20.546, 36.107 and 43.608 accordingly and the tabulated value of z is 1.640, 1.640 and 1.640, which is greater than that of the tabulated value (Table-6.32, 6.34 and 6.36). Therefore, it is suggested that there is significant variation in their annual income.

From the distribution of total wood cutters under study to according to their average income from wood cutting of the Sundarbans forest, it is seen that at 1% level of significance the calculated value of Z is 27.383 and the tabulated value of Z is 1.640, which is greater than that of the tabulated value (Table-6.38). Therefore it is suggested that there is significant variation in their average annual income.

From the distribution of the total Bawali under study according their average income from Golpatta cutting of the Sundarbans Forest, it is seen that at 1% level of significance the calculated value of z is 21.117 and the tabulated value of z is 1.640, which is greater than that of the tabulated value (Table-6.40). So, it is suggested that there is significant variation in their average annual income.

From the distribution of total Mawali under study according to their average income from honey collection of the Sundarban Forest, it is seen that at 1% level of significance the calculated value z is 38.578 and the tabulated value of z is 1.640, which is greater than that of the tabulated value (Table-6.42). So, it is suggested that there is significant variation in their average annual income.

In response to the question about the main causes of the forest degradation and biodiversity reduction the Foresters have made comments that the principal causes of forest degradation and biodiversity reduction are illegal felling, the natural calamities (like-tidal surge, cyclone, saline water intrusion etc.) and water pollution as well. It is noteworthy here that the causes of forest degradation and biodiversity reduction are very much natural and man-made.

For over population pressure many types of plants, animals and birds species are extinct. In this regard, in response to the question about what types of plants, animals and birds are declining, the Foresters have mentioned that the sundri tree and other kinds of plants and tiger, crocodile, modontak, stark, different species of deer etc. They have pointed out that the main causes of extinction of these plants, animals and birds' species are destruction of the residence of wild life and life and illegally hunted silt of water and violating the

rules of wild life reservation. They have suggested that creating fearless forest will protect them.

The bio-diversity of the Sundarbans has been under threat for various reasons. There has been increasing conversion of the forestland for agriculture, mainly for paddy and shrimp farming and for human habitation. The forest's bio-diversity is also threatened by unabated poaching, hunting, illegal felling of trees, diseases, unplanned and over extraction of resources, insufficient conservation effort, deterioration of law and order situation, corrupt practices of the forest officials and unscrupulous traders etc. Poverty, population pressure and encroachment by the forest/local people are blamed for the depletion of bio-diversity in the Sundarbans. Contrary, to this customary belief, plundering and exploitation of forest resources by the poachers and dacoits in connivance with the corrupt forest officials are said to be the main causes of forest loss in the Sundarbans. Recurrent natural calamities like storms, cyclones and tornadoes pose a big threat to tall slender trees, which act as a barrier against the cyclones and tidal surges originating in the sea. More than a dozen of cyclones have hit the Sundarbans during the last decade. A disastrous cyclone at Dublar Char in 1988 devastated the forests and the fishermen's villages.

On the other hand, besides these anthropogenic activities and natural calamities, some ecological changes like increase in salinity, outbreak of diseases like "top dying" of the Sundri trees pose a serious threat to rich biodiversity of the Sundarbans. Such diseases are taking a heavy toll of the wood lots in the Sundarbans. Actual cause of the disease is not yet known, Diversion of the natural courses of rivers, construction of embankments, dams and bridges in the upstream as well as decreased flow of fresh water in the rivers resulted in the increase in salinity level and over silting in many places and caused subsequent changes in the mangrove ecosystem. Increased salinity and salutation within the forest area may hinder the biological functions of the breathing roots and are supposed to the major causes of top during of the trees possibility of fungus pathogens can not be overlooked. In the Sundarbans, for bringing non commercial cover areas under tree cover indifferent areas of Chandpai, Sarankhola and Khulna forest ranges, plantation

of exotic species, like *Acacia mlotica*, *Albizia procera* have taken place. Though at a limited scale, many other exotic species have been introduced in the Sundarbans mangrove ecosystems, particularly in areas around the forest offices. It is apprehended that these exotic species may pose a threat to the native variety of mangrove species.

The Sundarban Reserve Forest is floristically unique because of the dominance of Sundri (*Heritiera fomes*) its most highly prized timber species. As has been mentioned elsewhere in this report. The rather alarming and widespread phenomenon of Sundri dieback ("top-dying"), thought to be due to the changing hydrological regimes, is considered an important indicator of the environmental health of the SRF. Doubtless, other significant but less prominent impacts and changes are accompanying this phenomenon. Other well known tree species that were once harvested regularly, before the imposition of the 1989 Moratorium on felling in the natural forests, include; Amur (*Amoora cucullata*), Baen (*Avicennia officinalis*), Kankra (*Bruguiera gymnorhiza*), Keora (*Sonneratia apetala*) and Passur (*Xylocarpus mekongensis*). In addition to Sundri, two other species are both prominent components of the flora and still widely utilized: Gewa (*Excoecaria agallocha*) - the raw material for the nearby KNM paper mill, and Goran (*Ceriops decandra*) - an important fuel wood species.

Because the Sundarbans have been treated as a reserved forest for more than a century, it is not surprising that there is a good deal of forest inventory data and information. The difference between the 1960 Forestall Inventory and the 1985 ODA Inventory, showed significant depletions of the growing stock, of 40/45 percent for the two dominant species, Sundri and Gewa, respectively. Provides a summary of the findings of the two inventories for these two species. Many to corroborate or refute concerns about the condition of the forest anxiously await the results of another forest inventory presently being carried out under the aegis of FRMP.

There are also multiplicities of other plant species that are extracted as important non-wood forest products. The most prominent are palms-- Golpatta (*Nypa fruticans*)--whose fronds serve as local roof thatching and Hantal

(*Phoenix paludosa*)--the ribs of which provide durable rafters and purlins in local construction. Both are harvested intensively on an annual basis and their production runs to the thousands of tons. A Variety of grasses as well as medicinal and aromatic plants are also among the most sort-after components of the flora. Finally, the flora provides the fodder for the wild bees which is highly prized and extracted by a specialist user group.

Many factors contribute to mangrove forest loss, including the charcoal and timber industries, legal and illegal logging, oil spill, tourism industries, unplanned development projects, urban growth pressures, and mounting pollution problems. However, one of the most recent and significant causes of mangrove forest loss in the past decade has been the consumer demand for luxury shrimp, or "prawns", and the corresponding expansion of destructive production methods of export-oriented industrial shrimp aquaculture along the forest.

Almost all Khulna-based industries like the match factories, fish processing plants, jute mills, steel mills, the Khulna Shipyard and newspaper mills discharge liquid or solid wastes directly into the Bhairab-Rupsha river system. According to a DOE paper, the Khulan Newspaper Mills alone is estimated to use and discharge 30,000 of processed water laden with chlorides and dissolved and suspended solids everyday along with the municipal wastes of the regional cities.

According to studies carried out at different times by the forest department, British ODA and UNDP/FAO sponsored Forest Resource Management Plan, the mean volume per hectare of the Sundari tree was 34.5 in 1959. The volume was reduced to 19.9 in 1983 and 17.8 in 1996. In case of Gewa, the mean volume per hectare was 8.7 in 1959, which was reduced to 4.6 in 1983, and 2.1 in 1996. The dramatic decrease is blamed on their over exploitation, legally and illegally, because of their commercial value and Subtle changes in the ecosystem. A number of issues related to the Sundari, Gewa and Goran trees have emerged for immediate concerns of the foresters.

According to experts, the reasons for the decline in Sundari (*Heriteria fomes*) are twofold. First, as a valuable timber species with real commercial value, it has been subject to heavy exploitation. Second, increasing salinity as a subsequent impact of the subtle ecological changes, noticeable increase in salinity and salutation have resulted in hostile anaerobic conditions in which the Sundari finds it difficult for healthy respiration. This has resulted in dieback whereby the tree is progressively defoliated from the top downwards. The phenomenon, in fact an infectious disease, is called "top dying".

With regard to Gewa, forest officials say high pressure from deer population in some areas of forest patches have spared or caused nil regeneration of the species, leaving the areas under-stocked. The decline in Gewa (*Excoecaria agallocha*) is largely attributable to harvesting of around 50,000 mt per annum as feedstock to Khulna Newsprint Mill for the production of newsprint over the years.

The marsh crocodiles, once abundant, are already extirpated. The saline-water crocodile (*Crocodylus porosus*) still survives in low densities and like the marsh crocodiles its population is being reduced through indiscriminate hunting and trapping for skins, quite apart from the immediate conflict with men. Despite an apparent reduction in illegal trade in its skin, the population shows little sign of recovery.

Some 30 species of snakes have been recorded in the SRF and there appears to have been a general decline in densities or at least in their sighting particularly in the past two decades. The Rock Python (*Python molurus*) is one of the valuable SRF snake species, which is said to have declined over recent years. IUCN has listed it as a "vulnerable species."

A number of species like Javan rhinoceros (*Rhinoceros sondaicus*), water buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvauceli*), gaur (*Bos gaurus*), hog deer (*Axis porcinus*) and marsh crocodile (*Crocodylus palustris*) became extinct during the last 100 years from the Sundarbans.

While the Sundarban, the world's largest mangrove forest, is faced with growing problems of deforestation and biodiversity loss, the government's

decision to allow hydrocarbon exploration by some international oil companies in the area caused wide concerns as mangroves are known to be the most vulnerable coastal habitats to such activities.

The fragile and delicate mangrove ecosystem depends on many variable components like tides, salt contents in water and soil, duration of sunlight, contents of sediment and organic substances in water, and temperature and density of seawater and freshwater. The composition of terrestrial and marine flora and fauna also plays an important role in the mangrove ecosystem. If sun is regarded as the source of all energy flow, water must be considered as the nursing mother of an ecosystem.

In the Sundarbans, the flow of freshwater received from the tributaries of the Ganges (Padma) is lighter in the turbidity than that of the Bay of Bengal waters. The temperature of the two waters also varies seasonally. The fresh water carries loads of mineral and microbe-rich silts, which do not flow easily into the tidal waters from the sea as the influence of the tides make the water flow back and forth. The mixture of the flows of freshwater and brackish water and the mineral microbe silts from upstream and the forest wastes like over mature leaves creates an ideal environment for different mangrove organisms.

The Sundarbans is the largest mangrove forest of the world. There are many kinds of fauna and flora. The main attraction of the Sundarbans is Royal Bengal Tiger. Besides this, there are beautiful deer, python, elephant, etc. There are many kinds of birds. The main flora of the Sundarbans is Golpata, Goran, Gewa, Shal tree and so on. These above mention flora and fauna are the natural resources of Bangladesh. These properties help the people of the Sundarbans area in particular and all the people of Bangladesh in general. The usefulness and necessity of these plants and animals are needless to mention. But it is regrettable that the Forest is threatened by many unabated reasons. Like poaching, hunting, illegal felling of threes, diseases, unplanned and over extraction of resources, insufficient conservation efforts, deterioration of law and order situation, corrupt practice of the officials and finally unscrupulous traders etc. Acute poverty, over population pressure, and illegal encroachment by the forest / local people are blamed for the depletion of biodiversity in the

Sundarbans forest. On the contrary, the traditional belief, plundering and exploitation of forest resources by the poachers and dacoits in connivance with the corrupt forest officials are said to be the main causes of forest loss in the Sundarbans. The recurrent natural calamities, like storms, cyclones, and tornadoes pose a great threat to tall sunder trees, which act as a big barrier against the cyclone and tidal surges originating in the sea. More than a dozen of cyclones have been hit on the Sundarbans during the last decade.

The Tiger and the other major species of the fauna are by far the most important element of the ecosystem attracting tourists. Future investments on wood and non-wood resource development, harvesting, research and monitoring, and on tourism development will require a much better understanding of the behavioral ecology and physiology of this population which is of enormous national and international significance. Basic background information on tiger ecology and behavior is vital to make the proper management decision but such data are either scarce or lacking, which necessitates further investigation and study.

Like the tiger, the other most visible mammal species, the Spotted Deer (*Axis axis*) lives on the edge of its natural range in the SRF. They are found throughout the SRF but are most abundant in the south where extensive grassland and scattered forests of Keora occur. This type of habitat occurs in the three existing wildlife sanctuaries. Towards the north of the SRF, the forests become denser, the preferred fodder species less prevalent, and also more disturbed, and the deer have lower densities in these habitats. Spotted deer population in SRF is substantial, an estimated number of 80,000 individuals.

The Royal Bengal Tiger is an inseparable part of the legend attached to the Sundarbans. The tidal mangrove forest is a rare habitat for this tiger species. But today they have been pushed due to habitat shrinkage. The SRF tiger population estimate in the past 20 years remained in the range of 350 to 400, the largest discrete population of the species in a single tract of natural habitat in the world.

But the preservation of the Royal Bengal Tigers is, by far, the most important challenge for those concerned for the protection of the Sundarbans bio-diversity. This challenge has become even more compelling of late with recent media reporting of the outcome of a tiger population in the Indian part of the Sundarbans where the number of tigers was once estimated at something similar to that in the Bangladesh part-i.e.300 +. The figure is now down to some 50 only.

Millions of people are involved in Bagda try collection in the Sundarbans, which has created an ecological problem in both aquatic and forest environment. There are about 10500 nos. of licensed fishermen doing fishing in the Sundarbans Forest. Fishing is not allowed in the Wildlife Sanctuaries and restricted rivers and khals.

Many experts fear that far-reaching changes are taking place in the delicate ecosystem due to growing pollution and human interference in the areas adjacent to the forest. The Mongla Port on the northern edge of the forest and its associated marine traffic are a frequent source of oil spills and there is a permanent risk of accidents from handling chemicals in the port area.

Many factors contribute to mangrove forest loss, including the charcoal and timber industries, legal and illegal logging, oil spill, tourism industries, unplanned development projects, urban growth pressures, and mounting pollution problems. However, one of the most recent and significant causes of mangrove forest loss in the past decade has been the consumer demand for luxury shrimp, or "prawns", and the corresponding expansion of destructive production methods of export-oriented industrial shrimp aquaculture along the forests.

Brackish water shrimp and fish farming is now a firmly established and substantial industry of great importance for export earnings and for national foreign trade balance. Shrimp farm operate over large areas of otherwise unprotected land subject to regular tidal, saline inundation and also inside many of the coastal polders despite the fact that they were originally intended to exclude salt water.

Fishes and other living aquatic resources have been serving as a source of food, commerce and recreation for people from ancient times. Living aquatic resources are intensively harvested today around the world as a source of protein in the family diet, for commercial gain or for recreation. A fishery is the union of aquatic organisms and humans. There are three basic elements to a fishery: the resources itself, its aquatic environment and the people who harvest the resources or change the condition of its aquatic surroundings.

The expanding shrimp farming in the greater Khulna region has caused wide concerns for the rich bio-diversity of the Sundarbans. Experts say indiscriminate shrimp and salt cultivation already destroyed the valuable mangrove forest in Chokoria Sundarban and fear that the ecosystem of the SRF too would be in jeopardy for the same reason in the near future. The fisheries department reckons that some 200 billion different fish fries are destroyed every year in course of gathering two billion shrimp fries from the water bodies along the Sundarbans due to the crude methods adopted for the purpose.

Several international reports suggests that vast tracts of mangrove forests particularly in Latin America, Africa and the Pacific Islands have been cleared to make way for the establishment of coastal shrimp farm facilities. The failure of national governments to adequately regulate the shrimp industry, and the headlong rush of multilateral lending agencies to fund aquaculture development without meeting their own stated ecological and social criteria, are other important pieces to this unfortunate puzzle.

The bio-diversity of the Sundarbans has been under threat for various reasons. There has been increasing conversion of the forestland for faulty practice of agriculture, mainly paddy and shrimp farming and for human habitation. In response to the question about overcome the problems about the main causes of forest degradation and biodiversity reduction, they have told that this problem can be overcome naturally. They have also told that it is necessary to make general people conscious about the law of increase the number of employee, necessary to make boundary of the forest, make profession of the local people of the forest zone and finally make conscious of the people about the importance of forest grown property.

It is said that Bangladesh is the most densely populated country of the world. It is completely true, but the real fact is that this population is not as skilled as it would be. That is why, this population is not wealth but it is the burden for the country. So, we should convert our population into manpower. Then we prosper in every sector in our national life. In respect of the question about being have enough manpower and logistic support to protect the Sundarbans forest. All the foresters have claimed that there are no enough manpower and other logistic support to protect the Sundarbans forest. They have specifically mentioned that manpower, logistic support, like, speedboat, trawler / launch, car (jeep), fuel oil, safe office space, wireless, safe drinking water etc. In answer to the strength and weakness of present Sundarbans Forest Management System, all Foresters have pointed out that the strength of the forest is intensive supervision, reduction of political impact on it, and supplying of modern firearms. The weakness is that the forest department does not control the pirates, lack of necessary vessels and vehicles, fuel oil, crisis of pure and safe water and proper treatment.

The administrators and the local people both kinds of person have mentioned various prosperities and some problems. Most of them have emphasized the biodiversity and conversion of the forest as well as other factors related to forest degradation. Some of them have mentioned that there has been decreasing land of the forest because of agriculture, i.e. paddy cultivation, shrimp farming and for human habitation. And there are many more causes of the Sundarbans degradation.

The researcher has already mentioned the techniques by which he has collected information from the Sundarbans Forest related persons. In this sense it is very much relevant to mention the source of the data and information from which the researcher has collected to complete his ongoing study. The main source of this study is field level data, which is very much effective to complete the research. On the other hand, besides primary data, the researcher has to depend on the secondary data, which he has collected from many published and unpublished books, articles, journals, periodicals, newspapers, government and non-government documents etc.

In 1988, a disastrous cyclone at Debaucher caused much harm for the adjacent people and distracted the forest and the fishermen's villages. The researcher has categorizers the interviewees into eleven categories. If it analyses the answers of them it has been found that the actual condition of the Sundarbans is not so well.

In answer to the question about the natural destruction and its impact of biodiversity of Sundarbans the two Divisional Forest Officers have made comments that this has many negative effect and influence the biodiversity of the forest. In reply to the question about the strength and weakness of the management system four Range Officers have point out that there are many circle to improve the Sundarbans and they have mentioned that the weakness is only that the rules and regulations are not maintained. So, to improve the strength of the forest rules and regulations should be maintained strongly. In answer to another question about the role of the forest in economy four range officers have mentioned that the forest can play a vital and pivotal role to improve the whole economic system of our country in general and the people of the Sundarbans region in particular.

Mangrove forests are one of the most productive and bio-diverse wetlands on earth. Yet, these unique coastal tropical forests are among the most threatened habitats in the world as experts' fear they may disappear more quickly than inland tropical rainforests because of lack of public notice. The Sundarbans too is no exception.

Most experts agree that due to direct and indirect impact of human interventions, far-reaching changes are taking place slowly but steadily - affecting the delicate Sundarbans ecosystem. Much of such changes are not clearly visible. Direct human impacts are further worsened by the less-readily detected but perhaps more menacing impacts which threaten the mangrove ecosystem. Massive changes in both the adjacent agricultural lands and upstream areas with construction of polders, embankments or barrages are feared to have been generating fundamental changes in the hydrological regime of the Sundarbans.

Incidental mortality due to diseases, illegal hunting and subtle changes in the Sundarbans ecosystem poses a serious risk for the survival of the Royal Bengal Tiger. Apart from that, the interaction with humans in the area, particularly the killing of humans by tiger, complicates the management of the area. IUCN has listed it as an endangered species in its Red Book.

Some 30 species of snakes have been recorded in the SRF and there appears to give a general decline in densities or at least in their sighting particularly in the past two decades. The Rock Python (*Python molurus*) is one of the valuable SRF snake species, which is said to have declined over recent years. IUCN has listed it as a "vulnerable species."

The results of four independent inventories undertaken over the past seventy years indicate that the overall volume of wood per hectare has decreased. Moreover, closer analysis of three inventories undertaken in 1959, 1983 and 1996 indicate a marked reduction in total standing volume for the two principal species of economic importance, Sundari and Gewa.

The infectious top-dying disease of Sundari causes another management problem as experts said poor execution of infected trees invalidate the basic rationale for the "sanitation/salvage" method to save the uninfected trees. Long delays between marking and cutting causes more trees in an area affected by top dying eventually exposing them to "axes instead of saws."

Experts say there is apparently little respect for the basic rule of leaving one stout stem to aid re-growth while cutting Goran trees, the second largest tree species of the SRF as all available merchantable stems are being cut from one area. Some officials admit there is also Goran cutting going on outside the coups areas, including the wildlife sanctuaries. However, acknowledging the importance of forest resources exploitation on a sustainable basis, the Forest Department imposed a logging moratorium in 1989 on all timber species except Gewa in the SRF.

Forest department officials admit that though slowly far-reaching changes are taking place pervasively in the Sundarbans. These arise from direct and indirect impacts of human influence in the area causing widespread quantitative and qualitative degradation of the resource base throughout the Sundarbans eco-system. According to forest inventory, it is clear that the level of elicits takeoff, some purely illegal and some quasi-sanctioned, may be quite larger than what could be scientifically justified for sustainable management of the SRE.

The changes in freshwater flushing are visibly caused by gradual eastward shift of the flow of the Ganges River. The change is acknowledged as being historical in nature although the more recent impact of the Karaka Barrage in India and subsequent salutation in the Gorai is accelerating the process. It is believed that the changes affecting the salinity, flood intensity and periodicity, erosion, salutation and sedimentations may all be factors or perplexing and worrisome loss to the world's largest mangrove system.

A number of species like Javan rhinoceros (*Rhinoceros sondaicus*), water buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvauceli*), gaur (*Bos gaurus*), hog deer (*Axis porcinus*) and marsh crocodile (*Crocodilus palustris*) became extinct during the last 100 years from the Sundarbans.

No discussion of the ecology of the SRF would be complete without noting the problem of water pollution. Pollution from various sources is a major determinant of water quality--both in reverie and coastal areas of lathe Sundarbans. As approximately one third of the nearly 600,000 hectares of the Sundarbans area consists of tidal channels and most of the reminder is subject to periodic inundation, impacts of water pollution are potentially very widespread. Pollutants are carried into the Sundarbans and ultimately into the Bay of Bengal from various upstream sources including the industrial units, municipal wastes, agrochemicals and port sewages in the Mongla and Khulna region.

The main threat today may come from outside the area in the form of pollution. On the northern edge of the area, Mongla, Bangladesh' second seaport, is situated. This port and its associated marine traffic is a frequent source of oil spills and there is a permanent risk of accidents with chemicals. Moreover, toxic products (pesticides, etc.) enter the system due to upstream pollution in the huge Ganges catchments. Pollution may not be a direct source of mortality, but it may also reduce the health of the forests, increasing the mortality rate of the flora and fauna on the long term. Many products such as pesticides have also been proved to reduce to reproductively (birth rate) in animal populations.

Oil spills during transfer of refined petroleum from tankers to receive stations in Mongla and Khulna, fuel oil spillage and discharge of oily ballast and sewages from some 600 ships anchored in Mongla Port and residual heavy oil sludge, lubricants and engine oils discharged during ship breaking operations in Khulna are major sources of water pollution affecting the Sundarban.

A future threat is the exploitation of mineral gas, which is abundant in the underground of the Sundarbans. The recent government decision to allow exploration by international oil giants in the area has caused added concerns, as mangrove environments are known to be the most vulnerable coastal habitats to such activities.

A very densely populated area surrounds the SRE. Around 1.2 million local users reside seasonally in the area for fishing and other resource use activities. Commercial hunting was a problem mainly before the 1970s and this resulted particularly in a serious depletion of the crocodile populations and to a lesser extent to the deer population. Although wildlife protection has improved significantly in the last decades, illegal hunting is still occurring on and the remaining turtle and crocodile populations as these animals are frequently caught up in fishing nets.

Due to natural processes the role of the Sundarbans to discharge the water of the Ganges and Brahmaputra catchments is decreasing as min waterways are shifting eastwards. As a result, the salinity of the Sundarbans is

increasing - particularly in the western region. Further, the total annual discharge is decreasing due to intensifying land use (*dams, irrigation*) upstream. The role of this change is not yet clear, but it is evident that it will influence wildlife populations and vegetation in the long term.

The expanding tourism trade is appearing to be another major concern for the protection of the Sundarbans. Except the conscious tourists or tour operators, others tend to knowingly or unknowingly disturb the delicate ecosystem of the Sundarbans staging bonfires, playing loudspeakers or disposing of non-degradable wastes like polythene inside the forest, sea shores or water bodies. That should be stopped.

In reply to the question about the types of plantation to restore the forest coverage in degraded areas the foresters have mentioned that plantation of new trees like rain tree, korai, Babla, Chambul Akasmoni, shirish, Mehgoni, etc. are needed for the forest coverage in degraded area. The foresters have also mentioned the process in which the natural resource collection sustainable. They have told that if they cut the trees by selection and through selection cum-improvement system then they can make the natural resource collection sustainable.

Age of the any people plays a vital role to determine their socio-economic condition. So, under the study area of the Sundarbans, age of the people is analyzed and even makes Z-test and t-test. It is seen that at 1% level of significance the calculated value of t is 13.925, 23.080, and 28.460 of the foresters, the guards, and the boatmen respectively and the tabulated value of t is 2.228, 2.145, and 2.052 which are greater than that of the tabulated value. Therefore, it suggests that there is significant variation in their age. From the distribution of total wood cutter, the Bawali, the Mawali and the local people under study according to their age in the Sundarbans forest it is seen that as 1% level of significance the calculated value of Z is 33.227, 27.000, 24.919 and 26.504 the tabulated value of Z is 1.640, 1.640, 1.640 and 1.640 which is greater than that of the tabulated value. Therefore, it is suggested that there is significant variation in their age.

In the concluding statement the researcher can say that the Sundarbans is a valuable source of natural resources. If the government takes necessary steps and measurement of this forest in general and its properties in particular, it is quite possible to develop our country as well as the nation. Although there are some problems, the government should give attention to the recommendations made by other researchers and the present researcher as well. Only then the sustainable development is possible for the Sundarbans Forest.

Chapter 8

CONCLUSIONS AND RECOMMENDATIONS

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Conclusions

Sundarbans is a source of resources, which can be used for the sustainable development of Bangladesh. Through practical survey it has been proved that the currently adopted measures are neither enough nor absolute for sustainable management of the forest.

The government has taken several development programs. Without proper management it has not produced the expected results. There is a big gap between the assumption and reality. It is clear that the people of the forest are not well educated. To some extent professionals are not even interested about education. As a result it is very difficult to make them aware of the needs. So they fail to imagine even the near future. This is one of the main barriers of the management process. Most of the local people also depend on the forest product like timber, honey, and fish and so on for their day-to-day life.

There is also a big flaw in the partiality and the management program. For sustainable development none should think only about preservation of the forest. We ought to think about people also. The program should be revised so that the people of the Sundarbans can continue their lives with the help of the project. Without direct involvement of the people the sustainable management cannot be possible. Through participant observation method it is clear that the local people are fully dependent on the natural resource of the Sundarbans forest. So, there is a need for a perfect adjustment between the demand and the supply of project.

It is suggested that in the management system the recommended management plan should be introduced. The existing plan needs a correction. The preservation of forest can be done through selection cutting method. Participation of the local people would be very essential in that case.

Finally, for a sustainable management of the Sundarbans forest appropriate participation of the local people, administration, law enforcement agency and the government is very vital.

Recommendations

To protect the Sundarbans, all managements would be taken of sustainable development and preservation. To develop of the condition first of all protect them who are engaged in the protection of the Sundarbans then the condition will be developed.

1. To develop the sustainable mechanism for protect Sundarbans resources.
2. To sustain a green ecosystem for biodiversity.
3. Must be amendment of forest law. Bangladesh is seriously considering improvements to improve enforceability of the legal provisions through changes in acts, rules, regulations, and institutional structures of the forest department.
4. To ensure the sustainable developmental activities.
5. To create mass awareness: With a view to expose the villagers and students of schools and colleges to various aspects of Joint Forest Management (JFM) and conservation of forests and wildlife, video-shows in different areas on forestry and wildlife are arranged by different units of the Sundarbans Biosphere Reserve (SBR).
6. Established sustainable Shrimp culture mechanism.
 - a) To establish shrimp hatchery.
 - b) To reduce harvest of wild shrimp seed.
 - c) To formulate appropriate land use policy.
 - d) To reduce farm size for efficient operation.
 - e) To conserve and develop mangrove forest.
 - f) To develop appropriate shrimp culture technology.
 - g) To develop soil water quality management.
 - h) To develop rotational shrimp and fish culture.

- i) Appropriate land use pattern has to be introduced to resolve socio-economic conflicts. Aquaculture and shrimp culture zone have to be demarcated and established. There should be mandatory mangrove a forestation programme for the shrimp grower in places mangrove forest has been destroyed.
- j) There is a need to establish formal and non-formal environmental education and promotion of linkages between concerned institutions.
- k) People's awareness about fisheries and environment has to be created through proper training.

7. Wood extraction

- i) As disease attacked sundri wood are not cutting, other trees also are contaminated. It should start woodcutting and disease affected and selected wood will be cut. If we do this we can increase the revenue of the government on the one side and on the other side the regeneration will be happened of the forest as well.
- ii) The system should be as selection cutting method, which can be operated slot by slot. It will bring the proper evolution of the wood and the process will help the regeneration of the forest. It is the sustainable management plans of the Sundarbans.

8. After disaster development

Pre-trained teams of specialist volunteers and pre-packed sets of standardized equipment ready for immediate use. The Disaster Law programme seeks to reduce human and forest ecosystem and biodiversity vulnerability by promoting legal preparation for disasters. Legal issues are often invisible in emergencies, but effective disaster laws underpin the safety of our homes, the efficiency of emergency responders and the success of recovery efforts.

9. Conservation and Sundarbans Management Plan

From a narrowed concept of conservation we have to move to environment and to sustainable development in order to be successful in the conservation of tiger in the wild. In the context of future food reserve and food security, the

Sundarbans will remain an important resource potential. Tiger is an integral part of the complex food web in the Sundarbans and its flora and fauna including one of the most productive fish breeding grounds in the region. When the population of Bangladesh doubles within the next country, food and protein shortage will be acute. Therefore we need to look at our forests and wetlands as future food reserves. It is well worth investing on new areas such as environment – the Sundarbans, the marine eco systems, and the wetlands to save something for the future generation.

10. The people of southern-west region of Bangladesh use sundri wood for dwelt house, vessels and build bridge etc. But at present because of stop cutting sundri wood, local people are cutting good sundri wood secretly. For this reason regeneration is not hampered in the forest. On the other hand, as disease attacked sundri wood are not cutting, other trees also are contaminated. So, I think that it should start woodcutting and disease affected and selected wood will be cut. If we do this, we can increase the revenue of the government on the one side and on the other side the regeneration will be happened of the forest as well.
11. According to the order of the government of Bangladesh cutting down trees has banned from 2000-2010. As a result the local people steal the trees to meet their demand. Cutting trees after a long time like 10 years is not also evaluated properly as necessary. According to my idea, the system should be as selection cutting method, which can be operated slot by slot. It will bring the proper evolution of the wood and the process will help the regeneration of the forest. It is the sustainable management plans of the Sundarbans.
12. The officers and the employees who work in fields' level in the Sundarbans region collect essentials including water in high price. There are ration procedure and special allowance for the police, the Answer, including the Army who work in other different organizations. In the hill area there is hill allowance for the officers and the employees. The Sundarbans is the most impassable region of Bangladesh. So, special allowance and ration procedure are necessary for the officers and employees in the Sundarbans region.

13. Development of the Sundarbans is possible if it will be restricted the access of the undesired people in the Sundarbans.
14. Terror and political influence are the great problems of the Sundarbans preservation. So, solution has to be done of it. If necessary, the coast Guard and the Rapid Action Battalion (RAB) have to be deployed to protect the Sundarbans.
15. Legal reforms and measures should be taken up to stop killing of tiger as man eater and deer shooting and to improve the law and order situation inside the forest and offshore.
16. Monitor salinity and other hydrodynamic and topographic changes including adverse effects of Ganges withdrawal on the Sundarbans during dry season.
17. Improvement of communication: Naturally the communication system of the forest is not so smooth. And after the devastating cyclone "SIDR" the total communication system had been collapsed. Proper communication system is necessary to maintain proper vigilance.
18. The forest is going to be destroyed to search for fire wood. So, it is necessary to provide the fuel for that remote area as it is very scarce.
19. Others
 - i. To conserve expanded and developed forest to sustain the ecological balance and meet the Socio-economic needs and realities.
 - ii. To stop shrinkage and depletion of forest loud forest resources.
 - iii. To develop and encourage use of substitutes of forest products.
 - iv. To conserve wildlife and bio-diversity strengthen related research and help insemination and exchange of knowledge.
 - v. To conserve and develop wetlands and protect migratory birds.

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APENDICES

Appendix 1.1
Sanctuary of Sundarban

Division	Wild animals sanctuary	Head office	Centers	Area of hector
Divisional Forest Office of west Sundarban	Sanctuary North of Sundarban	Nil Komol	Nil Komol and Dobeyki	36,971
	Sanctuary west of Sundarban	Noytabaki	Noytabaki, Mondarbaria and Pouspkiti	71,502
Divisional Forest Office of East Sundarban	Sanctuary East of Sundarban	Kotka	Kotka, Kochikali and Soupti	31,227

Source: Field survey report

Appendix 1.2
Different Scenario of Sundarban

Sl. No	Name of rangeS	Name of tourism center	Name of rivers	Distance to Twon		Communication
				Name	Distance (km)	
1	Satkhira	Munshigonj	Chona river	Satkhira	70	By road
2	Satkhira	Burigowalini	Arpangashia	Satkhira	80	By road
3	Satkhira	Dobeki	Malonch	Satkhira	85	By road and river
4	Satkhira	Mandarbaria	Sea	Satkhira	105	By road and river
5	Satkhira	Pushpkati	Malonch	Satkhira	145	By road and river
6	Khulna	Nilkamal	Sea	Mogla	80	By road and river
7	Khulna	Sheker Take	Shibsha	Khulna	110	By road and river
8	Khulna	Sutarkhali	Sutarkhali river	Khulna	100	By road and river
9	Khulna	Nolian	Shibsha	Khulna	80	By road and river
10	Khulna	Kalabogi	Sutarkhali	Khulna	90	By road and river
11	Khulna	Jalia	Bol	Khulna	125	By river
12	Khulna	Patcosta	Hongswaraz	Khulna	130	By river
13	Chandpai	Chandpi	Shela	Mogla	14	By road and river
14	Chandpai	Daonmari	Poshor	Mogla	3	By road and river
15	Chandpai	Karomjol	Poshor	Mogla	5	By river
16	Chandpai	Junra	Poshor	Mogla	13	By river
17	Chandpai	Migramari	Shela	Mogla	20	By river
18	Chandpai	Harbaria	Poshor	Mogla	20	By river
19	Sarankhola	Sarankhola	Vola	Mogla	50	By road and river
20	Sarankhola	Suepoti	Boleshsar	Mogla	75	By river
21	Sarankhola	Kachikhali	Boleshsar	Mogla	110	By river
22	Sarankhola	Katka	Sea	Mogla	125	By river

Source: Sundarban Vhabna by Heider, 2004

Appendix 1.3

List of restricted Khals for fishing

Ranges	Name of Khals	Compartment No.
1. Khulna	a) Bhadra	32
	b) Sarbatkhali	32
	c) Mora Bhadra	33
	d) Haddura	33
2. Satkhira	a) Chota keyakhali	46
	b) Bara keyakhali	46
	c) Khalisa Bunia	46
	d) Sapkhali	46
3. Chandpai	a) Karamjal	31
	b) jongra	31
	c) Nandabala	26
	d) Mora Passur	30
	e) Jhapsi	29 & 30
4. Sarankhola	a) Ali Banda	1
	b) Chandeswar	15
	c) Katka	4
	d) Kachikhali	6
	e) Shapla	1
	f) Dasher Varani	24

Source: Field survey report

Appendix 1.4

The deference types of Shrimp, hervested from the Sundarbans

SL.No	SectionName	Bangla Name	Scientific Name	English Name
1	Penaeidea	বাগদা চিংড়ি (Bagda Chingri)	<i>Penaeus monodon</i>	Tiger shirmp
2	Do	চাপা চিংড়ি (Chaga Chingri)	<i>Penaeus indicus</i>	Indian white shrimp
3	Do	দারকুটা চিংড়ি (Darkuta Chingri)	<i>Penaeus japoicus</i>	Kuruma shrimp
4	Do	চামা চিংড়ি (Chama Chingri)	<i>Penaeus merguinensis</i>	Banna shrimp
5	Do	বাগতারা চিংড়ি (Bagtara Chingri)	<i>Penaeus semisulcatus</i>	Green tiger shrimp
6	Do	ললিয়া চিংড়ি, চালি (Lolia Chingri, Chali)	<i>Metapenaeus brevicornis</i>	Yellow shrimp
7	Do	খৈরখোরা চিংড়ি (Khoirkhora Chingri)	<i>Meapeaeus affinis</i>	Giant mud shrimp
8	Do	হ্যানি চিংড়ি (Honey Chingri)	<i>Metapeaeus lysianassa</i>	Brown shrimp
9	Do	হরিনা চিংড়ি (Harina Chingri)	<i>Metapenaeus monoceros</i>	Brown shrimp, speckled shrimp
10	Do	চামা, হ্যানি (Chama, Honey)	<i>Metopenaeus spindulats</i>	Spotted brown shrimp
11	Do	রুডা চিংড়ি (Ruda Chingri)	<i>Parapenaeopsis</i>	Rainbow

			<i>sculptilius</i>	shrimp
12	Do	টিগা চিংড়ি (Tiga Chingri)	<i>Parapenaeopsis uncta</i>	Kuncho river prawn
13	Do	গুশা চিংড়ি (Gusha Chingri)	<i>Parapenaeopsis hardwickii</i>	Kiddi shrimp
14	Do	রুডা চিংড়ি (Ruda Chingri)	<i>Parapenaeopsis stylifera</i>	Kiddi Shrimp
15	Solenoceridae	চামা, সুরা চিংড়ি (Chama, Sura Chingri)	<i>Solenocera subnuda</i>	Mud srimp
16	Sergestidae	গুড়া ইচা, লটিয়া ইচা (Gura Icha, Lotia Icha)	<i>Acetes indicus</i>	Mud shrimp
17	Palaemonidae	গলদা ইচা (Golda Icha)	<i>Macrobrachium rosenbergii</i>	Giant freshwater prawn
18	Do	নাজাড়ি ইচা, সুল ইচা (Najari Icha, Shul Icha)	<i>Macrobrachium birmanicus</i>	Freshwater prawn
19	Do	ঠেঙ্গা ইচা (Thenga Icha)	<i>Macrobrachium lamrrei</i>	Freshwater prawn
20	Do	লুইট্যা ইচা (Luita Icha)	<i>Macrobrachium mirabilis</i>	Spider prawn
21	Do	কুচা চিংড়ি (Kucha Icha)	<i>Macrobrachium rudis</i>	Freshwater prawn
22	Do	ডিমুয়া ইচা (Dimua Icha)	<i>Macrobrachium villosimanus</i>	Freshwater Prawn
23	Do	গুরা ইচা (Gura Icha)	<i>Nematopalaemon tenuipes</i>	
24	Do	গুড়া ইচা (Guda Icha)	<i>Palaemon styliferus</i>	Freshwater prawn
25	Alpheidae	গোদা ইচা (Goda Icha)	<i>Alpheus euphrosyne</i>	Freshwater prawn
26	Scyllardae	বেলসানাসা (Belsanasa)	<i>Thenus orientalis</i>	Locust lobster , cigale - demer

Appendix 1.5

Relative salt tolerance of horticultural and land landscape plant

Woody fruits and trees		Ornamentals, grasses and ground covers		Herbaceous fruits, vegetables, field crops, and flowers	
Highly sensitive	Moderately	Highly sensitive	Moderately	Highly sensitive	Moderately
ECe: <1.3 dS/m	EC: <3.0 dS/m	ECe <1.3 dS/m	EC: <3.0 dS/m	ECe: <1.3 dS/m	EC: <3.0 dS/m
Apple	Aspen	American	Clematis	Beans	Aster
Cherry %	Black locust	linden	Common	Carrot	Broccoli
Prunus spp.	Cottonwood	Cotoneaster	snowball	Onion	Cabbage
Chokecherry	Grape	Mock orange	English Ivy	Parsnip	Cauliflower
Currant	Fir	Oregon	Honeysuckle	Strawberry	Celery
Gooseberry	Green ash	grape	Lilac	Lentil	Corn
Pear	Honey	Rose	Orchardgrass	Mash kalai	(Maize)

Plum Raspberry Lemon Orange Peach	locust Poplar Siberian elm Spruce Willow Maples		Privet Service berry Yellow sage	Chickpea Beans Groundnut Berseem	Cucumber Flowers, general Gladiolus Kale Lettuce Pea Pepper Potato Pumpkin Radish Spinach Squash, scallop Cowpea Broadbean Vetch Bajra Grasspea Gourds Sweet potato Sorghum Millets Clover, berseem Tomato Turnip Watermelon
Moderately Tolerant	Tolerant	Moderately Tolerant	Tolerant	Moderately Tolerant	Tolerant
ECe:<6.0 dS/m	Ec:<10.0 dS/m	ECe<6.0 dS/m	Ec:<10.0 dS/m	ECe:<6.0 dS/m	EC:<10.0 dS/m
Autumn Olive Evergreen, general Juniper Russian olive	Tamarix Date palm Tamarix Salvadora	Blue Grama Karnal grass Buffalo grass Caragana	Alkali grass Creeping barngrass Iceplant	Spinach Sugarcane Raya Rice (direct sowing)	Barley — Cotton Sugar beet

Hackberry		Oleander		Rice (Trans.	Turnip
Pine		Crested		BR-23,	Tobacco
		wheatgrass		Brridhan-47)	Safflower
Guava		Perennial			
		ryegrass			
Pomegranate		Tall fescue		Mustard	Ber
Desi babul		Fine fescue		Safflower,	Mesquit
(Accasia)				Soyabean	
Casuarina		Potentilla		Wheat	
Grape		Wing		Pearl millet	
		euonymous		Sesame	
		Blue panic		Oats	
		grass			
		Para grass		Alfalfa	
		Rhode grass			
		Sudan grass			

Source: Technical Bulletin-1, Hisar Agricultural University, 1992, Blaylock A.D., 1994 and SID

Appendix 1.6 Administrative Areas of Sundarban

Division	District	Upazila	Range office	Area of hector
Divisional Forest Office of west Sundarban	Khulna	Dachap, Paeakgasa and Koyra.	Nolian	1,61,363
	Satkira	Shamnogor	Burigowalini	1,82,663
Divisional Forest Office of East Sundarban	Bagerhat	Mogla and Morolgong	Chandpi	1,00,012
		Sarankhola	Sarankhola	1,33,247

Source: Field survey report

Appendix 1.7 Different Rates of Transport for Tourist

		(in BD Tk.)
		2010
1.	Launch, Trolar and Boat of enter fee (per trip)	
	a) Launch high of 100 Feet per Launch is	2000
	b) Launch high of 50 Feet and low of 100 Foot is	1500
	c) Launch low of 50 Feet is	1000
	d) Trolar (non register)	500
	e) Trolar (registered)	50
	f) Boat	100
	g) Speed boat	300
2.	Accommodation fee:	
	a) For of the per Launch per day	200
	b) For of the per Trolar per day	100
	(Breed Boat and Speedboat cannot situate more days to	

one)	
3. Tourist (Everyday per men in Sundarban with camera)	
a) Home – per man	50
b) Foreigner – per man	350
4. Karamjal and Adjacent Area (per man per day)	
a) Tourist Home	5
b) Tourist foreigner	50
c) Student (per man per day)	10
d) Researcher (Home - per man per day)	30
e) Researcher (foreigner - per man per day)	100
f) Launch Crew (per man per day)	30
g) Guide (per man per day)	50
h) Security guard (per man per day)	100
i) Video camera fee (for home tourist)	100
j) Video camera fee (for foreigner tourist)	200

Source: Field survey report

Appendix 4.1 Differents Rates of Sundarbans Resources

Name of the wood	Unit	2007-2008	2008-2009	2009-2010
Timber	000, sq. fet	6600	8122	6786
Fuel wood	000, sq. fet.	13000	6663	9481
Goal patha	000 M.Ton	72	67	68
Bamboo	000 md	80000	119206	90466
Son Grass	000 Bundles	458	1016	1092
Honey	000 M.Ton	159	182	107
Fish	000 M.Ton	4715	5528	5093

Source: Field survey report

Appendix 4.2

Three wildlife sanctuaries were established in the year 1977 under Bangladesh Wildlife (preservation) (amendment) Act 1974 namely (i) Sundarban East Sanctuary (ii) Sundarban South Sanctuary (iii) Sundarban West Sanctuary.

Name of Sanctuary	Compartment No.	Area (ha.)	Place of importance for wildlife
Sundarban East	4567 (part)	22575.0	Katka, Kachkikhali, Supati & Jamtola
Sundarban South	43 & 44	36971.0	Nilkarnal (Hiron Point), Keora shoti, Kalirchar & Putni Island
Sundarban West	53545549 (part)	71502.0	Mandarbaria & Notabaki

Source: Conserve biodiversity of sundarban reserve forest, Dey, 2001.

Appendix 4.3
Wildlife Biodiversity in Sundarban

Wildlife	No. of Species available in Bangladesh	No. of Species available in Sundarban	Species Biodiversity (%) in Sundarban as compare to Bangladesh
Amphibians	23	8	34.78
Reptiles	154	35	22.72
Birds	632	186	29.43
Mammals	123	32	26.01
Fishes	325	177	54.46
Shrimps	35	24	68.57
Crabs	11	7	63.63

Source: Conserve biodiversity of sundarban reserve forest, Dey, 2001.

Appendix 4.3.1
The Local and Scientific Names of the plants harvested from the Sundarbans

SL.No.	Local Name	Scientific Name
01	হারগোজা (Hargoja)	<i>Acanthus ilicifolius</i>
02	গুদো / টাইগার ফার্ন (Gudo, Tiger Fern)	<i>Acrostichum aureum</i>
03	ডালচাখা (Dalchakha)	<i>Aegialitis rotundifolia</i>
04	খলসী (Kholshi)	<i>Aegiceras corniculatum</i>
05	আমুর (Amur)	<i>Amoora cucullata</i>
06	চোর কাঁটা (Chor Kata)	<i>Andropogon aciculatus</i>
07	সাদা বাইন (Sada Bain)	<i>Avicennia alba</i>
08	মরিচা বাইন (Moricha Bain)	<i>Avicennia marina</i>
09	বাইন (Bain)	<i>Avicennia officinalis</i>
10	কুম্ব (Kumvo)	<i>Barringtonia racemosa</i>
11	শেতপলী (Shatpoli)	<i>Premna integrifolia</i>
12	সুন্দরী লতা (Sundori Lota)	<i>Brownlowia tersa</i>
13	কাঁকড়া (Kakra)	<i>Bruguiera gymnorhiza</i>
14	কুটুম কাঁটা (Kutum Kata)	<i>Caesalpinia crista</i>
15	পানিয়াল (Panial)	<i>Calophyllum inophyllum</i>
16	সিটকা (Sitka)	<i>Clerodendrum inerme</i>
17	সিংগারা (Singara)	<i>Cynometra ramiflora</i>
18	গর্জন / বানা (Goron)	<i>Rhizophora mucronata</i>
19	খুসা (Khusha)	<i>Cyperus javanicus</i>
20	চাঁদাকাঁটা (Chadakata)	<i>Dalbergia spinosa</i>
21	বাঁচাদগা (Bachadaga)	<i>Dalbergia torta</i>
22	খোলা (Khola)	<i>Derris scandens</i>
23	কালি লতা (Kali Lota)	<i>Derris trifoliata</i>
24	গাব (Gab)	<i>Diospyros peregrina</i>
25	বন বকুল (Bon Bokul)	<i>Entada pursaetha</i>
26	নল ঘাস (Nal Gash)	<i>Eriochloa procera</i>
27	জাম (Jam)	<i>Eugenia frutcosa</i>
28	গেওয়া (Gawya)	<i>Excocaria agallocha</i>
29	বাটুল (Batul)	<i>Excoecaria indica</i>
30	গোয়েল (Goyal)	<i>Ficus infectoria</i>

31	নল খাগরা (Nol Khagra)	<i>Phragmites karka</i>
32	আশোরা (Ashera)	<i>Glycosmis pentaphylla</i>
33	সুন্দরী (Sundhori)	<i>Heritiera fomes</i>
34	আধা বিরনী (Adha Birni)	<i>Herpestis monniera</i>
35	ভোলা (Bhola)	<i>Hibiscus tiliaceous</i>
36	ভেলা (Bhela)	<i>Intsia bijuga</i>
37	কারানজা (Karanoja)	<i>Pongamia pinnata</i>
38	শুরা (Sura)	<i>Kandelia candel</i>
39	বন লিচু (Bon Lichu)	<i>Lepisanthes rubiginosa</i>
40	ছোট বরই (Soto Boro)	<i>Loranthus globosus</i>
41	কিরপা (Kirpa)	<i>Lumintzera racemosa</i>
42	বন নটাই (Ban Natai)	<i>Mallotus repandus</i>
43	ধানসী (Dhanshi)	<i>Oryza quarctata</i>
44	গোলপাতা (Goalpata)	<i>Nypa fruticans</i>
45	কেওয়া কাঁটা (Kowa Kata)	<i>Pandanus foetidus</i>
46	ডাগর (Dagor)	<i>Cerbera crista</i>
47	গরান (Goran)	<i>Ceriops decandra</i>
48	নারিকেলী (Narikel)	<i>Phtunga roxburghii</i>
49	হেঁতাল (Hetal)	<i>Phoenix paludosa</i>
50	উলু (Ulu)	<i>Saccharum cylindricum</i>
51	ছোট বরই (Soto Boro)	<i>Salacia chinensis</i>
52	বাওয়ালী লতা (Bowali Lata)	<i>Sarcolobus globosus</i>
53	কেওড়া (Kawra)	<i>Sonneratia apetala</i>
54	ওরা (Ora)	<i>Sonneratia caseolaris</i>
55	ঢেঁকি লতা (Dheki Lota)	<i>Stenochalena palustris</i>
56	নোনা ঝাউ (Nona Jaw)	<i>Tamariz galolica</i>
57	জার্মানী লতা (Germani Lota)	<i>Thunbergia sp.</i>
58	হোগলা (Hogla)	<i>Thypa elephantina</i>
59	সামু লতা (Samu Lota)	<i>Viscum minoicum</i>
60	ধুন্দল (Dhondul)	<i>Xylocarpus granatum</i>
61	পশুর (Poshur)	<i>Xylocarpus mekingensis</i>
62	কলাজিরা (Kolazira)	<i>Vernoria cinerea</i>
63	চিকন (Chikon)	<i>Plie ata</i>
64	ভুঁই ওকরা (Bhoi Okra)	<i>Saccolabium papillosun</i>
65	ছিটাইয়া বোড়া (Chitaia Bora)	<i>Polypodium iriodes</i>
66	দাদমারী (Dadmari)	<i>Ammannia sp</i>
67	দা-খুন্তি (Da Kunti)	<i>Sesuvium portulacastrum</i>
68	গলগটি লতা (Golgoti Lota)	<i>Tetrastichum aureum</i>
69	পাকুর (Pakur)	<i>Vitis quadrangulans</i>
70	ময়না (Moina)	<i>Fangueria spinosa</i>
72	মাকাল (Makal)	<i>Trichosanthes palmta</i>
73	বামনহাট্রি (Bamonhati)	<i>Clerodendron siphonanthus</i>
74	নুশা (Nuncha)	<i>Aphania danura</i>
75	বন কলমি (Bon Kolmi)	<i>Ipomea sepiaria</i>
76	বানুর কালাই (Banor Kalai)	<i>Aylosai scarabacoidas</i>
77	বড় কেউরি (Boro Kawri)	<i>Euphorbia pilulifera</i>
78	বড় সালফান (Boro Salphan)	<i>Flemingia proliferun</i>
79	বরুন (Borun)	<i>Cataeva religiosa</i>
80	বিলাতি কিকার (Bilati Kikar)	<i>Arkinsonia aculeata</i>
81	বোলি লতা (Boli Lota)	<i>Sarcolobus carinatus</i>
82	ছাকুন্দা (Sakunda)	<i>Cassia troa</i>

83	ইকবির (Ickbir)	<i>Helminthostachys zeylanica</i>
84	গোবারু (Gobaru)	<i>Amisomeles ovata</i>
85	হালাইসু (Halaisu)	<i>Cyperus tegetiformis</i>
86	মালাইয়া (Malaiya)	<i>Mariseus albesceup</i>
87	লানিয়া (Bania)	<i>Protulaca oleracesa</i>
88	পারানি কেলা (Parani Kela)	<i>Ottelia viridis</i>
89	টুনটুনি (Tuntuni)	<i>Amaranthus viridis</i>
90	উলু (Ulu)	<i>Lippia nodiflora</i>
91	শিয়াল কাঁটা (Shial Kata)	<i>Craicus arvensis</i>
92	ঠাঁহী মোদী (Modi)	<i>Pycneus polystachyus</i>
93	লিমলি (Limli)	<i>Tamarindus indica</i>
94	সামা (Sama)	<i>Panicum proliferum</i>
95	গুমা (Guma)	<i>Leucas linifolia</i>
96	দোরা বিয়ারা (Dora Biara)	<i>Setatia verticillata</i>
97	দুধি লতা (Dhdhi Lota)	<i>Finlaysonia obovata</i>
98	ডুমলা (Dumla)	<i>Traspesia populnea</i>
100	কুলিয়া (Kulia)	<i>Hygrophila spinosa</i>
101	কাসরা (Kashra)	<i>Hydrolea zeylanica</i>

Appendix 4.3.2
Wild animals of the Sundarbans

SL.No.	Bangla Name	Common Name	Scientific Name
1	ডোরা বাঘ /বড় বাঘ (Dora Bagh/ Boro Bagh)	Bengal Tiger	<i>Panther tigris</i>
2	চিত্রা হরিণ (Chitra Horin)	Spotted Deer	<i>Axis axis</i>
3	মায়া হরিণ (Maya Horin)	Barking Deer	<i>Muntiacus muntjak</i>
4	বানর (Banor)	Rhesus Macaque	<i>Mucaca mulatta</i>
5	বন শুকুর (Bon Sukor)	Wild Boar	<i>Sus scrofa</i>
6	বন বিড়াল (Bon Biral)	Jungle Cat	<i>Felis chaus</i>
7	মেছো বিড়াল (Meso Biral)	Fishing Cat	<i>Prionailurus viverrinus</i>
8	শিয়াল (Siyal)	Jackal	<i>Canis aureus</i>
9	বেজী (Beji)	Common Mongoose	<i>Herpestes edwardsi</i>
10	উদ (Udh)	Smooth-coated Otter	<i>Lutra perspicillata</i>
11	উড় গন্ধা গোকুল (Udh Gondha Gokul)	Large Indian Civet	<i>Viverra zibetha</i>
12	কাঠ বিড়ালী (Kath Biral)	Five-striped Palm Squirrel	<i>Funambulus pennanti</i>
13	বড় দাড়ি ইদুর (Boro Dari Edur)	Bandicoot Rat	<i>Bandicota indica</i>
14	ছোট দাড়ি ইদুর (Soto Dari Edur)	Lesser Bandicoot Rat	<i>Bandicota benglaensis</i>
15	ল্যাংটা ইদুর (Lankta Edur)	House Mouse	<i>Mus musculus</i>
16	ইদুর (Edur)	Common House Rat	<i>Rattus rattus</i>
17	গেছো ইদুর (Geso Edur)	Long-tailed Tree Mouse	<i>Vandeleuria oleracea</i>
18	সজারু (Sojaru)	Indian Porcupine	<i>Hystrix indica</i>
19	ইরাওয়াডি শুশুক (Irrawari Susuk)	Irrawaddy Dolphin	<i>Orcaella brevirostris</i>
20	শুশুক (Susuk)	Melon-headed Dolphin	<i>Peponocephala electra</i>
21	লবনাক্ত কুমির (Lobonakta Kumir)	Estuarine Crocodile	<i>Crocodylus porosus</i>
22	রিডলি সাগর কাছিম (Ridly Sagor Kasim)	Olive Ridley Turtle	<i>Lepidochelys olivacea</i>
23	সবুজ কাছিম (Sobus Kassim)	Green Turtle	<i>Chelonia mydas</i>

24	গুই সাপ (Gui Shap)	Common House Lizard	<i>Hamidactylus flaviviridis</i>
25	বাদামী গুই সাপ (Badami Gui Shap)	Grey/Bengal Monitor Lizard	<i>Varanus bengalensis</i>
26	হলুদ গুই সাপ (Holud Gui Shap)	Yellow Monitor Lizard	<i>Varanus flavescens</i>
27	আংটি গুই সাপ (Angti Gui Shap)	Ring Lizard	<i>Varanus salvator</i>
28	রিভার টেরাপিন (River Terrapin)	River Terrapin	<i>Batagur baska</i>
29	রাজ গোকরা (Raj Gokhra)	King Cobra	<i>Ophiophagus hannah</i>
30	সানকিনি (Sankini)	Common Krait	<i>Bungarus caeruleus</i>
31	ডোরা সানকিনি (Dora Sankini)	Banded Krait	<i>Bungarus fasciatus</i>
32	ডোরা সাপ (Dora Shap)	Checkered Iback	<i>Xenochrophis piscator</i>
33	লতা সাপ (Lota Shap)	Common Vine Sanke	<i>Ahaetulla nasustus</i>
34	বালির অজগর (Balir Ajogor)	Common Sand Boa	<i>Eryx conica</i>
35	অজগর (Ajogor)	Rock Pytho	<i>Python molurus</i>
36	পিটবিপার (Pitbipar)	Spot-tailed Pit Viper	<i>Trimeresurus erythrurus</i>
37	কুনো ব্যাঙ (Kuno Bang)	Common Toad	<i>Bufo melanostictus</i>
38	স্কিপার ব্যাঙ (Skiper Bang)	Sipper Frog	<i>Euphlyctis hexadactylus</i>
39	সবুজ ব্যাঙ (Sobuj Bang)	Green Pond Frog	<i>Hoplobatrachus tigerinus</i>
40	সোনা ব্যাঙ (Sona Bang)	Bull Frog	<i>Limnonectes tigerinus</i>
41	ঝিঝি ব্যাঙ (Jijhi Bang)	Cricket Frog	<i>Limnonectes limncharis</i>
42	ভাপু/পানা ব্যাঙ (Pana Bang)	Boulenger's Frog	<i>Rana alticola</i>
43	গেছো ব্যাঙ (Geso Bang)	Tree Frog	<i>Polypedates maculatus</i>
44	বন মোরগ (Bon Morog)	Red Junglefowl	<i>Gallus gallus</i>
45	লেন্জা (Lenja)	Northern Pintail	<i>Anas acuta</i>
46	রাজহাঁস (Rajhas)	Bar-headed Goose	<i>Anser indicus</i>
47	পাতরী হাঁস (Patrihas)	Common Teal	<i>Anas crecca</i>
48	ডুবরু হাঁস (Dubar has)	Common Pochard	<i>Aythya ferina</i>
49	খর্বাকার হাঁস (Korbakar has)	Cotton Pygmy-goose	<i>Nettapus coromandelicus</i>
50	কাল লেজ কাঠ তোকরা (Kalo Lej Kat Tokra)	Black-romped Flameback	<i>Dinopium benghalensis</i>
51	জাভান কাঠ তোকরা (Jaban Kat Tokra)	Common Flameback	<i>Dinopium javanense</i>
52	বড় কাঠ তোকরা (Boro Kat Tokra)	Greater Flameback	<i>Chrysocolaptes lucidus</i>
53	বাদামী মাথাওয়ালা কাঠ তোকরা (Badami Mathawala Kat Tokra)	Grey-headed Woodpecker	<i>Picus canus</i>
54	ডোরা কাটা কাঠ তোকরা (Dora Kata Kat Tokra)	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>
55	কাঠফোরা (Katfora)	Yellow-fronted Pied Woodpecker	<i>Dendrocopos mahrattensis</i>
56	ধূসর বুটি কাঠতোকরা (Dusor Jhuti Kat Tokra)	Grey-capped Pygmy Woodpecker	<i>Dendrocopos conicapillus</i>
57	বাদামী বুটি কাট তোকরা (Badami Jhuti Kat Tokra)	Brown-capped pygmy Woodpecker	<i>Dendrocopos nanus</i>
58	খয়েরী কাঠ তোকরা (Khorir Kat Tokra)	Rufous Woodpecker	<i>Celeus brachyurus</i>
59	খুদে মাছ রান্ধা (Khude Mash Ranga)	Common Kingfisher	<i>Alcedo atthis</i>
60	সারস মাছ রান্ধা (Sharosh Mash)	Stork-billed Kingfisher	<i>Halcyon capensis</i>

	Ranga)		
61	কাল ঝুটি মাছ রান্ধা (Kal Juti Mash Ranga)	Black-capped Kingfisher	<i>Halcyon pileata</i>
62	বাদামী মাছ রান্ধা (Badami Mash Ranga)	Brown-winged Kingfisher	<i>Halcyon amauroptera</i>
63	লাল মাছ রান্ধা (Lal Mash Ranga)	Ruddy Kingfisher	<i>Hacyon coromandra</i>
64	মাছ রান্ধা (Mash Ranga)	White-throated Kingfisher	<i>Halcyon smyrnensis</i>
65	মাছ রান্ধা	Collared Kingfisher	<i>Todiramphus chloris</i>
66	পাকরা মাছ রান্ধা (Pakra Mash Ranga)	Pied Kingfisher	<i>Ceryle rudis</i>
67	বাঁশপতি (Bashpoti)	Green Bee-eater	<i>Merops orientalis</i>
68	ভারতীয় কোকিল (Bharotio Kokil)	Indian Cuckoo	<i>Cuculus micropterus</i>
69	এশিয় কোকিল (Asia Kokil)	Asian Cuckoo	<i>Eudynamys scolopacea</i>
70	এশিয় নাক্কাটি (Asia Nakkati)	Asian Palm Swift	<i>Cypsiurus balasiensis</i>
71	নাক্কাটি (Nakkati)	House Swift	<i>Apus affinis</i>
72	লক্ষিপেঁচা (Loxmi Pecha)	Barn Owl	<i>Tyto alba</i>
73	কালপেঁচা (Kalo Pecha)	Jungle Owlet	<i>Glaucidium radiatum</i>
74	ভূতুম পেঁচা (Vutum Pecha)	Brown Fish Owl	<i>Ketupa zeylonensis</i>
75	হুতুম পেঁচা (Hutom Pecha)	Great Horned Owl	<i>Bubo bubo</i>
76	দিন কানা (Din Kana)	Indian Nightjar	<i>Caprimulgus asiaticus</i>
77	সবুজ ঘুঘু (Sobuj Ghu Ghu)	Emerald Dove	<i>Chalcochaps indica</i>
78	জালালী কবুতর (Jalali Kobutor)	Rock Pigeon	<i>Columba livia</i>
79	টিলা ঘুঘু (Tila Ghu Ghu)	Spotted Dove	<i>Streptopelia schinensis</i>
80	লাল ঘুঘু (Lal Ghu Ghu)	Red Collared Dove	<i>Streptopelia tranguerbarica</i>
81	জল মুরগী (Jal Murgi)	White-breasted Waterhen	<i>Amourornis phoenicurus</i>
82	বালি বাটন (Bali Baton)	Common Sandpiper	<i>Actitis hypoleucos</i>
83	সবুজ বাটন (Sobuj Baton)	Green Sandpiper	<i>Tringa ochropus</i>
84	বালু বাটন (Balu Baton)	Marsh Sandpiper	<i>Tringa stagnatilis</i>
85	বামন চা পাখি (Bamon Cha Phakhi)	Little Stint	<i>Calidris minuta</i>
86	কাদা খোঁচা (Kada Chokha)	Fantail Snipe	<i>Gallinago gallinago</i>
87	কাদা খোঁচা (Kada Chokha)	Pintail Snipe	<i>Gallinago stenura</i>
88	বালু বাটন (Balu Baton)	Wood Sandpiper	<i>Tringa glareola</i>
89	হ-টি-টি (Ho-Ti-Ti)	Red-wattled Lapwing	<i>Vanellus indicus</i>
90	হ-টি-টি (Ho-Ti-Ti)	Yellow-wattled Lapwing	<i>Vanellus indicus</i>
91	ছোট বালি বাটন (Soto Bali Baton)	Lesser Sand Plover	<i>Charadrius mongolus</i>
92	বড় বালি বাটন (Boro Bali Baton)	Greater Sand Plover	<i>Charadrius leschenaultii</i>
93	মোট ঠোঁট গাংচিল (Mot Thot Gang Chil)	Gull-billed Tern	<i>Gelochelidon nilotica</i>
94	কাল পেট গাংচিল (Calo Pet Gang Chil)	Black-bellied Tern	<i>Sterna acuticauda</i>
95	ছোট গাংচিল (Soto Gang Chil)	Little Tern	<i>Sterna albifrons</i>
96	গাংচিল (Gang Chil)	River Tern	<i>Sterna aurantia</i>
97	গঙ্গাচিল (Gonga Chil)	Whiskered Tern	<i>Chlidonias hybridus</i>
98	হেরিং জল কবুতর (Hering Jol Kobutor)	Herring Gull	<i>Larus argentatus</i>
99	জল কবুতর (Jol Kobutor)	Brown-headed Gull	<i>Larus brunnicephalus</i>

100	কালাসির জলকবুতর (Kalasir Jol Kobutor)	Black-headed Gull	<i>Larus ridibundus</i>
101	সাধারণ গাংচিল (Gang Chil)	Common Tern	<i>Sterna hirundo</i>
102	তুর্কি রাজ (Turki Raj)	Shirk	<i>Accipiter badius</i>
103	কালো ঘাড়ওয়ালা চিল (Kalo Gharoala Chil)	Black shouldered Kite	<i>Elanus caeruleus</i>
104	শকুন (Sokum)	White-backed Vulture	<i>Gyps bengalensis</i>
105	সাদা ঈগল (Sada Egale)	White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>
106	শঙ্খ চিল (Sonkho Chil)	Brahminy Kite	<i>Haliastur indus</i>
107	কালো চিল (Kalo Chil)	Black Kite	<i>Milvus migrans</i>
108	স্টেপ ঈগল (Step Egale)	Eastern Steppe Eagle	<i>Aquila rapax</i>
109	ওয়ারীয়েন্টাল বাজার্ড (Oriental Bajard)	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>
110	তিলা ঈগল (Tila Egale)	Crested Serpent Eagle	<i>Spilornis cheela</i>
111	হক্ক ঈগল (Hocks Egale)	Changeable Hawk Eagle	<i>Spizaetus cirrhatus</i>
112	কালো ঈগল (Kalo Egale)	Black Eagle	<i>Ictinaetus malayensis</i>
113	গয়ার (Gowar)	Darter	<i>Anhinga melanogaster</i>
114	পান কৌড়ি (Pan Kowri)	Little Cormorant	<i>Phalacrocorax niger</i>
115	ধুসর বক (Dhusor Bok)	Grey Heron	<i>Ardea cinerea</i>
116	কানা বক (Kana Bok)	Indian Pond Heron	<i>Ardeola grayii</i>
117	কুরো বক (Kuro Bok)	Little Heron	<i>Butorides striatus</i>
118	বড় বক (Boro Bok)	Great Egret	<i>Casmerodius albus</i>
119	কালো বক (Kalo Bok)	Black Bittern	<i>Dupetor flevicollis</i>
120	নিটি বক (Niti Bok)	Little Egret	<i>Egretta garzetta</i>
121	লালা বক (Lala Bok)	Cinnamon Bittern	<i>Ixobrychus cinnamineus</i>
122	মদন টাক (Modon Tak)	Lesser Adjutant	<i>Leproptilos javanicus</i>
123	দাঁড় কাক (Tar Kak)	Jungle Crow	<i>Corvus macrorhynchos</i>
124	কাক (Kak)	House Crow	<i>Icorvus splendens</i>
125	ফিংগে (Fenga)	Black Drongo	<i>Dicrurus macrocercus</i>
126	ছোট ভিমরাজ (Soto Vimraj)	Lesser Raquet-tailed	<i>Dicrurus remifer</i>
127	বড় ভিমরাজ (Boro Vimraj)	Lesser Raquet-tailed Drongo	<i>Dicrurus paradiseus</i>
128	শ্যামা (Shema)	White-rumped Shama	<i>Copsychus malabaricus</i>
129	দোয়েল (Dowel)	Oriental Magpie Robin	<i>Copsychus saularis</i>
130	ঝুটি শালিক (Juti Salik)	Jungle Myna	<i>Acridotheres fuscus</i>
131	শালিক (Salik)	Common Myna	<i>Acridotheres tristis</i>
132	বুলবুল (Bulbul)	Red-vented Bulbul	<i>Pycnonotus cafer</i>
133	পাকরা টুনটুনি (Pakra Tuntuni)	Purple-rumped Sundird	<i>Nectarinia zeylonica</i>
134	খঞ্জন (Khonjhon)	Forest Wagtail	<i>Dendronanthus indicus</i>
135	সাদা খঞ্জন (Sada Khonjhon)	White Wagtail	<i>Motacilla alba</i>
136	চড়ুই (Shuroi)	House Sparrow	<i>Passer domesticus</i>
137	বাবুই (Baboi)	Baya Weaver	<i>Ploceus philippinus</i>

Source: Field Survey report

Appendix 4.3.3

The Condrictis Speceics of the Sundarbans

SL No.	Section Name	Bangla Name	Scientific Name	Common English Name
1	Carcharhinidae	কালাহাঙ্গর (KaloHangor)	<i>Carcharhinus melanopterus</i>	Blacktip reef shark
2	Carcharhinidae	ইলিশাহাঙ্গর (HilsaHango)	<i>Glyphis glyphis</i>	Illisha shark
3	Carcharhinidae	থুদ্রেহাঙ্গর(ThutroHangor)	<i>Scoliodon laticaudus</i>	Spadenose shark
4	Carcharhinidae	থুদ্রেহাঙ্গর(ThutroHangor)	<i>Scoliodon sorrakowah</i>	Dog fish
5	Carcharhinidae	কামোটহাঙ্গর(Kamot Hangor)	<i>Scolion walbeehmi</i>	Milk shark
6	Carcharhinidae	করাতহাঙ্গর(KorathHangor)	<i>Pristis microdon</i>	Saw fish
7	Sphyrnidae	হাতুরীহাঙ্গর(HaturiHangor)	<i>Eusphyrna blochii</i>	Hammerhead shark
8	Rhynchobatidae	পীতাম্বরী (Pitambori)	<i>Rhynchobatus djeddnsis</i>	Guitarfish
9	Rhinobatidae	পীতাম্বরী (Pitambori)	<i>Rhinobatos granulatus</i>	Scate
10	Dasyatidae	শাপলাপাতা (Shapla pata)	<i>Dasyatis zugei</i>	Pale-edged ray
11	Dasyatidae	শাপলাপাতা (Shapla pata)	<i>Himantura fluviatilis</i>	Gangetic stingray
12	Dasyatidae	শাপলাপাতা (Shapla pata)	<i>Himantura imbricata</i>	Scaly stingray
13	Dasyatidae	শাপলাপাতা (Shapla pata)	<i>Himantura uarnak</i>	Stingray
14	Dasyatidae	শাপলাপাতা (Shapla pata)	<i>Dasyatis walgu</i>	Stingray
15	Torpedinidae	চোর কাঁটা/দ্যুত মাছ(Chorkata)	<i>Narcine brunnea</i>	Electric ray
16	Torpedinidae	চোর কাঁটা/দ্যুত মাছ(Chorkata)	<i>Narcine brunnea</i>	Electric ray
17	Torpedinidae	চোর কাঁটা/দ্যুত মাছ(Chorkata)	<i>Narke dipterygia</i>	Electric ray
18	Gymnuridae	প্রজাপতিমাছ/ শাপলাপাতা(Projapotimash)	<i>Gymnura poicilura</i>	Butterfly ray

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19	Clupeidae	হিচ্চিরী (Hischiri)	<i>Escualosa thoracata</i>	White sardine
20	Clupeidae	টাকিয়া (Takia)	<i>Sardinella fimbriata</i>	Fringescale Sardine
21	Clupeidae	টন্দনা/টাকিয়া (Tondona/Takia)	<i>Sardinella gibbosa</i>	Goldstripe sardine
22	Clupeidae	টন্দনা/টাকিয়া (Tondona/Takia)	<i>Sardinella melanura</i>	Sardine

23	Clupeidae	চাপিলা (Chapila)	<i>Gudusia chapra</i>	Indian river shad
24	Clupeidae	ইলিশ (Elish)	<i>Tenualosa/Hilsa ilisha</i>	Hilsha shad
25	Clupeidae	গুর্তা ইলিশ (Gurta Elish)	<i>Hilsa kelee</i>	Keleeshad
26	Clupeidae	চন্দনা ইলিশ (Chondona Elish)	<i>Hilsa toil</i>	Toli shed
27	Clupeidae	চৌকা ইলিশ (Chouka Elish)	<i>Ilisha filligera</i>	Bigeye ilisha
28	Clupeidae	চোকা, চৌকা ইলিশ (Chokka, Chouka Elish)	<i>Ilisha megaloptera</i>	Bigeye ilisha
29	Clupeidae	চোকা, চৌকা ইলিশ (Chokka, Chouka Elish)	<i>Ilisha elongata</i>	Indian ilisha
30	Clupeidae	রাম চৌকা (Ram Chouka)	<i>Ilisha elongata</i>	Bigeye ilisha
31	Do	কই পুটি (Koe Putee)	<i>Anodonlostoma chacunda</i>	Gizzard shad
32	Do	ফাতরা, ফ্যাসা (Fatra Fesha)	<i>Raconda russelliana</i>	Smooth-back herring
33	Do	নাইল্যা (Nyla)	<i>Dussumieria acula</i>	Rainbow sardine
34	Engraulidae	আলুয়া, আমাদি, বৈরাগী (Alura, Amadi, Boieragi)	<i>Coilia dussumieria</i>	Pointed tail anchovy
35	Engraulidae	আলুয়া, আমাদি, বৈরাগী (Alura, Amadi, Boieragi)	<i>Coilia neglecta</i>	Neglected
36	Engraulidae	আলুয়া, আমাদি, বৈরাগী (Alura, Amadi, Boieragi)	<i>Coilia ramkorati</i>	Tapertail anchovy
37	Engraulidae	ফ্যাসা (Fesha)	<i>Setippina phasa</i>	Gangetic hairfin anchovy
38	Engraulidae	তেইল্যা ফ্যাসা (Toiela Fesha)	<i>Setipinna taty</i>	Scaly hairfin anchovy
39	Engraulidae	কাটা ফ্যাসা (Kata Fesha)	<i>Stolephorus tri</i>	Anchovy
40	Engraulidae	ফ্যাসা (Fesha)	<i>Thryssa mystax</i>	Moustached thryssa
41	Engraulidae	ফ্যাসা (Fesha)	<i>Thryssa dussumieria</i>	Dussumier's thryssa
42	Engraulidae	রাম ফ্যাসা (Ram Fesha)	<i>Thryssa hamiltony</i>	Hamilton's thryssa
43	Chirocentridae	করাতি চালা (Korati Chela)	<i>Chirocentrus dorab</i>	Wolf herring
44	Chirocentridae	করাতি চালা (Korati Chela)	<i>Chirocentrus nudus</i>	Wolf herring
45	Elopidae	ইলোপ (Eloop)	<i>Elops machnata</i>	Tenpounder, terpon
46	Muraenesoidae	কামিলা (Kamila)	<i>Congresox talabon</i>	Yellow pike-conger
47	Muraenesoidae	কামিলা (Kamila)	<i>Mystus gulio</i>	Daggertooth pike-conger
48	Bagridae	গুইল্যা (Guila)	<i>Mystus gulio</i>	Long-whiskered catfish
49	Schilbeidae	শিলং (Sheling)	<i>Silonia silonsia</i>	Silondia
50	pangasidae	পাঙ্গাস (Punggas)	<i>Pangasius pangasius</i>	Fatty catfish
51	Ariidae	মেদ কাঁটা (Meth)	<i>Arius arius</i>	Threadfin sea catfish

		Kata)		
52	Ariidae	মেদ কাঁটা (Meth Kata)	<i>Arius caelatus</i>	Engraved catfish
53	Ariidae	মেদ কাঁটা (Meth Kata)	<i>Arius gagora</i>	Gagor catfish
54	Ariidae	মেদ কাঁটা (Meth Kata)	<i>Arius meculatus</i>	Spotted catfish
55	Ariidae	মেদ কাঁটা (Meth Kata)	<i>Arius thalassinus</i>	Giant sea catfish
56	Plotosidae	কাউন মাগুর (Kowun Magur)	<i>Plotosus canius</i>	Canine eeltail catfish
57	Plotosidae	কাউন মাগুর (Kowun Magur)	<i>plotosus lineatus</i>	Striped eeltail catfish
58	Synodontidae	টিকটিকিত, আচিলা (Tiktikit, Aychela)	<i>Saurida tumbil</i>	Greater lizardfish
59	Hamiramphidae	লইট্যা (Loita)	<i>Harpadon nehereus</i>	Bombay duck
60	Batrachoididae	গনগোনিয়া (Gongonira)	<i>Butrichthys grunniens</i>	Gangetic toadfish
61	Hamiramphidae	এক থুইট্যা (Aek Thuita)	<i>Hemiramphus georgii</i>	Geore's halfbeak
62	Hamiramphidae	এক থুইট্যা (Aek Thuita)	<i>zenarchopterus ectuntio</i>	Ectuntio halfbeak
63	Belonidae	কাঁকিলা (Kakila)	<i>Strogylura strongylura</i>	Needlefish
64	Fistularidae	বঙশি (Bongashe)	<i>Fistularia villosa</i>	Rough frutem outh
65	Syngnathidae	ঘোড়া মাছ (Ghora Mach)	<i>Hippocampus kuda</i>	Seahorse
66	Synbranchidae	কুইচা (Kuicha)	<i>Monopterus cuchia</i>	Gangetic mudeel
67	Scoraenidae	রঙ্গিলা (Rongila)	<i>Pterois russelli</i>	Russel's lionfish
68	Scoraenidae	রঙ্গিলা (Rongila)	<i>Pterois miles</i>	Russel's lionfish
69	Platycephalidae	ফোঁটা মুর বাইল্যা (Fota Mur Baila)	<i>Platycephalus crocodylus</i>	Spottead
70	Do	মুর বাইল্যা (Mur Baila)	<i>Ploatycephalus scaber</i>	Rough flathead
71	Do	মুর বাইল্যা (Mur Baila)	<i>Platycephalus indicus</i>	Flathead
72	Do	কাঁটা মুর বাইল্যা (Kata Mur Baila)	<i>Platycephalus asper</i>	Thorny flathead
73	Centropomidae	ভেটকি, কোরাল (Vetki Koral)	<i>Lates calearifer</i>	Sea bass, barramundi
74	Ambassidae	নামা চান্দা (Nama Chanda)	<i>Chanda nama</i>	Elongate glassy perchiet
75	Ambassidae	কাটা চান্দা (Kata Chanda)	<i>Pseudanbassis baculis</i>	Himalayan glassy perchiet
76	Ambassidae	লাল চান্দা (Lal Chanda)	<i>Pseudambassis ranga</i>	Indian glassy perchiet
77	Serranidae	বোল (Boal)	<i>Cephalopholis miniatus</i>	Grouper
78	Serranidae	বোল (Boal)	<i>Epinephalus fasciatus</i>	Grouper
79	Serranidae	বোল (Boal)	<i>Epinephalus tauvina</i>	Grouper
80	Theraponidae	বারগুনি (Barguni)	<i>Therapon jarbua</i>	Therapon perch
81	Theraponidae	গুগু (GuGu)	<i>Therapon theraps</i>	Banded therapon perch
82	Apogonidae	দুইদা (Duida)	<i>Apogon septemstriatus</i>	Nine-banded cardinalfish

83	Apogonidae	গোগলা (Gogla)	<i>Apogon septemstriatus</i>	Seven-banded cardinalfish
84	Sillaginidae	হুন্দ (Hundo)	<i>Sillaginopsis panjus</i>	Gangetic sillago
85	Sillaginidae	হুন্দ (Hundo)	<i>Sillago sihama</i>	Silvr whiteling
86	Sillaginidae	হুন্দ (Hundo)	<i>Sillago domina</i>	Ladyfish
87	Carangidae	পেখম মুরি (Pathom Muri)	<i>Alectis indica</i>	Threadfin trevally
88	Carangidae	মুরি (Muri)	<i>Alepes djeddaba</i>	Djeddaba crevalle
89	Carangidae	ডোরা মুরি (Dora Muri)	<i>Alepes melanoptera</i>	Blackfin crevalle
90	Carangidae	মুরি (Muri)	<i>Atropus atropus</i>	Kuweh trevally
91	Carangidae	কাউয়া (Koura)	<i>Megalasois orbdyla</i>	Torpedo trevally hardtall scad
92	Carangidae	চাপা কোরি (Chapa Kouri)	<i>Scomberoides commersonianus</i>	Talang queenfish
93	Carangidae	মুরি (Muri)	<i>Commersonianus</i>	Malabar cavalla
94	Carangidae	মুরি, সালার (Muri, Salar)	<i>Selar boops</i>	Oxeye scad
95	Carangidae	বোরো চৌকা (Boro Chouka)	<i>Selar rumenophthalmus</i>	Bigeye scad
96	Carangidae	কালো ডোরা, মুরি (Kalo Dora, Muri)	<i>Seriolina nigrofasciata</i>	Black-banded trevally
97	Lactariidae	সাড়া (Sada)	<i>Lactarius lactarius</i>	False trevally
98	Formionidae	হাইল চান্দা (Hail Chanda)	<i>Formio niger</i>	Black pomfret
99	Menidae	চান্দা (Chanda)	<i>Mene maulata</i>	Moonfish
100	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Gazza minuta</i>	Toothed ponyfish
101	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Leiognathus bidus</i>	Orangefin ponyfish
102	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Leiognathus equulus</i>	Common ponyfish
103	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Leiognathus brevirostris</i>	Shortnose ponyfish
104	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Leiognathus fasciatus</i>	Striped ponyfish
105	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Secutor ruconius</i>	Deeponose ponyfish
106	Leiongahidae	টাকা চান্দা (Taka Chanda)	<i>Secutor insidiator</i>	Pugnose ponyfish
107	Lutjanidae	রাঙ্গা চৌকা (Rangga Chouka)	<i>Lutjanus johni</i>	John's snapper
108	Lutjanidae	রাঙ্গা চৌকা (Rangga Chouka)	<i>Lutjanus sanguineus</i>	Blood snapper
109	Lutjanidae	রাঙ্গা চৌকা (Rangga Chouka)	<i>Lutjanus malabaricus</i>	Malabar red snapper
110	Lutjanidae	চৌকা (Chouka)	<i>Pinjalo pinjalo</i>	Pinjalo snapper
111	Nemipteridae	রূপবান (Rupban)	<i>Nemiplerus japonicus</i>	Japanese threadfin bream
112	Nemipteridae	সোনাবাম (Sonabam)	<i>Nemiplerus nemalophorux</i>	Doublewhip threadfin bream

113	Lobotidae	সাগর কৈ (Sagor Koi)	<i>Loboles surinamensis</i>	tripletail
114	Gerreidae	ডোম (Dom)	<i>Gerras filamentotus</i>	Whiptail silver biddy
115	Gerreidae	লাগিরি (Lagiri)	<i>Pentaprion longimanus</i>	Longfin silver biddy
116	Haemulidae	দাতিনা (Datina)	<i>Pomadasys argenteus</i>	Silver grunt
117	Haemulidae	গুটি দাতিনা (Guti Datina)	<i>Pomadasys maculatus</i>	Blotched grunt
118	Haemulidae	সাদা দাতিনা (Sada Datina)	<i>Pomadasys hasta</i>	White grunt
119	Lethridae	চৌকিয়া (Choukkira)	<i>Lethrinus ornatus</i>	Ornate emperor
120	Sparidae	দাতিনা (Datina)	<i>Acanthopagrus latus</i>	Yellow seabream
121	Sparidae	লাল দাতিনা (Lal Datina)	<i>Argyrops spinifer</i>	Longspine seabream
122	Sciaenidae	কাল পোয়া (Kala Pora)	<i>Atrubucca nibe</i>	Blackmouth
123	Sciaenidae	পোয়া (Kala Pora)	<i>Dentrophysa russelli</i>	Goatee croaker
124	Sciaenidae	লালা পোয়া/রূপ পোয়া/ভোলা (Lala Poya/Rup Poya/Vola)	<i>Johnius argentatus</i>	Silver croaker
125	Sciaenidae	কাল পোয়া (Kala Poya)	<i>Johnius dussumieri</i>	Black croaker
126	Sciaenidae	পেয়া, মেটা পোয়া (Payea, Meta Poya)	<i>Johnius vogleri</i>	Sharp tooth hammer Croaker
127	Sciaenidae	কুইজা পোয়া (Kueja Poya)	<i>Marospinosa cuja</i>	Cuja Croaker
128	Sciaenidae	দাটো পোয়া (Dato Poya)	<i>Otolithes rubbner</i>	Tiger-toothed croaker
129	Sciaenidae	লাম্বু (Lambu)	<i>Otolithes pama</i>	Pama croaker
130	Sciaenidae	পোয়া (Poya)	<i>Otolithes cuvieri</i>	Lesser tiger-toothed croaker
131	Sciaenidae	পোয়া (Poya)	<i>Panna microdon</i>	Panna croaker
132	Sciaenidae	চোকা পোয়া (Choka Poya)	<i>Pennahia macrophalmus</i>	Bigeye craker
133	Sciaenidae	কাল পোয়া (Kala Poya)	<i>Protonibea diacanthus</i>	Spotted croaker
134	Sciaenidae	গুটি পোয়া (Guti Poya)	<i>Pterolithus maculatus</i>	Blotched tiger-toothed croaker
135	Siganidae	জাভা (Java)	<i>Siganus javus</i>	Streaked rabbitfish
136	Mullidae	সোনালী বাটা (Sonali Bata)	<i>Upeneus sulphureus</i>	Yellow striped goatfish
137	Mullidae	সোনালী বাটা (Sonali Bata)	<i>Parupeneus heplacanthus</i>	Goatfish
138	Toxotidae	পুইটকি (Puietki)	<i>Toxotes jaculatrix</i>	Banded archerfish
139	Toxotidae	পুইটকি (Puietki)	<i>Toxotes chatareus</i>	Spotted archerfish
140	Drepanidae	পান (Pan)	<i>Drepane longimana</i>	Sicklefish
141	Drepanidae	পান (Pan)	<i>Drepane punctata</i>	Spotted sicklefish
142	Drepanidae	হাতর কান (Hator Kan)	<i>Ephippus orbis</i>	Spadefish
143	Scatojagidae	বিশতার, চিত্রা (Bista, Chietra)	<i>Seatophagus argus</i>	Spotted scat

144	Mugilidae	পার্সিয়া (Parsia)	<i>Liza parsia</i>	Goldsport mullet
145	Mugilidae	ভাঙ্গা বাটা (Vangga Bata)	<i>Liza subyiridis</i>	Greenback grey mullet
146	Mugilidae	গুল বাটা (Gul Bata)	<i>Liza tade</i>	Tade grey mullet
147	Mugilidae	খরুল বাটা (Khurul Bata)	<i>Mugil cephalus</i>	Flathead grey mullet
148	Mugilidae	খোলা বাটা (Khola Bata)	<i>Rhinomugil</i>	Yellowtail mullet
149	Mugilidae	পথা বাটা (Potha Bata)	<i>Valmugil speigleri</i>	Speigler's gary mullet
150	Mugilidae	কাচি খোলা (Kachi Khola)	<i>Sicamugil cascasia</i>	Blue spot mullet
151	Rachycentridae	সমুদ্র গজার (Sumudra Goger)	<i>Rachycentron canadom</i>	Cobia
152	Sphyraenidae	দারকুটা (Derkuta)	<i>Sphyraena barracuda</i>	Barracuda
153	Do	দরকুটা (Dorkuta)	<i>Sphyraen forsteri</i>	Forster's Barracuda
154	Do	দরকুটা (Dorkuta)	<i>Sphyraena putnamiae</i>	Sawtooth barracua
155	Polynemidae	তাইল্যা (Taila)	<i>Eleuthronema tetradactylum</i>	Fourfinger threadfin
156	Do	তাপশি (Taposhe)	<i>Polynemus paradiseus</i>	Paradise threadfin
157	Do	লাখুয়া (Lathua)	<i>Polynemus indicus</i>	Indian threadifin
158	Do	সোনা তাইল্যা (Sona Taila)	<i>Polynemus sexfilis</i>	Golden threadifin
259	Do	কাটা তাইল্যা (Kata Taila)	<i>Polynemus sextarius</i>	Blackspot threadfin
160	Priacanthidae	পারি (Pari)	<i>Priacanthus Tavenus</i>	Purple-spotted bigeye
161	Uranoscopidae	টার গজার (Tara Goger)	<i>Uamosopus guttatus</i>	Stargazer
162	Do	বুতাম (Butam)	<i>Lchysocopus inermis</i>	Star gazar
163	Eliotridae	কালো বাইল্যা (Kalo Baila)	<i>Butis melanotigma</i>	Blackspot sleeper
164	Do	বুধ বাইল্যা (Buth Baila)	<i>Elirtis fusca</i>	Dusky sleeper
165	Gobiidae	নুনা বাইল্যা (Nuna Baila)	<i>Brachygobius nunus</i>	Bumblebee goby
166	Do	বাইল্যা (Baila)	<i>Golossogobius giuris</i>	Tank goby
167	Do	বাইল্যা (Baila)	<i>Pogonogobius planiformes</i>	Goby
168	Do	বাইল্যা (Baila)	<i>Stigamtogobius sadanundio</i>	Goby
169	Do	চিরিং (Chering)	<i>Odontamblyopus ruicandus</i>	Goby
170	Do	চিরিং (Chering)	<i>Apocryptes bato</i>	Goby
171	Do	চেওয়া, চিরিং (Choua Chering)	<i>Paracryptes batoides</i>	Goby
172	Do	চেওয়া, চিরিং (Choua Chering)	<i>Pseudapocryptes lanceolatus</i>	Goby
173	Do	ডাহুক (Dahuk)	<i>Scatelaos higtophorus</i>	Goby
174	Do	ডাহুক (Dahuk)	<i>Boleophthalmus boddarti</i>	Mud skipper
175	Do	ডাহুক (Dahuk)	<i>periophthalmodon schlosseri</i>	Mudskipper

176	Do	ডাহুক (Dahuk)	<i>Periophthalmus koelreueri</i>	Mudskipper
177	Gobioididae	লাল চেওয়া (Lal Choua)	<i>Odontanblyopus</i>	Rubcundus ellgoby
178	Trypauchanidae	সাদা চেওয়া (Sada Choua)	<i>Trypauchan vagina</i>	Burrowing goby
179	Kuridae	জুটি (Juti)	<i>Kurtus indicua</i>	Indian lamphead
180	Trichiuridae	সুরি (Suri)	<i>Eupleurogrammus muticus</i>	Ribbonfish
181	Do	ছুরি (Suri)	<i>Lepturacanthus savala</i>	Ribbonfish
182	Do	সুরি (Suri)	<i>Trichiursu lepturus</i>	Ribbonfish
183	Scombridae	বোম মাইট্যা (Bom Maieta)	<i>Euthynnus affinis</i>	Eastern little tuna
184	Do	চাম্পা (Champa)	<i>Rastrelliger brachrysoma</i>	Indian mackerel
185	Do	চাম্পা (Champa)	<i>Rastrelliger knangurta</i>	Indian mackerel
186	Do	বোম মাইট্যা (Bom Maieta)	<i>Sarda orientalis</i>	Striped bonito
187	Do	বোম মাইট্যা (Bom Maieta)	<i>Auxis rochei</i>	Bullet tuna
188	Do	মাইট্যা (Maieta)	<i>Scomberomorus commersoni</i>	Spanfish mackerel, Kingfish
189	Do	মাইট্যা, সুমা (Maieta Suma)	<i>Scomberomorus guttatus</i>	Indoacific king mackerel
190	stromateidae	ফলি চান্দা (Koli Chanda)	<i>Pamapas argenteus</i>	Silver pomfret
191	Do	রূপ চান্দা (Rup Chanda)	<i>Pampas chinensis</i>	Chinese pomfret
192	Do	কালো চান্দা (Kalo Chanda)	<i>Parastromateus niger</i>	Pomfret
193	Psettodidae	সমুদ্র সেরবতি (Sumodra Seroboti)	<i>Psettodes erumei</i>	Indian halibat
194	paralichthyidae	সেরবতি (Seroboti)	<i>Pseudorhombus arsius</i>	Large tooth flounder
195	Do	সেরবতি (Seroboti)	<i>Pseudorhombus elevatus</i>	Deep flounder
196	Do	সেরবতি (Seroboti)	<i>Pseudorhombus</i>	Malay flounder
197	soleidae	সেরবতি, কটাল (Seroboti, Katal)	<i>Synaptura pan</i>	Sole
198	Do	সেরবতি, কাঠাল পাতা (Seroboti, Katal Pata)	<i>Synaptura orientalis</i>	Oriental sole
199	Do	সেরবতি (Seroboti)	<i>Zebreas altipinnis</i>	Zebra sole
200	Myliobatidae	দগল মাছ (Egol Mach)	<i>Aetomylaeus maculatus</i>	Motted eagle ray
201	Do	কুকুরজিব (Kukurjib)	<i>Cynoglossus bilineatus</i>	Fourlined tonguesole
202	Do	কুকুরজিব (Kukurjib)	<i>Cynoglossus cynoglossus</i>	Gangetic tonguesole
Do203	Do	কুকুরজিব (Kukurjib)	<i>Cynoglossus lingua</i>	Long tonguesole
204	Do	কুকুরজিব (Kukurjib)	<i>Cynoglossusversicolor</i>	Tonguesole
205	Do	কুকুরজিব (Kukurjib)	<i>Cynoglossus puncticeps</i>	Speckled tonguesole

206	Do	কুকুরজিব (Kukurjib)	<i>Paraplagusia bilineata</i>	Double lined tonguesole
207	Balistidae	সাগর পটকা (Sagor Potka)	<i>Abalistes stellaris</i>	Starred triggerfish
208	Triacanthidae	বোঁচা সুকুরা (Bochua Sukura)	<i>Triacanthus brevirostris</i>	Tripod fush
209	Tetraodontidae	বোঁচা সুকুরা (Bochua Sukura)	<i>Arothron stellatus</i>	Star puffer
210	Do	পটকা (Potka)	<i>Chelonodon fluviatilis</i>	Green puffer
211	Do	সাদা পটকা (Sada Potka)	<i>Chelonodon patoca</i>	Gangetic potka
212	Do	পটকা (Potka)	<i>Tetraodon cutcutia</i>	Ocellated puffer

Appendix 4.3.4
Deference types of Crabs, hervested from the Sundarbans

SL.No	SectionName	Bangla Name	Scientific Name	English Name
1	Protundiae	কাঁকড়া (Kakra)	<i>Scylla serrata</i>	Mud crab
2	Do	কাঁকড়া (Kakra)	<i>Scylla oceanica</i>	Mud Crab
3	Do	ঝাঁকি কাঁকড়া (Jhaki Kakra)	<i>Protunus /Neptunus pelagicus</i>	Blue swimmer crab
4	Do	ককরোল (Kokorol)	<i>Neptunus/ Portunus sanguinolenus</i>	Swimmer crab
5	Grapsidae	ককরোল (Kokorol)	<i>Sesuma mederi</i>	Fiddler crab
6	Do	ককরোল (Kokorol)	<i>Metaplex elegans</i>	Fiddler crab
7	Do	ককরোল (Kokorol)	<i>Metaplex crenulata</i>	Fiddler crab
8	Ocypodidae	ককরোর (Kokoror)	<i>Macrophthalmus brevis</i>	Fiddler crab
9	Do	ককরোল (Kokorol)	<i>Uca dussumieri</i>	Fiddler crab
10	Do	ককরোর (Kokoror)	<i>Uca forcipata</i>	Fiddler crab
11	Do	লাল কাঁকড়া (Lal Kakra)	<i>Gelasimus annulipes</i>	Fiddler crab
12	Limulidae	সাগর কাঁকড়া (Sagor Kakra)	<i>Carcinoscorpus rotundicauda</i>	Horseshoe Crab
13	Ocypodidae	গুলি কাঁকড়া (Guli Kakra)		Small swimming crab

Appendix 4.3.5
Deference types of Molluscs, hervested from the Sundarbans

SL.No	SectionName	Bangla Name	Scientific Name	English Name
1	Octoptodidae	অক্টোপাস (Oktopash)	<i>Octopus vulgaris</i>	Common octopus
2	Sepiidae	নুনা চেওয়া (Nuna Choua)	<i>Sepia officinalis</i>	Cuttlefish
3	Loliginiade	নুইল্যা (Nuiela)	<i>Loligo edulis</i>	Squid
4	Neritidae	শামুক (Samuk)	<i>Nerita articulata</i>	Cherry snail
5	Do	শামুক (Samuk)	<i>Neritna fulgurans</i>	Cherry snail

6	Do	শামুক (Samuk)	<i>Neritna cornucopia</i>	Cherry snail
7	Do	শামুক (Samuk)	<i>Neritna smithi</i>	Cherry snail
8	Do	শামুক (Samuk)	<i>Neritina violacea</i>	Cherry snail
9	Ellobiidae	জোংড়া (Jongra)	<i>Cassidula multiplicata</i>	Snail
10	Do	জোংড়া (Jongra)	<i>Cassidul aurisfelis</i>	Snail
11	Do	জোংড়া (Jongra)	<i>Ellobium gangetica</i>	Snail
12	Do	শামুক (Samuk)	<i>Pythis plicata</i>	Snail
13	Littorinidae	জোংড়া (Jongra)	<i>Littoraria melanostama</i>	Snail
14	Potamidiade	জোংড়া (Jongra)	<i>Chrithidea alata</i>	Snail
15	Do	জোংড়া (Jongra)	<i>Cerithidea obtusa</i>	Snail
16	Do	জোংড়া (Jongra)	<i>Cerithidea cingulata</i>	Snail
17	Do	জোংড়া (Jongra)	<i>Telescopium telescopium</i>	Snail
18	Teredinidae	কামুক (Kamuk)	<i>Teredo sp.</i>	Ship worm
19	Purpuridae	শামুক (Samuk)	<i>Cymia tissoti</i>	Snail
20	Thiaridae	শামুক (Samuk)	<i>Thiara tuberculata</i>	Snail
21	Viviparidae	শামুক (Samuk)	<i>Bellamya bengalensis</i>	Snail
22	Volemidae	শামুক (Samuk)	<i>Pugilina cochlidium</i>	Snail
23	Do	শামুক (Samuk)	<i>Indoplanorbis exusts</i>	Snail
24	Do	শামুক (Samuk)	<i>Lymnaea acuminata</i>	Patula form
25	Do	শামুক (Samuk)	<i>Lymnaea acuminata</i>	Typical Form
26	Unionidae	ঝিনুক (Jhenuk)	<i>Lamellidens marginalis</i>	Clam, mussel
27	Corbiculidae	ঝিনুক (Jhenuk)	<i>Polymesoda bengalensis</i>	Clam
28	Do	ঝিনুক (Jhenuk)	<i>Anadara sp</i>	Blood clam
29	Do	ঝিনুক (Jhenuk)	<i>Meretrix meretrix</i>	Thick-shelled clam
30	Do	ঝিনুক (Jhenuk)	<i>Hiatula sp</i>	Sunset clam
31	Do	ঝিনুক (Jhenuk)	<i>Donax sp</i>	Pacific bean Clam
32	Do	ঝিনুক (Jhenuk)	<i>Pholas sp</i>	Angel wing clam
33	Thaididae	ঝিনুক (Jhenuk)	<i>Thais sp</i>	Clam
34	Ostreidae	ঝিনুক (Jhenuk)	<i>Crassostrea gigas</i>	Giant oyster
35	Do	কস্তুরি ঝিনুক (Kostori Jhenuk)	<i>Crassostrea gryphoides</i>	Rock oyster
36	Do	ঝিনুক (Jhenuk)	<i>Ostrea</i>	Oyster
37	Do	ঝিনুক (Jhenuk)	<i>Achatina fulica</i>	Oyster
38	Pilidae	আপেল শামুক (Apel Samuk)	<i>Pila globosa</i>	Snail
39	Do	আপেল শামুক (Apel Samuk)	<i>Pila globossa</i>	Incrassatula form
40	Do	আপেল শামুক (Apel Samuk)	<i>Pila scutata</i>	Snail
41	Naticidae	শামুক (Samuk)	<i>Polinics didyma</i>	Bladder moon snail
42	Ostreidae	কস্তুরি ঝিনুক (Kostor Jhenuk)	<i>Dendostrea folium</i>	Leaf oyster

Source: Field Survey report

Appendix 4.4 Wildlife of Sundarban

Wild animal	Number / Population
Tiger	350-450
Deer	1,00,000-1,50,000
Monkey	40,000-50,000
Wild boars	20,000-25,000
Crocodile	150-200

Otters	20,000-25,000
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Source: Sundarban Vhabna by Heider, 2004

Appendix 5.1

Different categories of products harvested from the Sundarbans with their average annual production and value in the year of 2009-2010.

Category	Products	Production (2009-2010)	Value (Taka in Crore) 2009-2010	Production (2010-2011)	Value (Taka in Crore) 2010-2011
Wood	Timber	18,000 (cubic meters)	68	20,000 (cubic meters)	72
	Pulpwood/Matchwood	63,000 (cubic meters)		72,000 (cubic meters)	
	Fuel wood	61,000 (tons)		70,000 (tons)	
	Golpata/Hantal	69,000 (tons)		75,000 (tons)	
Fisheries	Fishes	3,700 (tons)	183	4,700 (tons)	193
	Crustaceans	1,400 (tons)		2,000 (tons)	
	Shrimp fries	253 million		270 million	
Non-wood	Honey/Wax	200 (tons)	53	250 (tons)	65
	Grass	8,300 (tons)		10,300 (tons)	

Source: Field survey report

Appendix 5.2 People of Sundarban who used of difference Assets

Name of District	Name of Upazala	Total People	User of Sundarban Assets	Percentage(%)
Khulna	Dacop	82,594	8,805	10.7
	Paikgacha	118,447	9,863	8.3
	Botiaghata	56,551	490	0.9
	Koyra	12,5409	10,472	8.4
	Total	3,83,001	29,630	7.7
Bagerhat	Rampal	47,895	6,270	13.1
	Morelgonj	1,34,117	10,785	8.0
	Sarankhola	96,774	17,613	18.2
	Mogla	58,300	4,184	7.2
	Total	3,37,086	38,852	11.5
Porajpur	Modbaria	79,769	10,251	12.9
	Nesrabad	1,15,827	8,472	7.3
	Vandaria	38,656	4,390	11.4
	Total	2,34,252	23,113	9.9
Satkhira	Kaligonj	1,05,454	1,928	1.8
	Shamnagor	2,13,081	17,708	8.3
	Asasuni	78,225	5,545	7.1
	Total	3,96,760	25,181	6.3
Borgona	Bamna	34,168	384	1.1
	Borgona	1,21,891	5,430	4.5
	Pathorghata	75,612	6,360	8.4
	Total	2,31,671	12,174	5.3
Total		15,82,770	1,28,950	8.1

Source: Field survey report

Appendix 5.3
People of Sundarban who depends on this banks

Sl. No.	Description	Number of peoples
1	Gum collector	437
2	Forest fruits collector	618
3	Mat collector	1,975
4	Land-lease	11,544
5	Government employer	8,343
6	Non-Government NGO	22,727
7	Medicine collector	740
8	Fisherman	3,678
9	Daily labor	38,820
10	Small businessman	31,921
11	Medium businessman	31,043
12	Big businessman	16,359
13	Consumer farmer	48,565
14	Medium farmer	30,623
15	Big farmer	3,377
16	Shop employer	7,508
17	Money lender	2,615
18	Money investor	652
19	Richka / van driver	20,019
20	Housewife	3,91,454
21	Students	39,870
22	Daily labour of various	1,00,973
23	Un-employer	20,306
24	Homeopathic doctor	984
25	Allopathic doctor	1,908
26	Kobiraj	753
27	Retired person employer	6,634
28	Beggar	1,846
29	Independent on others	2,08,249
30	Non-Resident	5,225
31	Imam	2,247
32	Technical hand	768
33	Member / Chairman	1,563
34	Artiest	546
35	Animal rarer	49,041
36	Bucher	805
37	Surveyor	217
38	Driver by bus / motor	6,766
39	Advocate /	957
40	Teacher	10,728
41	Prawn ghear	29,834
42	Others	75,313
Total		15,53,681

Source: Sundarban Vhabna by Heider, 2004

Appendix 5.3.1
The names of the working Division officers in the sundarbans

SL.No.	The name of the Officers	From	To
1	Mr. M. U. Grin	09.05.1884	12.05.1886
2	Mr. R Elich	13.06.1886	29.06.1888
3	Mr. Grin	30.06.1888	30.09.1888
4	Mr. R Elich	01.10.1888	04.08.1891
5	Mr. Qunel	05.08.1891	20.08.1891
6	Mr. R. L. Heinik	21.08.1891	15.04.1895
7	Mr. A.H. Miu	16.04.1895	14.07.1895
8	Mr. R.AL, Heinik	15.07.1895	04.03.1896
9	Mr. Sri Thor Chrobroti s	05.03.1896	11.03.1896
10	Mr. J.W. Griv	12.03.1896	08.04.1896
11	Mr. AF. Trofrid	09.04.1896	29.12.1896
12	Mr. C. G. D. Trodich	30.12.1896	21.04.1899
13	Mr. J. P. Shochlit	22.04.1899	08.05.1899
14	Mr. C. J. D. Trodich	09.05.1899	16.05.1899
15	Mr. J. P. Shochlit	17.05.1899	03.11.1899
16	Mr. C. G. D. Trodich	04.11.1899	30.07.1900
17	Mr. A.H. Miu	31.07.1900	30.10.1900
18	Mr. C. J. D. Trodich	31.10.1900	14.11.1900
19	Mr. A.H. Miu	15.11.1900	19.11.1900
20	Mr. W. F. Loyed	20.11.1900	30.04.1902
21	Mr. T. I. Tokek	01.05.1902	11.06.1902
22	Mr. W. F. Loyed	12.06.1902	29.03.1904
23	Mr. R. G. A. Hanan	30.03.1904	12.04.1904
24	Sir H. Frington	13.04.1904	06.04.1905
25	Mr. J. H. Monbuth	07.04.1905	21.09.1906
26	Sir H. Frington	22.09.1906	30.01.1908
27	Mr. F. Trodich	31.01.1908	22.04.1908
28	Mr. P. Tini	23.04.1908	06.10.1908
29	Mr. J. P. Shchlet	07.10.1908	12.12.1908
30	Mr. F. Trofid	13.12.1908	21.06.1909
31	Mr. J. P. Shchlet	22.06.1909	06.01. 1910
32	Mr. F. Trofid	07.01.1910	22.06.1910
33	Mr. H. S. Givshon	23.06.1910	21.11.1910
34	Mr. F. Trofid	22.11.1910	19.04.1911
35	Mr. R. Crikpetric	20.04.1911	27.10.1911
36	Mr. F. Trofid	28.10.1911	06.04. 1913
37	Dom: J. W. A. Griv	07.04.1913	06.08.1913
38	Mr. A. N. Griv	07.04.1913	07.11.1913
39	Mr. J. C. Homfrea	08.11.1913	29.04. 1914
40	Mr. L. M. Shen	30.04.1914	04.05.1914
41	Mr. J. C. Karol	05.05.1914	07.07. 1917
42	Mr.J.N.Bos	08.07.1917	25.09.1917
43	Mr.H.T.Luis	26.09.1917	05.08.1918
44	Mr. J.N.Bos	06.08.1918	04.10.1918
45	Mr. H.T.Luis	05.10.1918	04.03.1919
46	Mr.L.M.Sen	05.03.1919	13.06.1923
47	Mr.S.J.kartich	14.06.1923	25.10.1923
48	Mr. L.M.Sen	26.10.1923	18.03.1924
49	Mr.P.N.Mukargi	19.03.1924	16.04.1924
50	Mr. S.J.kartich	17.04.1924	27.03.1926
51	Mr.R.I.Moakalpain	28.03.1926	08.10.1926
52	Mr. S.J.kartich	09.10.1926	08.01.1929
53	Mr.S.A.uysif	09.01.1929	08.09.1929

54	Mr. S.J.Kartich	09.09.1929	08.04.1930
55	Mr.E.N.Mardar	09.04.1930	22.02.1933
56	Mr.N.Pal	23.02.1933	28.02.1933
57	Mr.S.Choudhury	29.02.1933	11.03.1936
58	Mr. J.C.Nath	12.03.1936	11.05.1936
59	Mr. S. Choudhury	12.05.1936	20.11.1937
60	Mr. D.A.G.Debidshon	21.11.1937	29.11.1940
61	Mr.C.T.Trig	31.11.1940	30.10.1941
62	Mr.A.C.Gupta	30.10.1941	09.04.1942
63	Ray S.N.Mith Bahadur	10.04.1942	21.12.1946
64	Ray Shahib U.K Kasnobith	22.12.1946	01.01.1947
65	Mr.Y.S.Ahmed	02.01.1947	10.08.1947
66	Mr.J.H.Hulan	11.08.1947	12.08.1947
67	Mr. A.C.Gupta	12.08.1947	19.08.1947
68	Mr.Q.G.Gawus	20.08.1947	19.12.1949
69	Mr.A.Hamid	20.12.1949	07.03.1950
70	Khan Shahib R.Ahmed	08.03.1950	21.01.1952
71	Mr.S.A.Alim	20.07.1952	14.07.1953
72	Mr.M.R. Choudhury	15.07.1953	19.07.1953
73	Mr. S.A.Alim	20.07.1953	19.08.1953
74	Mr. M.R. Choudhury	20.08.1953	09.12.1953
75	Mr. S.A.Alim	10.12.1953	31.03.1955
76	Mr.M.Ahemd	01.04.1955	04.04.1955
77	Mr.A.W.Khan	04.04.1955	14.01.1957
78	Mr. S.A.Alim	15.01.1957	27.05.1958
79	Mr. A.Alim	28.05.1958	19.06.1958
80	Mr.Q.Goni	20.06.1958	20.12.1958
81	Mr.A.Alim	21.12.1958	08.01.1959
82	Mr. Q.Goni	09.01.1959	29.01.1959
83	Mr. A.Alim	30.01.1959	08.02.1959
84	Mr. A.H. Choudhury	09.02.1959	22.04.1960
85	Mr.M.E.Haque	23.04.1960	02.08.1962
86	Mr. M.Hoshain	02.08.1962	15.09.1962
87	Mr.M.A. Choudhury	15.09.1962	28.12.1963
88	Mr.A.Alim	28.12.1963	13.07.1965
89	Mr.M.A.Sattar	14.07.1965	12.08.1965
90	Mr.A.Alim	13.08.1965	06.11.1967
91	Mr. M.A.Sattar	07.11.1967	08.02.1968
92	Mr. M.A.Hoshain	09.02.1968	16.05.1970
93	Mr.M.A.Bashit	17.05.1970	31.05.1970
94	Mr. M.A.Hoshain	01.05.1970	18.09.1971
95	Mr.A.R.K.Ushyf Jae	19.09.1971	22.02.1972
96	Mr.Mohammad Shofi	23.02.1972	28.02.1972
97	Mr.Sythe Salamoith Ali	29.02.1972	13.11.1972
98	Mr. Aha.K.M.Fojlul Haque	14.11.1972	26.01.1976
99	Mr.Ali Ahakbar Vhuoya	26.01.1976	27.01.1979
100	Mr.Shah Ali Emim	27.01.1979	23.05.1980
101	Mr. Golam Habib	23.05.1980	23.06.1983
102	Mr. Abdul Jobber	24.06.1983	31.07.1983
103	Mr. Mohiuddin	03.07.1983	15.08.1983
104	Mr. Abdul Jobber	15.08.1983	26.09.1983
105	Mr. Mohiuddin	26.09.1983	21.10.1984
106	Mr. Ukliil Mondol	21.10.1984	31.10.1984
107	Mr.a.K.M.Abu Tasher	31.10.1984	23.12.1985
108	Mr. Golam Habib	23.12.1985	20.03.1989
109	Mr.ad Nuruzzaman	20.03.1989	14.07.1991
110	Mr.Monchi Anoawerul Islam	14.07.1991	28.02.1994
111	Mr.A.Z.M.Samsul Huda	28.02.1994	02.08.1995

112	Mr. Mosharuf Hossan	02.08.1995	06.08.1997
113	Mr. Ali Kober Hader	06.08.1997	23.03.1998
114	Mr.M. Atiqul Azom	23.03.1998	26.04.1999
115	Mr.Johir Hossan Kondokar	26.04.1999	28.09.2000
116	Mr. Topon Kumar Dey	28.09.2000	02.08.2001

Appendix 5.3.2
After that the Sundarbans is divided into two parts

The Sundarbans West Department

SL.No.	The name of the Officers	From	To
1	Mr.Topon Kumar Dey	02.08.2001	08.11.2001
2	Mr.Shah -E-Alam	08.11.2001	01.08.2002
3	Mr.Bodrul Anam Bhuyan	01.08.2002	17.01.2005
4	Mr.Sheak Mizanur Rahman(Inchars)	17.01.2005	12.04.2005
5	Mr.Mojaharul Islam	12.04.2005	27.07.2008
6	Mr.Oboni vasion Thakur	27.07.2008	06.09.2009
7	Mr.S.M.Johirul Islam(Inchars)	06.09.2009	07.10.2009
8	Mr.Oboni vasion Thakur	07.10.2009	21.04.2010
9	Mr.Johir Uddion Ahammod	21.04.2010	Present

The Sundarbans East Department

1	Mr.Eunos Ali	22.07.2001	08.11.2001
2	Mr.Abdul Mabod	08.11.2001	31.08.2002
3	Mr.Toriquil Islam	31.08.2002	27.11.2004
4	Mr.Sheak Mizanur Rahman(Inchars)	27.11.2004	07.12.2006
5	Mr.S.M.Shohidulla	07.12.2006	16.04.2009
6	Mr.Mishir Kumar Dey	16.04.2009	Present

Appendix 7.1

Standing volume and volume per ha as estimated by Forestal and ODA

Species	Standing volume (million m ³)		Mean volume/ha (m ³ /ha)	
	Forestal (1960)	ODA (1985)	Forestal (1960)	ODA (1985)
Sundri	13.04	7.87	34.5	19.9
Gewa	3.3	1.82	8.7	4.6

Source: ODA Inventory, volume 1.

SECTION-II

1. Ten Forest Experts of the Sundarbans Forest, 2. Two Divisional Forest Officers of the Sundarbans Forest, 3. Four Range Officers of the Sundarbans, 4. Six Forest Rangers of the Sundarbans, 5. Sixteen Deputy Forest Rangers of the Sundarbans Forest, 6. Eleven Foresters of the Sundarbans, 7. Fifteen Forest Guards of the Sundarbans and 8. Twenty Eight Forest Boat Men of the Sundarbans Forest were interviewed to know causes of forest degradation, weakness of present management and their mitigation in sustainable way.

9. Thirty-three Forest Wood Cutters of the Sundarbans, 10. Thirty Five Forest Bawali of the Sundarbans, 11. Thirty Forest Mawali and 12. Thirty Five Local People of the Sundarbans Forest around the Sundarbans were interviewed to get the peoples.

Forest Experts of the Sundarbans Forest

Appendix 6.2.1

Comment of Forest Experts about Environmental Impact Assessment of Development Activities in the Sundarbans

Questions: A = What is your idea about Management Structure of the Forest? B= What are the Characteristics of Management of the Forest? C = What is the strength of the forest? D = Do you know at any of its weakness of management?

Name & Address	Comments/Answer			
	A	B	C	D
1. Mr. Altaf Hossain Khan Deputy Chief Conservator, Bhan Vabon, Agarga, Dhaka	Periodic management plan is estimated for Sundarbans management from the long past. The subject matter of management plan is compulsory/ necessary.	To create employment opportunities for the people of the forest adjacent areas. To supply the forest goods in the market. To conserve the natural forest for the next generation.	Several Cultural Systems of Sundarbans: Selection Cum Improvement System. The working circles under these systems are Sundri Working circle, Gewa working circle, Golpata working circle, Fuel wood working circle, and miscellaneous working circle.	To surprises whether the description prescribed in the management plan is implemented properly
2. Dr. Mr. Ashraful Alam Professor, & Head Nagor and Village Planning Decipline, Khulna University, Khulna	Management is run according to the description of accepted management plan for forest management	Sustainable management to create employment opportunities for the people adjacent areas, the socioeconomic development and the conservation of various bio-diversity.	According to the management plan, the work done in different steps depending on different steps, depending on different circles such as Sundri working circle, Gewa working	No weakness

			circle, Fuel wood working circle. But at present only the Golpata and Goran Fuel working pass permit is given.	
3. Dr. Gazi Abdullah Baki Deputy Registrar Khulna University, Khulna	Management system by forest master plan	Ensure the employment of the local people to supply the forest grown materials in the market.	The management of Sundarban is conducted in selection cum improvement system under various circles like Sundary working circle, Gewa working circle, Golpata working circle, Goran working circle and Miscellaneous working circle.	Fail to protect the pirate, problem of manpower.
4. Mr. Amalendu Saha Conservator of Forest, Khulna	Periodic management plan is estimated for Sundarbans management from the long past. The subject matter of management plan is compulsory/ necessary.	(i) To ascertain the proper use of all forest grown properties of Sundarban. (ii) To ascertain the sustainability of the forest by cutting off increment portion only. (iii) To create employment of the people of impact zone and contribute in the national economy.	The activities are completed according to various circles.	The project of Sundori working circle of management plan is not materialized. Besides, it is problem to supervise properly the activities of management plan.
5. Dr. Mahamud Hossain Associate Professor Forestry & Technology Department, Khulna University, Khulna	The management of the forest completely followed by forest rules	After fulfillment the local demand strengthen government by paying revenue of national Revenue Board. It is called keeping ecological balance.	The management of Sundarban is conducted in selection cum improvement system under various circle as like -Sundory working circle, Gewa working circle, Golpata working circle, Goran working circle and Miscellaneous working circle.	Almost accurately
6. Mr. A.K. Fazlul Haque Professor, Forestry & Technology Department, Khulna University, Khulna	Requirement of Sustainable management plan	Employment for local people, meeting wood requirement, and other assets	(1) Sundari working circle, (2) Gawa working circle, (3) Golpata working circle, (4) Goran fuel working circle,	Disability to protect the pirate

			(5) Miscellaneous working circle	
7. Dr. Mr. Nobiul Islam Khan, Associate Professor Forestry & Technology Decipline, Khulna University, Khulna	Forest management is run according to the directions of working plan.	Empowering the revenue board by meeting local demand	(1) Sundari working circle, (2) Gawa working circle, (3) Golpata working circle, (4) Goran fuel working circle, (5) Miscellaneous working circle	Defeciency of skilled manpower defeciency of fuel oil, disability to protect the pirate
8. Mr. Firoz Sha Assistant Commissionar (Land), Puthia, Rajshahi	Man power goal to check except one or two	(1) Employment for local people, (2) Demand fulfillment of wood in market, (3) Preservation of wild life, (4) Reservation of fish, honey, wild life and forest product for future.	Working through several circle	Deficiency of fuel oil, pirate
9. Mr. Mihir Kumar Dey, Deputy Conservator of Forest, Khulna	Camping system runs by only one or two person in the office in miscellaneous jobs in the forest to lead the activities.	Conservation of ecological balance and strength the government by fulfilling the local demand and paying revenue to the revenue board.	Camp in the forest, inspect the seasonal cutting of the well accurately or not.	There are many problems like- problems of office repair, problem of fuel oil, problem of govt. trawler, problem of deriver, problem of trawler mechanic, problem of primary treatment, and residential problem.
10. Prof. Anowarul Kadir Executive Director, Sundarban Academic, Khulna	The management of forest is not satisfactory for conservation of the forest office.	The forest employees are not suitable for handling tools properly. The camps in the forest are not suitable to conserve or to keep firearms. There is no essential government vessel. Crisis of fuel.	The management of Sundarban is conducted in Selection-cum-improvement system under various circles like Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Attract of the pirate, inefficient and insufficient employee, vessels and crisis of fuel.

Source: Field survey report

Appendix 6.2.1
Comment of Forest Experts about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E= How the development works of the forest is done? F= What are the main sources of revenue of the forest? G= What are the different types of expenses incurred for the forest? H = What is your idea about the role of the forest in our economy?

Name & Address	Comments/Answer			
	E	F	G	H
1. Mr. Altaf Hossain Khan Deputy Chief Conservator, Bhan Vabon, Agarga, Dhaka	If we got fuel (oil), travel allowance, and residence it is possible to follow management plan with enhance camping system.	Wood, fish, honey, fire wood, golpata etc.	Communication of ship or boat river way. Communication of vessels by river.	Sundarban protects the people from cyclone, spate, by creating silterbelt with fulfill the demand of forest grown wealth of the country.
2. Dr. Mr. Ashraful Alam Professor, & Head Nagor and Village Planning Decipiline, Khulna University, Khunla	It is possible of the forest prosperity to materialise the management plan accurately.	Wood, fish, honey, firewood, golpata etc.	A vessel for traveling by water and fuel (oil).	Contribution of forest is almost 2% in GDP. Accurate management and by buying more forest materials and increasing revenue income it is possible to develop the socioeconomic condition of the people.
3. Dr. Gazi Ashraful Baki Deputy Registrar Khulna University, Khunla	If we can follow the direction of management plan, it is possible of forest prosperity.	Wood, fish, honey, firewood, golpata, tourist fee etc.	Vessel for traveling by water and fuel (oil).	Create post for the people by collecting and using forest grown property.
4. Mr. Amalendu Saha Conservator of Forest, Khulna	If we can follow the direction of management plan, it is possible of forest prosperity.	Wood, fish, honey, wax etc.	Vessel for traveling by water and fuel (oil).	Prosper of the people by collecting forest grown property and creating job in the forest.
5. Dr. Mahamud Hossain Associate Professor, Forestry & Technology Decipiline, Khulna University, Khunla	It is possible of the forest prosperity to materialise the management plan accurately.	Wood, fish, honey, fire wood, golpata etc.	Vehicle, fuel	(1) Saving people from cyclone and flood and enhancing their employment opportunity, (2) Revenue increases from wood and forest

				assets, (3) Revenue increasing in tourism management, (4) maintaining natural balance
6. Mr.A.K. Fazlul Haque Professor, Forestry & Technology Decipline, Khulna University, Khunla	If we got fuel (oil), travel allowance, and residence it is possible to follow management plan with enhance camping system.	Wood, fish, honey, fire wood, golpata etc.	Vessel for traveling by water and fuel (oil).	Enough
7. Dr. Mr. Nobiu Islam Khan, Associate Professor Forestry & Technology Decipline, Khulna University, Khunla	If we can follow the direction of management plan, it is possible of forest prosperity.	Wood, fish, honey, fire wood, golpata etc.	Fuel oil	Very important
8. Mr. Firoz Sha Assistant Commissionar (Land), Puthia, Rajshahi	Attachment of unusual job for the relevant people except forest	Wood, fish, honey, fire wood, golpata etc.	Vessel for traveling by water and fuel (oil).	Forest is the local based service centre for the economic prosperity. Forest fulfills all kinds of essentials demand to the people. Supplies Oxygen. Man can get all things from forest, which need from his birth to death.
9. Mr.Mihir Kumar Dey, Deputy Conservator of Forest, Khulna	Doing work according to the rules	Wood, fish, honey, fire wood, golpata etc.	Abundant	Roles of forest are highly co- related with economic prosperity.
10. Prof. Anowarul Kadir Executive Director, Sundarban Academic, Khulna	Regular searching, awaring the people	Selling of seezed wood, goran fuel, golpata, honey, fish, and others revenue	Vessel for traveling by water and fuel (oil).	Forest plays many vital roles from our childhood to grave

Source: Field survey report

Appendix 6.2.1
Comment of Forest Experts about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I = How for the natural destruction affects our biodiversity? J = How for the Bawali and Mawali are benefited by the forest? K = What about the suggestion for sustainable development of Sundarban Forests?

Name & Address	Comments/Answer		
	I	J	K
1. Mr. Altaf Hossain Khan Deputy Chief Conservator, Bhan Vabon, Agarga, Dhaka	Flow of freshwater, increasing salinity, siltation etc. impact on biodiversity.	Live on from received earning.	Management plan is prepared by the stock assessment of total resource and main annual increment.
2. Dr. Mr. Ashraful Alam Professor, & Head Nagor, Village Planning Decipline, Khulna University, Khulna	Because of less freshwater flow and siltation increase declined the biodiversity Strom/ cyclone, natural (high-tide) spate, harmful for the animals and the plants.	Woodcutter and maoali pay government revenue and their collected materials sell in the market and lead their life.	Sustainable management will be ensured if the forest resource and functions are directed according to the management plan and directions.
3. Dr. Gazi Ashraful Baki Deputy Registrar Khulna University, Khulna	Storm and Spate.	Lead the life	If management materials according to the plan then ensure sustainable management.
4. Mr. Amalendu Saha Conservator of Forest, Khulna	Because of increasing the salinity of water and decreasing of navigation of river decrease the biodiversity of forest.	Maintaining income	If management materializes according to the plan then ensure sustainable management is possible.
5. Dr. Mahamud Hossain Associate Professor Forestry & Technology Decipline, Khulna University, Khulna		Enough to lead life	If the management is done according to rules
6. Mr. A.K. Fazlul Haque Professor, Forestry & Technology Decipline, Khulna University, Khulna	Effect of storm and flood on wildlife and food habit	To carry life	Protection of the pirates attack, protection of Tiger attack, protect wood and other forest grown materials from smugglers.
7. Dr. Mr. Nobiul Islam Khan, Associate Professor Forestry & Technology Decipline, Khulna University, Khulna	Enough to lead life	To Lead life	We should cut the tree by selecting and a proper management of other properties

8. Mr. Firoz Sha Assistant Commissioner (Land), Puthia, Rajshahi	Abundant	Wood cutter and Maolis get benefit from forest to lead their life Ensure sufficient security because, godfathers help the pirates	There is no alliance at all to get up in the new building.
9. Mr. Mihir Kumar Dey, Deputy Conservator of Forest, Khulna	Mostly	Get enough benefit but it is not possible to ensure sufficient security because, godfathers help the pirates	If management materializes according to the plan then ensure sustainable management is possible.
10. Prof. Anowarul Kadir Executive Director, Sundarban Academic, Khulna	Mostly	Wood cutters and Moalis get many benefits to lead their life	Need a sustainable management

Source: Field survey report

Divisional Forest Officers of Sundarbans Forest

Appendix 6.2.2

Comment of Divisional Forest Officers about Environmental Impact Assessment of Development Activities in the Sundarbans

	Name & Address	Name & Address
Questions	Shree Oboni Vosun Takhur Divisional forest officer Sundarban West, Khulna	Mr. S.M. Sahidullah Divisional forest officer Sundarban East, Bagherhat
	Comments/Answers	Comments/Answers
A. What is your idea about management structure of the forest?	Periodic management plan is estimated for Sundarbans management from the long past. The subject matter of management plan is compulsory/necessary.	Management is run according to the description of accepted management plan for forest management
B. What are the characteristics of management of the forest?	4. To create employment opportunities for the people of the forest adjacent areas. 5. To supply the forest goods in the market. 6. To conserve the natural forest for the next generation.	Sustainable management to create employment opportunities for the people adjacent areas, the socioeconomic development and the conservation of various bio-diversity.
C. What is the strength of the forest?	Several Cultural Systems of Sundarbans: Selection Cum Improvement System. The working circles under this system are Sundri Working circle, Gewa working circle, Golpata working circle, Fuel wood working circle, and miscellaneous working circle.	According to the management plan, the work done in different steps depending on different steps, depending on different circles such as Sundri working circle, Gewa working circle, Fuel wood working circle. But at present only the Golpata and Goran Fuel working pass permit is given.
D. Do you know at any	To surprises whether the	No weakness

of its weakness of management?	description prescribed in the management plan is implemented properly	
E. How the development works of the forest is done?	If we can follow the instructions of the management plan, it is possible proper management.	if the functions are run according to the directions of the management plan, it is possible to develop the forest
F. What are the main sources of revenue of the forest?	Wool, Fuel wood, Golpata, Honey, Water resources.	Wood, Fuel wood, Golpata, Honey, Water resources
G. What are different types of expenses incurred for the forest?	Water Vehicles and Fuel Oil.	Water Vehicles and Fuel Oil
H. What is your idea about the role of the forest in our economy?	1. To same the human settlement from the cyclone and water tidal 2. To create employment opportunity. 3. To supply of forest product in the market.	To create employment for different types of people, to develop socioeconomic condition including collecting of forest goods according to management plan.
I. How for the natural destruction affects our bio-diversity?	Stream, tidal waves, intensity of salinity and siltation, water flow influence the biodiversity of the forest.	The increase of water salinity and the decrease of navigation of the rivers influence the biodiversity of the forest
J. How for the Bawali and Mawali are benefited by the forest?	To earn their livelihood	To earn their livelihood.
K. Please state the yearly earnings from the forest?	The income of the year 20004 - 2005: 30465873 Tk. of Sundarban West	In the fiscal year 2004 - 2005 36700000 Tk. . of Sundarban East
L. What might be the yearly revenue expenses for forest management?	The budget allotment of the year 2004-2005: 45870430 Tk.	The budget allotment of the year 20004-2005: 34400000 Tk.
M. What is the organization chart of its management?	Divisional forest office → Range Office → Revenue station → patrol camp.	Divisional office → Range office → Revenue station → Patrol camp → Selling depu
N. What about the suggestion for sustainable development of Sundarban Forest?	Management plan is prepared by the stock assessment of total resource and main annual increment.	Sustainable management will be ensured if the forest resource and functions are directed according to the management plan and directions.

Source: Field survey report

Range Officers of the Sundarban Forest

Appendix 6.2.3

Comment of Range Officers about

Environmental Impact Assessment of Development Activities in the Sundarbans

Questions: A= What is your idea about management structure of the forest? B= What are the characteristics of management of the forest? C= What is the strength of the forest?

D = Do you know at any of its weakness of management?

Name & Address	Comments/Answer			
	A	B	C	D
1. Shree Bipul Krishno Das, Assistant Conservator of Forest, Shoran Khola Range, Sundarban East, Bagerhat	The management of the forest completely followed by forest rules	Ensure the employment of the local people to supply the forest grown materials in the market. Conservation of forest.	The activities are completed according to various circles.	Fail to protect the pirate, problem of manpower.
2. Mr. Shabuddin Assistant Conservator of Forest, Chand Pai Range, Sundarban East, Bagerhat	Management system followed by forest master plan	After fulfillment the local demand strengthen government by paying revenue of national Revenue Board. It is called keeping ecological balance.	The management of Sundarban is conducted in selection cum improvement system under various circles like Sundory working circle, Gewa working circle, Golpata working circle, Goran working circle and Miscellaneous working circle.	Almost accurately
3. Shree Rajeg Chakma Assistant Conservator of Forest, Khulna Range, Nolian, Sundarban West, Khulna	In Sundarban management system provides in the scientific basis by 20 years/10 years plan.	(i) To ascertain the proper use of all forest grown properties of Sundarban. (ii) To ascertain the sustainability of the forest by cutting off increment portion only. (iii) To create employment of the people of impact zone and contribute in the national economy.	The management of Sundarban is conducted in selection cum improvement system under various circles as like -Sundory working circle, Gewa working circle, Golpata working circle, Goran working circle and Miscellaneous working circle.	The project of Sundori working circle of management plan is not materialized. Besides, it is problem to supervise properly the activities of management plan.
4. Shree Rajeg Chakma Assistant Conservator of Forest, Burigoalini Range, Sundarban West, Khulna	Management system followed by forest master plan	Sustainable management, create job for the local people and conservation of biodiversity.	Various circles of different works like - Sundori working circle, Gewa working circle, Golpata working circle, Goran working circle etc. are completed according to the management plan. But, now only Golpata and Goran Fire wood pass is permitted for work.	No comment

Source: Field survey report

Appendix 6.2.3

Comment of Range Officers about

Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E= How the development works of the forest is done? F= What are the main sources of revenue of the forest? G= What are the different types of expenses incurred for the forest? H = What is your idea about the role of the forest in our economy?

Name & Address	Comments/Answer			
	E	F	G	H
1. Shree Bipul Krishno Das, Assistant Conservator of Forest, Shoran Khola Range, Sundarban East, Bagerhat	If we got fuel (oil), travel allowance, and residence it is possible to follow management plan with enhance camping system.	Wood, fish, honey, fire wood, golpata etc.	Communication of ship or boat river way. Communication of vessels by river.	Sundarban protects the people from cyclone, spate, by creating silterbelt with fulfill the demand of forest grown wealth of the country.
2. Mr. Shabuddin Assistant Conservator of Forest, Chand Pai Range, Sundarban East, Bagerhat	It is possible of the forest prosperity to materialise the management plan accurately.	Wood, fish, honey, firewood, golpata etc.	A vessel for traveling by water and fuel (oil).	Contribution of forest is almost 2% in GDP. Accurate management and by buying more forest materials and increasing revenue income it is possible to develop the socioeconomic condition of the people.
3. Shree Rajeg Chakma Assistant Conservator of Forest, Khulna Range, Nolian, Sundarban West, Khulna	If we can follow the direction of management plan, it is possible of forest prosperity.	Wood, fish, honey, firewood, golpata, tourist fee etc.	Vessel for traveling by water and fuel (oil).	Create post for the people by collecting and using forest grown property.
4. Shree Rajeg Chakma Assistant Conservator of Forest, Burigoalini Range, Sundarban West, Khulna	If we can follow the direction of management plan, it is possible of forest prosperity.	Wood, fish, honey, wax etc.	Vessel for traveling by water and fuel (oil).	Prosper of the people by collecting forest grown property and creating job in the forest.

Source: Field survey report

Appendix 6.2.3
Comment of Range Officers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I = How for the natural destruction affects our biodiversity? J = How for the Bawali and Mawali are benefited by the forest? K= Please state the yearly earnings from the forest? L = What might be the yearly revenue expenses for forest management? M = What is the Organization chart of its management? N = What about the suggestion for sustainable development of Sundarban Forests?

Name & Address	Comments/Answer					
	I	J	K	L	M	N
1. Shree Bipul Krishno Das, Assistant Conservator of Forest, Shoran Khola Range, Sundarban East, Bagerhat	Flow of fresh water, increasing saltiness, siltation etc. impact on biodiversity.	Live on from received earning.	Three- Four crore taka	There is no revenue expenditure but need a separate budget.	Divisional office, Range office, Station office and Camp	No answer
2. Mr. Shabuddin Assistant Conservator of Forest, Chand Pai Range, Sundarban East, Bagerhat	Because of less fresh water flow and siltation increase declined the biodiversity Strom/ cyclone, natural (high-tide) spate, harmful for the animals and the plants.	Woodcutter and maoali pay government revenue and their collected materials sell in the market and lead their life.	In Khulna range revenue income was around Tk. 15100000 in the 2009-2010 fiscal years.	No answer	No answer	No answer
3. Shree Rajeg Chakma Assistant Conservator of Forest, Khulna Range, Nolian, Sundarban West, Khulna	Storm and Spate.	Live on/ Lead the life	No answer	No answer	Forest Department al/divisional office range -office range-office station-office camp	If management materials according to the plan then ensure sustainable management.
4. Shree Rajeg Chakma Assistant Conservator of Forest, Burigoalini Range, Sundarban West, Khulna	Because of increasing the salt ness of water and decreasing of navigation	No answer	No answer	No answer	Forest Department aloffice, Range Office station Officeand camp	If management materializes according to the plan the

	of river decrease the biodiversity of forest.					ensure sustainab le manage ment is possible.
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Source: Field Survey report

Sundarban Forest Rangers
Appendix 6.2.4
Comment of Forest Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Questions: A = What is your idea about management structure of the forest? B= What are the characteristics of management of the forest? C= What is the strength of the forest? D= Do you know at any of its weakness of management?

Name & Address	Comments/Answer			
	A	B	C	D
1. Mr. Kamaluddin Ahamed, Forest Ranger, Srankhola Range, Sundarban East, Bagerhat	Requirement of new management plan	(1) Employment for local people, (2) Demand fulfillment of wood in market, (3) Preservation of wild life, (4) Reservation of fish, honey, wild life and forest product for future.	(1) Sundari working circle, (2) Gawa working circle, (3) Golpata working circle, (4) Goran fuel working circle, (5) Miscellaneous working circle	No answer
2. Mr. Abdul Hamid Forest Ranger, Srankhola Range, Sundarban East, Bagerhat	Requirement of new management plan	Employment for local people, meting wood requirement, preserving wildlife, preserving wildlife and other assets	(1) Sundari working circle, (2) Gawa working circle, (3) Golpata working circle, (4) Goran fuel working circle, (5) Miscellaneous working circle	Epidimty of pirate
3. Mr. Aslam Mojumder Forest Ranger, Khulna	Good	Employment for local people and demand fulfillment of wood in market.	(1) Sundari working circle, (2) Gawa working circle, (3) Golpata working circle, (4) Goran fuel working circle, (5) Miscellaneous working circle	Disability to protect the pirate

4. Mr. Rofiquil Hossain, Forest Ranger, Chandpai Range, Sundarban East, Begerhat.	Man power goal to check except one or two	Empowering the revenue board by meeting local demand	Doing work through several working plan	Defeciency of skilled manpower defeciency of fuel oil, disability to protect the pirate
5. Mr. Nural Amin Forest Ranger, Nolion, Khulna Range, Sundarban West, Khulna.	Good	Meeting local demand	Doing work through several circle	Car (Jeep) & fuel oil
6. Mr. Fozlul Haque Forest Ranger, Khulna Range, Sundarban West, Khulna.	Good	Maintaining bio-diversity	Working through several circle	Deficiency of fuel oil, pirate

Source: Field survey report

Appendix 6.2.4
Comment of Forest Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E= How the development works of the forest is done? F= What are the main sources of revenue of the forest? G= What are the different types of expenses for the forest? H= What is your idea about the role of the forest in our economy?

Name & Address	Comments/Answer			
	E	F	G	H
1. Mr. Kamaluddin Ahamed, Forest Ranger, Srangkhol Range, Sundarban East, Bagerhat	Attachment of unusual job for the relevant people except forest	Wood, fire wood, goal pata, honey, water resource and tourist fees	Water vehicle and fuel oil	(1) Saving people from cyclone and flood and enhancing their employment opportunity, (2) Revenue increases from wood and forest assets, (3) Revenue increasing in tourism management, (4) maintaing natural balance
2. Mr. Abdul Hamid Forest Ranger, Srangkhol Range, Sundarban East, Bagerhat	By observation	Pass permit, revenue	Manpower, fuel	Same

3. Mr. Aslam Mojumder Forest Ranger, Khulna	Regular searching, awaring the people	Selling of seezed wood, goran fuel, golpata, honey, fish, and others revenue	Vehicle, fuel	Very important
4. Mr. Rofiquel Hossain, Forest Ranger, Chandpai Range, Sundarban East, Begerhat.	Doing work according to the regulation	Collecting forest assets	Vehicle, fuel oil	Enough
5. Mr. Nural Amin Forest Ranger, Nolon, Khulna Range, Sundarban West, Khulna.	Directing through regulation	Collecting forest	Fuel oil	Enough
6. Mr. Fozlul Haque Forest Ranger, Khulna Range, Sundarban West, Khulna.	Doing work according to the rules	Forest assets	Abundant	Enough

Source: Field survey report

Appendix 6.2.4

Comment of Forest Rangers about

Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I= How for the natural destruction affects our biodiversity? J= How for the Bawali and Mawali are benefited by the forest? K= Please state the yearly earnings from the forest?, L= What might be the yearly revenue expenses for forest management?, M= What is the organization chart of its management?, N= What about the suggestion for sustainable development of Sundarban Forests?

Name & Address	Comments/Answer					
	I	J	K	L	M	N
1. Mr. Kamaluddin Ahamed, Forest Ranger, Srankhola Range, Sundarban East, Bagerhat	Effect of storm and flood on wildlife and food habit	Maintaing income	No answer	No answer	No answer	No answer
2. Mr. Abdul Hamid Forest Ranger, Srankhola Range, Sundarban East, Bagerhat	Mostly	To carry life	No answer	No answer	The organization of chart of Sundarban. Range office → station office → camp	No answer
3. Mr. Aslam Mojumder Forest Ranger, Khulna	Much	To Lead life	No answer	No answer	Divisional Range office → station office → camp	No answer
4. Mr. Rofiquel	Abundant	Enough	No	No	The organization of	No

Hossain, Forest Ranger, Chandpai Range, Sundarban East, Begerhat.		to lead life	answer	answer	chart of Sundarban. Range office → station office → camp	answe r
5. Mr. Nural Amin Forest Ranger, Nolon, Khulna Range, Sundarban West, Khulna.	Mostly	Enough to lead life	No answer	No answer	The organization of chart of Sundarban. Range office → station office → camp	No answe r
6. Mr. Fozlul Haque Forest Ranger, Khulna Range, Sundarban West, Khulna.	Enough to lead life	Enough to lead life	No answer	No answer	The organization of chart of Sundarban. Range office → station office → camp	No answe r

Source: Field survey report

Deputy Rangers of the Sundarban Forest

Appendix 6.2.5

Comment of Deputy Rangers about Environmental Impact Assessment of Development Activities in the Sundarbans

Questions: A = What is your idea about Management Structure of the Forest? B= What are the Characteristics of Management of the Forest?

Name & Address	Comments/Answer	
	A	B
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	The management of forest is not satisfactory for conservation of the forest office.	The forest employees are not suitable for handling tools properly. The camps in the forest are not suitable to conserve or to keep firearms. There is no essential government vessel. Crisis of fuel.
2. Mr. Sahidul Islam Deputy Ranger, Bogi Station, Srangkhol Range, Sundarban East, Begerhat,	Camping system runs by only one or two person in the office in miscellaneous jobs in the forest to lead the activities.	Camp in the forest, inspect the seasonal cutting of the well accurately or not.
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	Forest management is run according to the directions of working plan.	Conservation of ecological balance and strength the government by fulfilling the local demand and paying revenue to the revenue to the revenue board.
4. Mr. Anowar Us Saleh Deputy Ranger, Sundarban West Khulna	Forest management is well	To strengthen the govt. through collect revenue
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarangkhol Range, Khulna	Well and good.	No answer

6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	Well and good.	To make profession of the local people.
7. Mr. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	Need a new management plan	To make conscious of the local People
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	Well and good.	Fulfill the demand of wood in the market
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer, Kashiabad, Nolian, Khulna	Well and good.	Fulfill the demand of wood in the market
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	Well and good.	Fulfill the demand of wood in the market.
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	Need a new management plan	To make profession of the local People, and fulfill the demand of wood in the market
12. Mr. Solaiman Howladar Deputy Ranger, Sutter Khali, Khulna Range, Sundarban West, Khulna.	Need a new management plan	Fulfill the demand of wood
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban Eest, Bagerhat.	It should be introduced new sustainable management	Make profession for the local people and fulfill the local demand of wood.
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	Need a new management plan	Make profession for the local people and fulfill the local demand of wood.
15. Mr. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	Well and good.	Make profession for the local people and fulfill the local demand of wood.
16. Mr. Kazi Lutfor Rahman Deputy Ranger, Chandpai Range, Sundarban Eest, Bagerhat.	Well and good.	Make profession for the local people and fulfill the local demand of wood.

Source: Field survey report

Appendix 6.2.5

**Comment of Deputy Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans**

**Questions: C = What is the strength of the forest? D = Do you know at any of its
weakness of management?**

Name & Address	Comments/Answer	
	C	D
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	Divisional head office, Range office, and Station office, Set up in the Sundarban. There are several camps under the station, which lead the structure of the management by watching various time in the forest.	Attract of the pirate, inefficient and insufficient employee, vessels and crisis of fuel.
2. Mr. Sahidul Islam Deputy Ranger, Bogi Station, Sranksola Range, Sundarban East, Begerhat,	Camp in the forest, inspect the seasonal cutting of the well accurately or not.	There are many problems like-problems of office repair, problem of fuel oil, problem of govt. trawler, problem of deriver, problem of trawler mechanic, problem of primary treatment, and residential problem.
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	The management of Sundarban is conducted in Selection-cum- improvement system under various circles like Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crises of expert manpower, crisis of supply of essential fuel oil, crisis of high-speed vehicles.
4. Mr. Anowar Us Saleha Deputy Ranger, Sundarban West Khulna	No answer	Theft of wood
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarankhola Range, Khulna	No answer	Theft of wood and corruption of the forest officer/employee.
6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of fuel oil and do not protect the pirate
7. Mr. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of fuel oil and attaack of pirates.
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle	Fuel oil and pirates
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer, Kashiabad, Nolian,	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle	Fuel oil and pirates

Khulna		
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	Range station camp	Fuel oil and pirates
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of fuel oil, old- fashioned transport, do not protect the pirate.
12. Mr. Solaiman Howladar Deputy Ranger, Sutter Khali, Khulna Range, Sundarban West, Khulna.	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of oil, continue camp system and do not protect the pirate.
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban East, Bagerhat.	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of oil and do not protect the pirate
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban East, Bagerhat.	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Crisis of fuel oil, need a good arms and do not protect the pirate
15. Mr. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban East, Bagerhat.	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Fuel oil and pirates
16. Mr. Kazi Lutfor Rahman Deputy Ranger, Chandpai Range, Sundarban East, Bagerhat.	Sundori working circle, Gewa working circle, Goran working circle, Golpata working circle, and miscellaneous circle.	Fuel oil and pirates

Appendix 6.2.5

Comment of Deputy Rangers about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E = How the development works of the forest is done?

F = What are the main sources of revenue of the forest?

Name & Address	Comments/Answer	
	E	F
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	Enhance the camping system. Ultra modern aromatic firearms and overall swift traffic and supply of fuel	Collecting fish, the crab, Golpata, Goran, the cockle, and honey are the sources of revenue income.
2. Mr. Sahidul Islam Deputy Ranger, Bogi Station, Sarankhola Range, Sundarban East, Begerhat,	Manage good government trowler, trained driver and trained mechanic and to enhance camping trained manpower.	Huge forest revenue is being collected through seasonal well; pass through fish, and from honey.
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	Regular camping, and make conscious the people who are related with Sundarban to use forest grown property.	Buying controlled materials, collecting Goran fuel and Golpata, catching fish and crab.
4. Mr. Anowar Us Saleha Deputy Ranger, Sundarban	Lead Accurately	Permit the pass

West Khulna		
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarankhola Range, Khulna	To control accurately	Permit the pass and catch fish
6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	To make budget and camping	Forest grown Property
7. Md. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	No answer	Forest grown Property
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	If the activities go according to rules	Forest grown Property
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer, Kashiabad, Nolian, Khulna	No answer	Forest grown Property
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	If the activities go according to rules	Forest grown Property
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	It will protect the pirates and control the theft of wood	Forest grown Property
12. Md. Solaiman Howladar Deputy Ranger, Sutter Khali, Khulna Range, Sundarban West, Khulna.	It will protect the pirate, forecast about the natural disaster	Forest grown Property
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban Eest, Bagerhat.	It will protect the pirate	Forest grown Property
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	It will protect the pirate	Forest grown Property
15. Mr. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	It will protect the pirate	Forest grown Property
16. Mr. Kazi Lutfur Rahman Deputy Ranger, Chandpai Range, Sundarban Eest, Bagerhat.	It will protect the pirate	Forest grown Property

Source: Field survey report

Appendix 6.2.5
Comment of Deputy Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: G = What are the different types of expenses incurred for the forest? H= What is your idea about the role of the forest in our economy?

Name & Address	Comments/Answer	
	G	H
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	There is no expenditure except salary of the government employees	Forest is the local based service centre for the economic prosperity. Forest fulfills all kinds of essentials demand to the people. Supplies Oxygen. Man can get all things from forest, which need from his birth to death.
2. Mr. Sahidul Islam Deputy Ranger, Bogi Station, Sranchola Range, Sundarban East, Begerhat,	To build house, create forest orchard/garden	Forest plays many vital roles from our childhood to grave
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	Transportation, Communication and fuel	Roles of forest are highly co- related with economic prosperity.
4. Mr. Anowar Us Saleha Deputy Ranger, Sundarban West Khulna	Fuel, transportation and manpower	Sufficient
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarankhola Range, Khulna	Fuel oil	Enough
6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	Fuel oil	Sufficient
7. Mr. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	Fuel oil	Sufficient
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	Fuel oil	Enough
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer, Kashiabad, Nolian, Khulna	Fuel oil	Good
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	Fuel oil	Good
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	Fuel oil	Sufficient
12. Mr. Solaiman Howladar Deputy Ranger, Sutter Khali,	Fuel oil	Sufficient

Khulna Range, Sundarban West, Khulna.		
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban Eest, Bagerhat.	Fuel oil	Sufficient
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	Fuel oil	Need Sufficient
15. Mr. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	Fuel oil	Sufficient
16. Mr. Kazi Lutfor Rahman Deputy Ranger, Chandpai Range, Sundarban Eest, Bagerhat.	Fuel oil	Sufficient

Source: Field survey report

Appendix 6.2.5
Comment of Deputy Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I= How for the natural destruction affects our biodiversity? J= How for the Bawali and Mawali are benefited by the Forrest? K= please state the yearly earnings from the forest? L= What might be the yearly revenue expenses for forest management?

Name & Address	Comments/Answer			
	I	J	K	L
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	20%	Wood cutter and Maolis get benefit from forest to lead their life Ensure sufficient security because, godfathers help the pirates	Around one crore taka	Tk. 500000- 600000
2. Mr. Sahidul Islam Deputy Ranger, Bogi Station, Srankskola Range, Sundarban East, Begerhat,	Storms and high waves earthquake etc	Get enough benefit but it is not possible to ensure sufficient security because, godfathers help the pirates	No answer	No answer
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	Almost roughly	Wood cutters and Moalis get many benefits to lead their life	Around one and half crore taka per year/ every year / in a year	No answer
4. Mr. Anowar Us Saleha Deputy Ranger, Sundarban West Khulna	Rains sufficient	A lot of	No answer	No answer
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarankhola Range, Khulna	Enough	Lead their life	No answer	No answer
6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	Many	Lead their life	No answer	No answer
7. Md. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	Enough	Lead their life	No answer	No answer
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	Many	Lead their life	No answer	No answer
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer,	Many	Lead their life	No answer	No answer

Kashiabad, Nolian, Khulna				
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	Many	Lead their life	No answer	No answer
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	A huge number	Lead their life	No answer	No answer
12. Mr. Solaiman Howladar Deputy Ranger, Sutter Khali, Khulna Range, Sundarban West, Khulna.	A huge number	Lead their life	No answer	No answer
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban Eest, Bagerhat.	A huge number	Lead their life	No answer	No answer
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	A huge number	Lead their life	No answer	No answer
15. Mr. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	A huge number	Lead their life	No answer	No answer
16. Mr. Kazi Lutfor Rahman Deputy Ranger, Chandpai Range, Sundarban Eest, Bagerhat.	A huge number	Lead their life	No answer	No answer

Source: Field survey report

Appendix 6.2.5
Comment of Deputy Rangers about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: M= What is the organization chart of its management? N = What about the suggestion for sustainable development of Sundarban Forest?

Name & Address	Comments/Answer	
	M	N
1. Mr. Sahidul Islam Deputy Ranger of Forest, Chandpai Range, Sundarban East, Begerhat,	The organization of chart of Sundarban. Range office → station office → camp	Protection of the pirates attach, protest of Tiger attach, protect wood and other forest grown materials from smugglers.
2. Md. Sahidul Islam Deputy Ranger, Bogi Range, Sarankhola Range,	No answer	There is no alliance at all to get up in the new building.
3. Mr. Abdus Satter Deputy Ranger, Burigoalini Forest Office, Shatkhera Range,	No answer	No answer
4. Mr. Anowar Us Saleha Deputy Ranger, Sundarban	No answer	No answer

West Khulna		
5. Mr. Sayed Sawkhat Ali Deputy Ranger, Sarankhola Range, Khulna	No answer	No answer
6. Mr. Mostafizur Rahman Deputy Ranger, Sarankhola Range, Khulna	The organization of chart of Sundarban. Range office → station office → camp	No answer
7. Mr. Moniruzzaman Deputy Ranger, Station Officer, Sutarkhali, Nolian, Khulna	The organization of chart of Sundarban. Range office → station office → camp	If the management is done according to rules
8. Mr. Zahidur Rahman Deputy Ranger, Station Officer, Baniakhali, Nolian, Khulna	The organization of chart of Sundarban. Range office → station office → camp	If the management is done according to rules
9. Mr. Ibrahim Hossain Deputy Ranger, Station Officer, Kashiabad, Nolian, Khulna	The organization of chart of Sundarban. Range office → station office → camp	If the management is done according to rules
10. Mr. Ekramul Haque Deputy Ranger, Sarankhola Station Officer, Begerhat, Sarankhola	The organization of chart of Sundarban. Range office → station office → camp	If the management is done according to rules
11. Mr. Allauddin Deputy Ranger, Station Officer, Kalabogi, Nolian, Khulna	The organization of chart of Sundarban. Range office → station office → camp	We should cut the tree by selecting and a proper management of other properties
12. Mr. Solaiman Howladar Deputy Ranger, Sutter Khali, Khulna Range, Sundarban West, Khulna.	The organization of chart of Sundarban. Range office → station office → camp	It should be introduced new management plan and cut trees by selection.
13. Mr. Asaduzzaman Deputy Ranger, Jale polli, Patrol Camp Dubla, Sarankhola Range, Sundarban Eest, Bagerhat.	The organization of chart of Sundarban. Range office → station office → camp	Need a sustainable management
14. Mr. Tapus Kamar Sorkar Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	The organization of chart of Sundarban. Range office → station office → camp	Need a sustainable management
15. Md. Ismail Hossain Deputy Ranger, Sarankhola Range, Sundarban Eest, Bagerhat.	The organization of chart of Sundarban. Range office → station office → camp	No answer
16. Mr. Kazi Lutfor Rahman Deputy Ranger, Chandpai Range, Sundarban Eest, Bagerhat.	The organization of chart of Sundarban. Range office → station office → camp	Need a sustainable management

Source: Field survey report

Sundarban Foresters

Appendix 6.2.6
Comment of Foresters about

Environmental Impact Assessment of Development Activities in the Sundarbans

Comments: A= Age, B= What are the cause of forest degradation and bio-diversity reduction? C= How can overcome these problems? D= What types of plants, animals and birds species are declining? Please specify the causes and how can protect then.

Name & Address	Comments/ Answer			
	A	B	C	D
1.Mr. Citta Ranjan Mondal Forester, Khulna Range, Khulna	50 Years	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (2) Water pollution	It will be conscious of the people about the law of increase the number of employee	Sundori, tiger, crocodile, modontak, stark, siltiness of water and illegally bird hunting
2.Mr. Abdul Maleq Hawlader Forester, Sadar Range, Bagerhat	48 Years	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (2) Water pollution (3) Others	It can remove through supervise other problems	Sundori
3. Mr. Zillur Rahim Forester, Khulna Range, Sundarban West, Khulna	25 Years	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (2) Water pollution (3) Others	Boundary of the forest, make Profession of the local people of the forest zone, and make consciousness of the people about the importance of forest grown property	Tiger, crocodile, and different species of deer, modontak, because, destruction of the residence of wild life and illegally hunted, they will be protected by creating fearless forest
4.Mr. Kazi Nurul Islam Forester, Chandpai Range Sundarban East, Bagerhat.	50 Years	(1) Illegal felling, (2) natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori & different birdds
5. Mr. Abdur Rouf Forester, Srankhola Range, Sundarban East, Bagerhat.	51 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori & different birds
6. Mr. Jafor Ali Mia Forester, Chandpai Range, Sundarban East, Bagerhat.	52 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori
7. Mr. Kamrul Hasan Patoary Forester, Chandpai Range, Sundarban	34 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion	Natural	Sundori

East, Bagerhat.		etc), (3) Water pollution		
8. Mr. Sanaullah Patoary Forester, Nolian, Koyra Patrol Camp, Sundarban West, Khulna.	52 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori
9. Mr. Abdul Mannan Khan Forester, Nolian, Bardra Patrol Camp, Sundarban West, Khulna.	43 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori
10. Mr. Abdus Subur Forester, Nilcomal Avayornno Sundarban West, Khulna.	28 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori
11. Mr. Kazi Mahafujul Haque Forester, Harbaria Patrol Camp, Sarankhola Range, Sundarban East Bagerhat.	45 Years	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc), (3) Water pollution	Natural	Sundori

Source: Field survey report

Appendix 6.2.6

Comment of Foresters about

Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E= Do you have enough manpower and logistic support to protect the Sundarban Forest? If no, Please specify. F= What are the strength and weakness of present Sundarban Forest management system? G= What types of plantation do you suggest to restore the forest coverage in degraded area?

Name & Address	Comments/ Answer		
	E	F	G
1. Mr. Citta Ranjan Mondal Forester, Khulna Range, Khulna	(1) Manpower, (2) Sped boat, (3) Trauler/ launch; (4) Car (Jeep), (5) Wire-less, (6) Safe drinking water supply	Strong vessels, and fuel oil, crisis of pure water and treatment	Sharrish, mehgoni, koro, chambul and babla
2. Mr. Abdul Maleq Hawlader Forester, Sadar Range, Bagerhat	(1) Manpower (2) Logistic, (3) Speed boat; (4) Trauler, (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	No answer	No answer
3. Mr. Zillur Rahim Forester, Khulna Range, Sundarban West, Khulna	Yes, Manpower, legal support and a good number of transport, fuel oil etc. are needed for conservation of Sundarban	The positive aspects are reduction of political impact and it has been supplied some	Rain tree, Korai, Babla, Chambul, Akashmoni etc

		modern firearms	
4. Mr. Kazi Nurul Islam Forester, Chandpai Range	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
5. Mr. Abdur Rouf Forester, Srangkhol Range, Bagerhat	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
6. Mr. Jafor Ali Mia Forester, Chandpai Range, Sundarban East, Bagerhat.	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
7. Mr. Kamrul Hasan Patoary Forester, Chandpai Range, Sundarban East, Bagerhat.	Yes, (1) manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
8. Mr. Sanaullah Patoary Forester, Nolian, Koyra Patrol Camp, Sundarban West, Khulna.	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
9. Mr. Abdul Mannan Khan Forester, Nolian, Bardra Patrol Camp, Sundarban West, Khulna.	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
10. Mr. Abdus Subur Forester, Nilcomal Avayornno Sundarban West, Khulna.	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees
11. Mr. Kazi Mahafujul Haque Forester, Harbaria Patrol Camp, Sarankhola Range, Sundarban East Bagerhat.	Yes, (1) Manpower, (2) Logistic; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space, (8) Safe drinking water supply	Intensive supervision of forest department, do not control the pirates	Plantation of new trees

Source: Field survey report

Appendix 6.2.6
Comment of Foresters about

Environmental Impact Assessment of Development Activities in the Sundarbans
Question: H=Do you want to involve local people in plantation programme of degraded area? What will be the sharing system? I= How can you make the natural resource collection sustainable? J=How many tourists enter into the Sundarban per year? Are these numbers adequate? If, not, Why? K=What are the main attraction of tourist in Sundarban.

Name & Address	Comments/ Answer			
	H	I	J	K
1.Mr. Citta Ranjan Mondal Forester, Khulna Range, Khulna	No	Through election	It is unknown	Tiger, deer, crocodile, monkey, etc
2.Mr. Abdul Maleq Hawlater Forester, Sadar Range, Bagerhat	No	We should maintain the rules	Yes	Tiger, deer monkey, & others.
3. Mr. Zillur Rahim Forester, Khulna Range, Sundarban West, Khulna	No	Through selection cum improvement system	28-31 thousand, it is not enough, because, increase of revenue, increase hire of transport.	Tiger, deer, crocodile, monkey, Sundri Trees, etc
4. Mr.Kazi Nurul Islam Forester, Chandpai Range, Sundarban East, Bagerhat.	No	If we cut trees by selection	Yes	Tiger, Deer & Crocodile
5. Mr. Abdur Rouf Forester, Srangkhol Range, Bagerhat	No	If we cut trees by selection	Yes	Tiger, Deer & Crocodile
6. Mr. Jafor Ali Mia Forester, Chandpai Range, Sundarban East, Bagerhat.	No	If we cut trees by selection	Yes	Tiger, & Deer
7. Md. Kamrul Hasan Patoary Forester, Chandpai Range, Sundarban East, Bagerhat.	No	If we cut trees by selection	Yes	Tiger, & Deer
8. Mr. Sanaullah Patoary Forester, Nolian, Koyra Patrol Camp, Sundarban West, Khulna.	No	If we cut trees by selection	Yes	Tiger, & Deer
9. Mr. Abdul Mannan Khan Forester, Nolian, Bardra Patrol Camp, Sundarban West, Khulna.	No	If we cut trees by selection	Yes	Tiger, & Deer
10. Mr. Abdus Subur Forester, Nilcomal Avayornno Sundarban West, Khulna.	No	If we cut trees by selection	Yes	Tiger, & Deer
11.Mr. Kazi Mahafujul Haque Forester.Harbaria Patrol Camp, Sarangkhol Range, Sundarban East Bagerhat.	No	If we cut trees by selection	Yes	Tiger, & Deer

Source: Field survey report

Sundarban Forest Guards

Appendix 6.2.7

**Comment of Forest Guards about
Environmental Impact Assessment of Development Activities in the Sundarbans**

Question: A =Age (years), B=what are the causes of forest degradation and bio-diversity reduction? C= How can overcome these problems? D=What types of plants, animals and birds species are declining? Please specify the causes and how can protect them.

Name & Address	Comments/ Answer			
	A (years)	B	C	D
1. Mr. Sahabuddin Forest Guard, Satkhira Range Burigoalini Forest Station	44	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Sundori, Gewa etc
2. Mr. Nazrul Islam Forest Guard, Satkhira Range	43	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution & (3) Others	Natural & stop theft	Sundori, tree, various birds
3. Mr. Abul Kalam Azad Forest Guard, Satkhira Range Burigoalini Forest Station	47	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Sundori tree, various birds
4. Mr. Sawakat Khan Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	45	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	In Natural cause	Sundori crab etc. because of saltiness of water
5. Mr. Saiful Alam Mollah Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	34	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Boundary of the forest makes profession of the local people of the forest zone, and makes consciousness of the people about the importance of forest grown property.	Sundori crab etc. because of saltiness of water
6. Mr. Mohammad Ali Mahmud Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	38	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Tiger, deer, Crocodile and various species of bird and fish, because destruction of the residence and hunt them.
7. Mr. Tariqul Islam Forest Guard, Nolian Station, Khulna Range,	29	(1) Illegal feeling, (2) Over exploitation (3) Natural calamity	No answer	Reducing maximum guest birds

Khulna		(cyclone, tidal surge, saline water intrusion etc.) (4) Water pollution		
8. Mr. Fazlur Rahman Forest Guard, Chandpai Range Chandpai Station	49	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Sundori, tree, various birds
9. Mr. Anil Chandra Roy Forest Guard, Begerhat Sadar Sundarban East, Begerhat	45	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural & stop theft	Sundori crab etc. because of saltiness of water
10 Mr. Harun-Ur-Rashid Forest Guard, Begerhat Sadar Range, Sundarban East, Begerhat	45	(1) Illegal feeling, (2) Over exploitation (3) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (4) Water pollution	Natural	Sundori, tree, various birds
11. Mr. Zakir Hossain Forest Guard, Sarankhola Range Bhola Camp, Sarankhola, Begerhat	35	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Sundori, tree, various birds
12. Mr. Munir Khan Forest Guard, Sarankhola Range, Sarankhola, Begerhat	32	(1) Illegal feeling, (2) Over exploitation (3) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (4) Water pollution	Natural & stop theft	Tiger, deer, crocodile and various species of bird and fish, because destruction of the residence and hunt them
13. Mr. Jalil Forest Guard, Goal Pata Kup, Sarankhola Range, Sarankhola	42	(1) Illegal feeling, (2) Over exploitation (3) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (4) Water pollution	Natural	Sundori, tree, various birds
14. Mr. Sha Alam Forest Guard, Morabhol Camp, Sarankhola Range, Sarankhola Begerhat	40	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (2) Water pollution	Natural	Sundori crab etc. because of saltiness of water
15. Mr. Lal Mia Forest Guard, Sarankhola Range, Sarankhola, Begerhat	53	(1) Illegal feeling, (2) Over exploitation (3) Natural calamity (cyclone, tidal surge, saline water intrusion etc.) (4) Water pollution	Natural	Tiger, deer, crocodile and various species of bird and fish, because destruction of the residence and hunt them

Source: Field survey report

Appendix 6.2.7
Comment of Forest Guards about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E = Do you have enough manpower and logistic support to protect the Sundarban Forest? If no, please specify. F = What are the strength and weakness of present Sundarban Forest management system? G = What types of plantation do you suggest to restore the forest coverage in degraded area?

Name & Address	Comments/ Answer		
	E	F	G
1. Mr. Sahabuddin Forest Guard, Satkhira Range Burigoalini Forest Station	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	New tree plantation
2. Mr. Nazrul Islam Forest Guard, Satkhira Range	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	New tree plantation
3. Mr. Abul Kalam Azad Forest Guard, Satkhira Range Burigoalini Forest Station	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	New tree plantation
4. Mr. Sawakat Khan Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive security system, continue camping system in the forest zone and attack of pirates	New tree plantation
5. Mr. Saiful Alam Mollah Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	New tree plantation
6. Mr. Mohammad Ali Mahmud Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Negative aspect are: There is no sufficient employee, transport and fuel	Rain tree, babla, mehgoni, akashmoni.
7. Mr. Tariqul Islam Forest Guard, Nolian Station, Khulna Range, Khulna	(1) Logistic support; (2) Trauler/launch; (3) Safe office space	Lack of Honesty	Sundori, kewra, poshari, Bine, etc
8. Mr. Fazlur Rahman Forest Guard, Chandpai Range Chandpai Station	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler; (5) Wire-less; (6) Safe office space; (7) Safe drinking water supply	No answer	Kewra
9. Mr. Anil Chandra Roy	(1) Manpower; (2) Logistic	Intensive	New tree

Forest Guard, Begerhat Sadar Sundarban East, Begerhat	support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	supervision of Forest department, cannot protect the pirate	plantation
10 Mr. Harun-Ur-Rashid Forest Guard, Begerhat Sadar Range, Sundarban East, Begerhat	(1) Logistic support; (2) Trauler/launch; (3) Safe office space	Intensive supervision of Forest department, cannot protect the pirate	Sundori, kewra, poshari, Bine, etc
11. Mr. Zakir Hossain Forest Guard, Sarankhola Range Bhola Camp, Sarankhola, Begerhat	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Negative aspect are: There is no sufficient employee, transport and fuel	New tree plantation
12. Mr. Munir Khan Forest Guard, Sarankhola Range, Sarankhola, Begerhat	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Negative aspect are: There is no sufficient employee, transport and fuel	New tree plantation
13. Mr. Jalil Forest Guard, Goal Pata Kup, Sarankhola Range, Sarankhola	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	Sundori, kewra, poshari, Bine, etc
14. Mr. Sha Alam Forest Guard, Morabhola Camp, Sarankhola Range, Sarankhola Begerhat	(1) Logistic support; (2) Trauler/launch; (3) Safe office space	Negative aspect are: There is no sufficient employee, transport and fuel	New tree plantation
15. Mr. Lal Mia Forest Guard, Sarankhola Range, Sarankhola, Begerhat	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest department, cannot protect the pirate	Sundori, kewra, poshari, Bine, etc

Source: Field survey report

Appendix 6.2.7

Comment of Forest Guards about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: H = do you want to involve local people in plantation programme of degraded area? What will be the sharing system/ I= How can you make the natural resource collection sustainable? J= How many tourists enter into the Sundarban per year? Are these numbers adequate? If, not, why? K= What are the main attraction of tourist in Sundarban.

Name & Address	Comments/ Answer			
	H	I	J	K
1. Mr. Sahabuddin Forest Guard, Satkhira Range Burigoalini Forest Station	No	If cut by selection	No, need more	Tiger, deer & crocodile

2. Mr. Nazrul Islam Forest Guard, Satkhira Range	No	If cut by selection	No, need more	Tiger, deer, crocodile, bird & tree
3. Mr. Abul Kalam Azad Forest Guard, Satkhira Range Burigoalini Forest Station	No	If collect by selection	No, increase more	Tiger, deer, crocodile, koromjal look after
4. Mr. Sawakat Khan Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	No	If collect by systematically	Sufficient	Chitol, deer, and tiger
5. Mr. Saiful Alam Mollah Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	No	If collect by systematically	Sufficient	Chitol, deer, and tiger
6. Mr. Mohammad Ali Mahmud Forest Guard, Nolian Station, Khulna Range, Sundarban West, Khulna	No	By selection	There is no sufficient management for the tourists	Tiger, deer and crocodile
7. Mr. Tariqul Islam Forest Guard, Nolian Station, Khulna Range, Khulna	No	No answer	Around 1000/15000 people, but it is not sufficient	Visit here for natural beauty, because being vanished natural property
8. Mr. Fazlur Rahman Forest Guard, Chandpai Range Chandpai Station, Sundarban East, Begerhat	No	No answer	There is no good trowler, rest house, and the management of car parking and repair of jetty	Tiger, deer and monkey
9. Mr. Anil Chandra Roy Forest Guard, Begerhat Sadar Sundarban East, Begerhat	No	If cut by selection	No, need more	Tiger, deer & crocodile
10 Mr. Harun-Ur-Rashid Forest Guard, Begerhat Sadar Range, Sundarban East, Begerhat	No	If cut by selection	Sufficient	Visit here for natural beauty, because being vanished natural property
11. Mr. Zakir Hossain Forest Guard, Sarankhola Range Bhola Camp, Sarankhola, Begerhat	No	If collect by systematically	No, need more	Tiger, deer & crocodile
12. Mr. Munir Khan Forest Guard, Sarankhola Range, Sarankhola, Begerhat	No	If cut by selection	There is no good trowler, rest house, and the management of car parking and repair of jetty	Tiger, deer & crocodile
13. Mr. Jalil Forest Guard, Goal Pata Kup, Sarankhola Range, Sarankhola	No	If collect by systematically	No, need more	Visit here for natural beauty, because being vanished natural property
14. Mr. Sha Alam Forest Guard, Morabhola	No	If cut by selection	No, need more	Chitol, deer, and tiger

Camp, Sarankhola Range, Sarankhola Begerhat				
15. Mr. Lal Mia Forest Guard, Sarankhola Range, Sarankhola, Begerhat	No	If collect by systematically	Sufficient	Tiger, deer & crocodile

Source: Field survey report

Sundarban Forest Boat Men

Appendix 6.2.8

Comment of Forest Boat Men about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: A=Age (years), B=What are the causes of forest degradation and bio-diversity reduction?

Name & Address	Comments/Answer	
	A (years)	B
1. Mr. Mizanur Rahman Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	40	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (3) Water pollution
2. Mr. Emran Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	30	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (3) Water pollution
3. Mr. Unus Ali Sakh Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	55	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
4. Mr. Tapan Kumar Achoza Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	51	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
5. Mr. Amzad Hossain Boat Man, Burigoalini Forest Office, Satkhira Range, Khunla	42	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
6. Mr. Abdur Razzak Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	48	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
7. Md. Zakaria Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	38	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
8. Mr. Mosleuddin Boat Man, Monshigonj Patrol Camp, Satkhira Range, Khunla	48	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
9. Mr. Polash Kumar Roy Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	38	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
10. Mr. Abul Kashem Hawlader Boat Man, Satkhira Range Sadar, Khunla	51	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
11. Mr. Habib Ullah Boat Man, The Tourist of Center House, Sundarban West, Khunla	39	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
12. Mr. Sayed Asaduzzaman Nolian Forest Station,	40	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution

Sundarban West, Khulna Range, Khulna		
13. Mr. Mohammad Sahabuddin Nolian Forest Station, Sundarban West, Khulna Range, Khulna	38	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
14. Mr. Shek Mojibur Rahman Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	34	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
15. Mr. Abdul Karim Mollah Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	42	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
16. Mr. Isaruzzaman Nolian Forest Station, Khulna Range, Khulna	52	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
17. Mr. Abdul Hai Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	28	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Others
18. Mr. Abdur Rob Boat Man, Cahndpai Forest Station, Chandpai Range, Bagerhat, Khulna	30	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
19. Mr. Abdul Hannan Chowdhury Boat Man, Cahndpai Station, Chandpai Range, Bagerhat, Khulna	46	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
20. Mr. Mozibor Rahman Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	50	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution
21. Mr. Abdul Jalil Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	45	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (3) Water pollution
22. Mr. Farid Ahmed Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	50	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
23. Mr. Mizanur Rahman Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	40	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (3) Water pollution
24. Mr. Abu Bakkar Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	35	(1) Illegal felling, (2) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (3) Water pollution
25. Md. Moazzem Hossain Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	56	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
26. Mr. Abu Hanif Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	42	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution (3) Others
27. Mr. Shadat Hossain Boat Man, Bagerhat Sadar	46	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution

Range, Forest East, Bagerhat, Khulna		
28. Mr. Ashraf Ali Shekh Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	49	(1) Natural calamity (cyclone, tidal surge, saline water intrusion etc); (2) Water pollution

Source: Field survey report

Appendix 6.2.8

Comment of Forest Boat Men about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: C=How can overcome these problems? D=What types of plants, animals and birds species are declining? Please specify the cause and how can protect them.

Name & Address	Comments/Answer	
	C	D
1. Mr. Mizanur Rahman Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	It will be reduced the illegal feelings	Sundori trees and some birds
2. Mr. Emran Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	Natural	Sundori trees become less
3. Mr. Unus Ali Sakh Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	Natural	Sundori Trees and birds
4. Mr. Tapan Kumar Achoza Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	More guard will be recruited with small vessels of wood engines	Sundori, poshru, deer, saltness, died spate, illness, treatment
5. Mr. Amzad Hossain Boat Man, Burigoalini Forest Office, Satkhira Range, Khunla	No comment	Sundori trees and deer etc
6. Mr. Abdur Razzak Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	No comment	It has been loss enough for the trees of Sundarban and animals and fishes
7. Mr. Zakaria Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	No comment	Sundori wood, monkey and deer etc
8. Mr. Mosleuddin Boat Man, Monshigonj Patrol Camp, Satkhira Range, Khunla	No comment	Sundori tree, deer and various birds
9. Mr. Polash Kumar Roy Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	No comment	Sundori tree and deer etc
10. Mr. Abul Kashem Hawlder Boat Man, Satkhira Range Sadar, Khunla	No comment	Sundori wood, monkey and birds

11. Mr. Habib Ullah Boat Man, The Tourist of Center House, Sundarban West, Khulna	In natural caus	Sundori, kakra, etc and saltness of water
12. Mr. Sayed Asaduzzaman Nolian Forest Station, Sundarban West, Khulna Range, Khulna	In natural caus	Sundori, kakra, etc and saltness of water
13. Mr. Mohammad Sahabuddin Nolian Forest Station, Sundarban West, Khulna Range, Khulna	In natural caus	Sundori, kakra, etc and saltness of water
14. Mr. Shek Mojibur Rahman Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	In natural caus	Sundori, kakra, etc and saltness of water
15. Mr. Abdul Karim Mollah Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	In natural caus	Sundori, kakra, etc and saltness of water
16. Mr. Isaruzzaman Nolian Forest Station, Khulna Range, Khulna	Natural	Sundori tree
17. Mr. Abdul Hai Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	By supplying fuel oil and transport, and make people conscious by advertisement through T.V and radio	Poshur, dhundol, tiger, deer, modontek, kite, other, crisis of food, protect the illegal hunting, mass- consciousness, food supply and stop illegal entry.
18. Mr. Abdur Rob Boat Man, Cahndpai Forest Station, Chandpai Range, Bagerhat, Khulna	Natural	Sundori tree, illness, and by treatment
19. Mr. Abdul Hannan Chowdhury Boat Man, Cahndpai Station, Chandpai Range, Bagerhat, Khulna	No comment	Natural cause, Sundori Dhundol, tiger, crocodile, and modontek, sturk, river gull, etd
20. Mr. Mozibor Rahman Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	No comment	In natural cause
21. Mr. Abdul Jalil Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	Natural	Sundori trees and some birds
22. Mr. Farid Ahmed Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	By supplying fuel oil and transport, and make people conscious by advertisement through T.V and radio	Poshur, dhundol, tiger, deer, modontek, kite other, crisis of food, protect the illegal hunting, mass- consciousness, food supply and stop illegal entry.
23. Mr. Mizanur Rahman Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	By supplying fuel oil and transport, and make people conscious by advertisement through T.V and radio	Sundori, kakra, etc and saltness of water
24. Mr. Abu Bakkar Boat Man, Sarankhola Office,	Natural	Sundori tree, deer and various birds

Sarankhola Range, Bagerhat, Khulna		
25. Mr. Moazzem Hossain Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	More guard will be recruited with small vessels of wood engines	Sundori trees and some birds
26. Mr. Abu Hanif Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	By supplying fuel oil and transport, and make people conscious by advertisement through T.V and radio	Poshur, dhundol, tiger, deer, modontek, kite other, crisis of food, protect the illegal hunting, mass- consciousness, food supply and stop illegal entry.
27. Mr. Shadat Hossain Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	More guard will be recruited with small vessels of wood engines	Sundori, kakra, etc and saltness of water
28. Mr. Ashraf Ali Shekh Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	By supplying fuel oil and transport, and make people conscious by advertisement through T.V and radio	Sundori tree, deer and various birds

Source: Field survey report

Appendix 6.2.8

Comment of Forest Boat Men about

Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E=Do you have enough manpower and logistic support to protect the Sundarban Forest? If no, please specify. F=What are the strength and weakness of present Sundarban Forest management system? G=What types of plantation do you suggest to restore the forest coverage in degraded area? H= Do you want to involve local people in plantation programme of degraded area? What will be the sharing system?

Name & Address	Comments/Answer			
	E	F	G	H
1. Mr. Mizanur Rahman Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantatio n	No
2. Mr. Emran Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantatio n	No
3. Mr. Unus Ali Sakh Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantatio n	No
4. Mr. Tapan Kumar Achoza Boat Man, Burigoalini	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep);	Rifles, trowler, problem, Boat in the condition of	Bine, Kewra, Poshur,	No

Forest Station, Satkhira Range, Khunla	(6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	armless	Kakra, Goran etc.	
5. Mr. Amzad Hossain Boat Man, Burigoalini Forest Office, Satkhira Range, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	No answer	Yes	No
6. Mr. Abdur Razzak Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	No answer	Yes	No
7. Mr. Zakaria Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	No answer	Yes	No
8. Mr. Mosleuddin Boat Man, Monshigonj Patrol Camp, Satkhira Range, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	No answer	Yes	No
9. Mr. Polash Kumar Roy Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Wire-less; (6) Safe office space; (7) Safe drinking water supply	No answer	Yes	No
10. Mr. Abul Kashem Hawlader Boat Man, Satkhira Range Sadar, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	No answer	Yes	No
11. Mr. Habib Ullah Boat Man, The Tourist of Center House, Sundarban West, Khunla	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Security condition, continue camping system in the forest and attack of pirates	New tree plantation	No
12. Mr. Sayed Asaduzzaman Nolian Forest Station, Sundarban West, Khulna Range, Khulna	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Security condition, continue camping system in the forest and attack of pirates	New tree plantation	No
13. Mr. Mohammad Sahabuddin Nolian Forest Station, Sundarban West, Khulna Range, Khulna	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Security condition, continue camping system in the forest and attack of pirates	New tree plantation	No
14. Mr. Shek Mojibur Rahman Nolian Forest Office,	(1) Manpower; (2) Logistic support; (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep);	Security condition, continue camping system in the	New tree plantation	No

Nolian Dacop, Khulna Range, Khulna	(6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	forest and attack of pirates		
15. Mr. Abdul Karim Mollah Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Security condition, continue camping system in the forest and attack of pirates	New tree plantation	No
16. Mr. Isaruzzaman Nolian Forest Station, Khulna Range, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Security condition, continue camping system in the forest and attack of pirates	Coconut, Kodom, rain-tree, mehgon y, hill margoss tree etc	No
17. Mr. Abdul Hai Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Fuel oil, transport, treatment, food, water, old ammunition, and firearms	Coconut, Kodom, rain-tree, mehgon y, hill margoss tree etc	No
18. Mr. Abdur Rob Boat Man, Cahndpai Forest Station, Chandpai Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	Natural way	No
19. Mr. Abdul Hannan Chowdhury Boat Man, Cahndpai Station, Chandpai Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	Rain tree, Korai, Sishu and Babla	No
20. Mr. Mozibor Rahman Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	Coconut, rain-tree, Korai, Babla, etc	No
21. Mr. Abdul Jalil Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantation	No
22. Mr. Farid Ahmed Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	Yes	No
23. Mr. Mizanur Rahman Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water	Strict security in the forest department and cannot protect the pirate	Rain tree, Korai, Sishu and Babla	No

	supply			
24. Mr. Abu Bakkar Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantation	No
25. Mr. Moazzem Hossain Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Fuel oil, transport, treatment, food, water, old ammunition, and firearms	Yes	No
26. Mr. Abu Hanif Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Rifles, trowler, problem, Boat in the condition of armless	Rain tree, Korai, Sishu and Babla	No
27. Mr. Shadat Hossain Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	New tree plantation	No
28. Mr. Ashraf Ali Shekh Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Fuel oil, transport, treatment, food, water, old ammunition, and firearms	Rain tree, Korai, Sishu and Babla	No

Source: Field survey report

Appendix 6.2.8

Comment of Forest Boat Men about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I=How can you make the natural resource collection sustainable? J= How many tourists enter into the Sundarban per year? Are these numbers adequate? If, not, why? K= What are the main attraction of tourist in Sundarban.

Name & Address	Comments/Answer		
	I	J	K
1. Mr. Mizanur Rahman Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	Yes	Tiger and deer
2. Mr. Emran Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	No answer	No answer
3. Mr. Unus Ali Sakh Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	Yes	Tiger and deer
4. Mr. Tapan Kumar Achoza Boat Man, Burigoalini Forest	Government law are strict	No answer	Tiger, deer, trees and plants

	supply			
24. Mr. Abu Bakkar Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Intensive supervision of Forest Department, can not protect the pirate	New tree plantation	No
25. Mr. Moazzem Hossain Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Fuel oil, transport, treatment, food, water, old ammunition, and firearms	Yes	No
26. Mr. Abu Hanif Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Rifles, trowler, problem, Boat in the condition of armless	Rain tree, Korai, Sishu and Babla	No
27. Mr. Shadat Hossain Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Strict security in the forest department and cannot protect the pirate	New tree plantation	No
28. Mr. Ashraf Ali Shekh Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	(1) Manpower; (2) Logistic support, (3) Speed boat; (4) Trauler/launch; (5) Car (Jeep); (6) Wire-less; (7) Safe office space; (8) Safe drinking water supply	Fuel oil, transport, treatment, food, water, old ammunition, and firearms	Rain tree, Korai, Sishu and Babla	No

Source: Field survey report

Appendix 6.2.8

Comment of Forest Boat Men about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: I=How can you make the natural resource collection sustainable? J= How many tourists enter into the Sundarban per year? Are these numbers adequate? If, not, why? K= What are the main attraction of tourist in Sundarban.

Name & Address	Comments/Answer		
	I	J	K
1. Mr. Mizanur Rahman Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	Yes	Tiger and deer
2. Mr. Emran Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	No answer	No answer
3. Mr. Unus Ali Sakh Boat Man, Burigoalini Forest Station, Satkhira Range, Sundarban West, Khunla	If cut by selection	Yes	Tiger and deer
4. Mr. Tapan Kumar Achoza Boat Man, Burigoalini Forest	Government law are strict	No answer	Tiger, deer, trees and plants

Station, Satkhira Range, Khunla			
5.Mr. Amzad Hossain Boat Man, Burigoalini Forest Office, Satkhira Range, Khunla	By collecting accurately	No answer	Tiger, deer, monkey, trowler of wood, tower, managrove, foreign ship
6. Mr. Abdur Razzak Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	By collecting accurately	No, need more and more	Tiger, deer, crocodile, monkey, animals and fish etc
7. Mr. Zakaria Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	By collecting accurately	No, need more and more	Tiger, deer, crocodile and animals etc
8. Mosleuddin Boat Man, Monshigonj Patrol Camp, Satkhira Range, Khunla	By collecting accurately	No, need more and more	Tiger, deer, crocodile and birds etc
9.Mr. Polash Kumar Roy Boat Man, Burigoalini Forest Station, Satkhira Range, Khunla	By collecting accurately	No, need more and more	Chito, deer and tiger
10. Mr.Abul Kashem Hawlader Boat Man, Satkhira Range Sadar, Khunla	By collecting accurately	No, need more and more	Chito, deer and tiger
11. Mr. Habib Ullah Boat Man, The Tourist of Center House, Sundarban West, Khunla	By collecting accurately	Sufficient	Chito, deer and tiger
12. Mr.Sayed Asaduzzaman Nolian Forest Station, Sundarban West, Khulna Range, Khulna	By collecting accurately	Sufficient	Chito, deer and tiger
13. Mr.Mohammad Sahabuddin Nolian Forest Station, Sundarban West, Khulna Range, Khulna	By collecting accurately	Sufficient	Chito, deer and tiger
14. Mr. Shek Mojibur Rahman Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	By collecting accurately	Sufficient	Chito, deer and tiger
15. Mr. Abdul Karim Mollah Nolian Forest Office, Nolian Dacop, Khulna Range, Khulna	By collecting accurately	Sufficient	Chito, deer and tiger
16. Mr. Isaruzzaman Nolian Forest Station, Khulna Range, Khulna	If cut by selection	Yes	Tiger and deer
17. Mr. Abdul Hai Boat Man, Cahndpai Forest Office, Chandpai Range, Bagerhat, Khulna	By inform and make conscious the Bawali and Mawali to collect accurately.	Nearly 25-30 Thousand, but this number is not sufficient, Because, increase government revenue besides, forest robber	Tiger, crocodile, deer, Sundori tree
18. Mr. Abdur Rob Boat Man, Cahndpai Forest Station, Chandpai Range, Bagerhat, Khulna	If cut by selection	No, Need more and more	Tiger, deer and crocodile etc
19. Mr. Abdul Hannan Chowdhury Boat Man, Cahndpai Station, Chandpai Range, Bagerhat, Khulna	If cut by selection	No sufficient, Need more and more	Tiger, deer, crocodile, monkey, snake and birds etc
20. Mr. Mozibor Rahman Boat Man, Cahndpai Forest Office, Chandpai Range,	By proper management	Sufficient	Tiger, deer, crocodile, monkey, snake and birds etc

Bagerhat, Khulna			
21. Mr. Abdul Jalil Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	If cut by selection	No, need more and more	Tiger, deer, monkey, trowler of wood, tower, managrove, foreign ship
22. Mr. Farid Ahmed Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	By collecting accurately	Sufficient	Tiger and deer
23. Mr. Mizanur Rahman Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	If cut by selection	No, need more and more	Tiger, deer, monkey, trowler of wood, tower, managrove, foreign ship
24. Mr. Abu Bakkar Boat Man, Sarankhola Office, Sarankhola Range, Bagerhat, Khulna	If cut by selection	No, need more and more	Tiger, deer, monkey, trowler of wood, tower, managrove, foreign ship
25. Mr. Moazzem Hossain Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	By collecting accurately	Sufficient	Tiger and deer
26. Mr. Abu Hanif Boat Man, Sarankhola Forest Office, Sarankhola Range, Bagerhat, Khulna	If cut by selection	Sufficient	Chito, deer and tiger
27. Mr. Shadat Hossain Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	By collecting accurately	Yes	Tiger and deer
28. Mr. Ashraf Ali Shekh Boat Man, Bagerhat Sadar Range, Forest East, Bagerhat, Khulna	By inform and make conscious the Bawali and Mawali to collect accurately.	Sufficient	Chito, deer and tiger

Source: Field survey report

Forest Wood Cutters of the Sundarban

Appendix 6.2.9

Comment of Forest Wood Cutters about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: A=Age (years), B=Education, C=Annual income (Tk.) from woodcutting.
D= Last five years income from woodcutting.

Name & Address	Comments/ Answer								
	A (years)	B	C	D {Goran fuel (Tk. in Thousand)}					Average
				2006	07	08	09	10	

1. Mr. Sadeq Ali Gazi Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	55	Class five	Tk. 20000	16	16	18	18	20	17600
2. Mr. Fazlu Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	30	Signature Knowledg e	Tk. 18000	14	15	15	18	18	16000
3. Mr. Sabot Sarkar Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	45	Class five	Tk. 20000	18	18	19	20	20	19000
4. Mr. Mahmud Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	40	Signature Knowledg e	Tk. 20000	16	18	18	20	20	18400
5. Mr. Oazed Baksha Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	50	Signature Knowledg e	Tk. 20000	16	18	18	20	20	18400
6. Mr. Abul Ali Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	50	Signature Knowledg e	Tk. 20000	10	10	10	12	12	10800
7. Mr. Sha Alam Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	25	Class five	Tk. 15000	12	12	14	15	15	13600
8. Mr. Alam Saha Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	30	Class seven	Tk. 14000	10	12	12	14	14	12400
9. Md. Abdul Gani Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	45	Class five	Tk. 15000	12	14	14	15	15	14000
10 Mr. Abu Musa Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	30	Class five	Tk. 30000	25	27	28	30	30	28000
11. Mr. Mokshed Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	45	Class five	Tk. 10000	7	8	8	10	10	8600
12. Mr. Kolilur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	55	Class five	Tk. 21000	18	20	20	21	21	20000

13. Mr. Faruk Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	38	Class eight	Tk. 20000	15	18	18	20	20	18200
14. Mr. Mahabubur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	34	Class five	Tk. 18000	15	16	15	18	18	16400
15. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Signature Knowledg e	Tk. 20000	15	18	18	20	20	18200
16. Md. Guni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 18000	15	16	16	18	18	16600
17. Mr. Kani Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class five	Tk. 22000	18	20	20	22	22	20400
18. Mr. Hurun Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 20000	16	18	18	20	20	18400
19. Mr. Monasser Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 20000	16	18	18	20	20	18400
20. Md. Harun Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 25000	20	22	22	25	25	22800
21. Mr. Kalam Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 18000	15	16	16	18	18	16600
22. Mr. Habi Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 20000	16	18	18	20	20	18400
23. Mr. Awal Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Class five	Tk. 18000	15	16	16	18	18	16600
24. Mr. Sukur Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Signature Knowledg e	Tk. 20000	15	16	16	20	20	17400
25. Mr. Nuzrul Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Class five	Tk. 22000	18	20	20	22	22	20400
26. Mr. Jahangir Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Signature Knowledg e	Tk. 22000	18	20	20	22	22	20400

27. Mr. Rostom Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Signature Knowledg e	Tk. 20000	15	17	18	20	20	18000
28. Mr. Sayed Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 25000	20	24	24	25	25	23600
29. Mr. Belayet Hossain Vill. Rajor, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	35	Class eight	Tk. 24000	20	22	22	24	24	22400
30. Mr. Abul Hares Hawladar Vill. Khanjakata, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	55	Signature Knowledg e	Tk. 20000	16	18	18	20	20	18400
31. Mr. Jaker Mia Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	52	H.S.C. pass	Tk. 25000	12	15	15	30	25	19400
32. Mr. Halim Torofdar Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	40	Signature Knowledg e	Tk. 24000	16	18	20	22	22	19600
33. Mr. Abul Kashem Khalifa Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	50	Class eight	Tk. 25000	20	22	24	23	25	23200

Source: Field survey report

Appendix 6.2.9

Comment of Forest Wood Cutters about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: E = What are you doing in other session? If you work in other place, please specially the type of work and annual income? F = What types of plants animals and birds, are decreasing in Sundarban? Why? How can you protect them? G=Do you observe any remarkable change in Sundarban Forest during your working period? H=Do you have full safety measure during work in Sundarban? If, no, How can improve the safety measure? I=Do you want to see any change of present forest management and timber extraction systems? If yes, how?

Name & Address	Comments/ Answer				
	E	F	G	H	I
1. Mr. Sadeq Ali Gazi Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.11000	Sundori tree, deer, bird, tree plantation, stop hunting, by teatment	Yes	No, fear of tiger. Like India, Provide electricity round human body	Yes, want proper managemen t, stop wood collecting and it be continued
2. Mr. Fazlu Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.25000	Sundori tree, monkey and bird. Lack of supervision	No	No, secure safety from tiger	It be started band of wood collection
3. Mr. Sabot Sarkar Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.30000	Sundori tree, deer and bird, lack of supervision	No	No, secure safety from tiger	Yes, it will be created new laws
4. Mr. Mahmud Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.25000	Sundori tree, deer, monkey and bird, lack of supervision	No	No, secure safety from tiger	Yes, it be started band of wood collection
5. Md. Oazed Baksha Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.20000	Sundori tree, deer and bird, lack of supervision	No	No, life insurance and other opportunity	Yes, new laws
6. Mr. Abul Ali Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Business of jackfruit, catch fish Tk. 20000	Sundori tree, deer and monkey lack of supervision	No	No	Yes, wood cutting be started
7. Mr. Sha Alam Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish Tk.10000	No answer	No ans wer	Fear of tiger and pirate, snake, crocodile	Yes
8. Mr. Alam Saha Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish and Kakra Tk.20000	Become not reduce	No	No, protect from the tiger, snake, crocodile, and the pirate	Yes, rest of the wood remain stopped except Goran, fuel, it will be stated
9. Mr. Abdul Gani Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Catch fish and Kakra Tk.20000	Become not reduce	No	No, protect from the tiger, snake, crocodile, and the pirate	Yes, stop of cutting wood be continued
10 Mr. Abu Musa Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Catch fish and Kakra Tk.20000	Become not reduce	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
11. Mr. Mokshed Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Catch fish and Kakra Tk.12000	Become not reduce	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued

12. Mr. Kolilur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Catch fish and Kakra honey collection Tk.20000	Sundori trees are being died, it will take step to treatment	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
13. Mr. Faruk Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Catch fish and Kakra Tk.22000	Sundori trees are being died, it will take step treatment	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
14. Mr. Mahabubur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Catch fish, Kakra, and daily labour Tk.20000	Sundori trees are being died, it will take step treatment	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
15. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra honey collection Tk.22000	Sundori trees are being died, it will take step treatment	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
16. Mr. Guni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra, and daily labour Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
17. Mr. Kani Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra & honey collection Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
18. Mr.. Hurun Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra, and daily labour Tk.22000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
19. Mr. Monasser Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
20. Mr. Harun Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
21. Mr. Kalam Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
22. Mr. Habi Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.22000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
23. Mr. Awal Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra, and daily labour Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued

24. Mr. Sukur Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra & honey collection Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
25. Mr. Nuzrul Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
26. Mr. Jahangir Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.21000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
27. Mr. Rostom Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish and Kakra Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
28. Mr. Sayed Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Catch fish, Kakra & honey collection Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
29. Mr. Belayet Hossain Vill. Rajor, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	Catch fish and Kakra Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
30. Mr. Abul Hares Hawladar Vill. Khanjakata, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	Catch fish and Kakra Tk.20000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
31. Mr. Jaker Mia Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Catch fish Tk.20000	Take come of Sundori tree	Tree die	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
32. Mr. Halim Torofdar Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Catch fish and Kakra Tk.30000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued
33. Mr. Abul Kashem Khalifa Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Catch fish and Kakra Tk.25000	Take come of Sundori tree	No	No, protect from the tiger, snake and the pirate	Yes, stop of cutting wood be continued

Source: Field survey report

Appendix 6.2.9
Comment of Forest Wood Cutters about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: J=What are the suitable methods of tree harvesting? Of them, which method is favourable for regeneration of forest? K= How many types of tree are you harvesting? Please, specify the volume in percentage and use? L=what are the strength and weakness of present Sundarban Forest management?

Name & Address	Comments/Answers		
	J	K	L
1. Mr. Sadeq Ali Gazi Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department, theft of wood
2. Mr. Fazlu Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 80 maund - use of fuel	Supervision of forest department, there is no effect if the wood theft
3. Mr. Sabot Sarkar Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Supervision of forest department, there is no effect if the wood theft
4. Mr. Mahmud Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Supervision of forest department, there is no effect if the wood theft
5. Mr. Oazed Baksha Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department
6. Mr. Abul Ali Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Supervision of forest department, there is no effect if the wood theft
7. Mr. Sha Alam Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	No answer
8. Mr. Alam Saha Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Supervision of forest department, there is no effect if the wood theft
9. Mr. Abdul Gani Vill. Datnakhali, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
10 Mr. Abu Musa Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
11. Mr. Mokshed Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Selective felling	Close Name of tree-total collection-use Goran Fuel - 80 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
12. Mr. Kolilur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Selective felling	Close Name of tree-total collection-use Goran Fuel - 38 maund - use of fuel	Strict security for the forest department, failure of control the pirate.

13. Mr. Faruk Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
14. Mr. Mahabubur Rahman Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
15. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
16. Mr. Guni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
17. Mr. Kani Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
18. Mr. Hurun Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
19. Mr. Monasser Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
20. Mr. Harun Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 80 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
21. Mr. Kalam Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
22. Mr. Habi Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
23. Mr. Awal Mirda Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 50 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
24. Mr. Sukur Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
25. Mr. Nuzrul Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.

26. Mr. Jahangir Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
27. Mr. Rostom Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
28. Mr. Sayed Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department, failure of control the pirate.
29. Mr. Belayet Hossain Vill. Rajor, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 80 maund - use of fuel	Strict security for the forest department cannot protect the pirate.
30. Mr. Abul Hares Hawladar Vill. Khanjakata, U.P. 2 no. Khanjakata, Thana - Sarankhola, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 70 maund - use of fuel	Strict security for the forest department cannot protect the pirate.
31. Mr. Jaker Mia Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department cannot protect the pirate.
32. Mr. Halim Torofdar Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Selective felling	Close Name of tree-total collection-use Goran Fuel - 60 maund - use of fuel	Strict security for the forest department cannot protect the pirate
33. Mr. Abul Kashem Khalifa Vill. Raenda, U.P. Raenda, Thana - Sarankhola, Dist. Bagerhat	Selective felling	Close Name of tree-total collection- useGoran Fuel - 60 maund - use of fuel	Strict security for the forest department cannot protect the pirate

Source: Field survey report

Forest Bawali of the Sundarban Forest

Appendix 6.2.10

**Comment of Forest Bawali about
Environmental Impact Assessment of Development Activities in the Sundarbans**

Question: A=Age (years), B=Education, C=Goalpata extraction period from November to March, D=Annual income (Tk.) from Goal pata cutting, E=Last five years income from Goal pata cutting.

Name & Address	Comments/Answers								
	A (years)	B	D	E					
				2006	07	08	09	10	Average
1. Mr. Abdul Guni Ali Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	25	Class five	Tk. 1200 0	14	15	14	16	14	14600
2. Mr. Abdul Aziz Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	55	Signature knowledg e	Tk. 1800 0	15	15	16	16	18	16000
3. Mr. Abdul Mannan Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	28	Class seven	Tk. 2000 0	15	17	18	20	20	18000
4. Mr. Harun Kha Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	50	Class five	Tk. 1800 0	12	14	16	16	18	15200
5. Mr. Mohammad Ali Sha Vill. Nolian, U.P. Suterkhali, Thana - Dacop, Dist. Khulna	55	Signature knowledg e	Tk. 2000 0	18	18	20	20	20	19200
6. Mr. Kuddus Ali Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Nolian, Dist. Khulna	38	Signature knowledg e	Tk. 1200 0	10	10	10	12	12	10800
7. Mr. Amzad Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	45	Class eight	Tk. 1600 0	12	12	15	15	16	14000
8. Mr. Mahbubur Rahman Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	28	Class eight	Tk. 1400 0	15	15	18	18	20	17200
9. Mr. Abdul Khaleq Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	60	Signature knowledg e	Tk. 1600 0	13	15	15	16	16	15000
10. Mr. Mojibar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Signature knowledg e	Tk. 1500 0	13	14	14	15	15	14200
11. Mr. Kalam Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Signature knowledg e	Tk. 1500 0	12	14	14	15	15	14000

12. Mr. Amzad Hossain Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	45	Signature knowledg e	Tk. 1400 0	12	10	13	14	14	12600
13. Mr. Moniruzzaman Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	30	Class seven	Tk. 1000 0	9	9	9	10	10	9400
14. Mr. Dhanipar Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	65	Signature knowledg e	Tk. 1400 0	12	13	13	14	14	13200
15. Mr. Daoud Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	50	Signature knowledg e	Tk. 2500 0	10	15	15	20	25	17000
16. Mr. Abdus Samad Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	55	Class five	Tk. 7000	6	6	6	7	7	6400
17. Mr. Mahabubur Rahman Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	35	Class seven	Tk. 1500 0	14	15	14	15	15	14600
18. Mr. Nazrul Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Class five	Tk. 7000	6	6	7	7	7	6600
19. Mr. Tulu Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	30	Signature knowledg e	Tk. 1800 0	15	16	16	18	18	16600
20. rd. Rostom Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 2500 0	20	20	20	24	25	21800
21. Mr. Harun Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class five	Tk. 3000 0	20	20	30	35	30	27000
22. Mr. Sukur Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 2000 0	15	18	18	20	20	18200
23. Md. Motaleb Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Signature knowledg e	Tk. 1800 0	14	15	15	18	18	16000
24. Mr. Dulal Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class five	Tk. 1600 0	12	15	15	16	16	14800
25. Mr. Mohar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class seven	Tk. 2200 0	18	20	20	22	22	20400
26. Mr. Gufur Shekh Vill. Joymoni, U.P. Chila,	40	Class four	Tk. 2000	15	18	18	20	20	18200

Thana - Mogla, Dist. Bagerhat			0						
27. Mr. Maleq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class five	Tk. 22000	16	18	21	22	22	19800
28. Mr. Isahaqe Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Signature knowledge	Tk. 21000	18	20	20	21	21	20000
29. Mr. Bareq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Signature knowledge	Tk. 20000	16	18	18	20	20	18400
30. Mr. Taher Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	60	Class four	Tk. 21000	16	18	18	21	21	18800
31. Mr. Toybur Jmadder Vill. Dhariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	40	Signature knowledge	Tk. 22000	13	14	14	15	15	14200
32. Mr. Khalil Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	35	Signature knowledge	Tk. 21000	18	18	20	20	20	19200
33. Mr. Shagir Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	30	S.S.C	Tk. 22000	13	15	14	16	18	15200
34. Mr. Mofazzal Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	40	Class five	Tk. 21000	12	14	15	17	19	15400
35. Mr. Ados Ali Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	55	Signature knowledge	Tk. 21000	14	15	16	18	22	17000

Source: Field survey report

Appendix 6.2.10
Comment of Forest Bawali about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: F = What are you doing in other session? If you work in other place, please specially the type of work and annual income. G = Do you want to see any change of present forest management and timber extraction systems? If yes, how? H = What are the suitable methods of tree harvesting? Of them, which method is favourable for regeneration of forest? I = How many types of tree are you harvesting? Please, specify the volume in percentage and use. J = What are the strength and weakness of present Sundarban Forest Management?

Name & Address	Comments / Answers				
	F	G	H	I	J
1. Mr. Abdul Guni Ali Vill. Burigoalini, U.P. Burigoalini, Thana - Samnagar, Dist. Satkhira.	Work has been done. Day labourer – Tk. 20,000 per year	Yes, wood will be cut	Selective felling	Band upto 2010 years	No answer
2. Mr. Abdul Aziz Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Cash fish – Tk. 20,000 per year	Yes wood cutting remained stopped, it is managed to be cut	Selective felling	Band upto 2010 years	Strict security of the forest department, cannot stop theft
3. Mr. Abdul Mannan Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Cash fish – Tk. 20,000 per year	Yes, sustainable management, wood cutting	Selective felling	Band upto 2010 years	Strict security of the forest department, cannot stop theft
4. Mr. Harun Kha Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Cash fish – Tk. 1500 per year	Yes, sustainable management, wood cutting	Selective felling	Band upto 2010 years	Strict security of the forest department, recommendation of the chairman and the members
5. Mr. Mohammad Ali Sha Vill. Nolian, U.P. Suterkhali, Thana - Dacop, Dist. Khulna	Cash fish and honey collection - Tk. 25,000 per year	Yes, wood cutting	Selective felling	Band upto 2010 years	Strict security of the forest department, political impact
6. Mr. Kuddus Ali Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Nolian, Dist. Khulna	Cash fish and kakra - Tk. 10,000 per year	Yes, wood cutting	Selective felling	Band upto 2010 years	Strict security of the forest department, cannot prevent the pirate
7. Mr. Amzad Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Cash fish, kakra and golpata cutting – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 200 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
8. Mr. Mahbubur Rahman Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
9. Mr. Abdul Khaleq Gazi Vill. Nolian, U.P. 5	Cash fish, kakra and honey	Yes, wood cutting remained stopped, it is	Selective felling	Band name of tree - total collection –	Strict security of the forest department,

no. Suterkhali, Thana - Dacop, Dist. Khulna	collection – Tk. 20,000 per year	managed to be cut		use Goran Fuel – 120 maund – use of fuel	and cannot protect the pirate
10. Mr. Mojibar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
11. Mr. Kalam Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, selection felling	Selective felling	Band name of tree - total collection – use Goran Fuel – 120 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
12. Mr. Amzad Hossain Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Cash fish, kakra and honey collection – Tk. 18,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
13. Mr. Moniruzzaman Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
14. Mr. Dhanipar Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Cash fish, kakra and honey collection – Tk. 18,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
15. Mr. Daoud Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Business of fish – Tk. 50,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
16. Mr. Abdus Samad Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Cash fish, sharmp culture and daily labourer – Tk. 30,000 per year	Bine fuel, Babla, Hetai and Baisut dry fuel	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
17. Mr. Mahabubur Rahman Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist.	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 100 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate

Satkhira.					
18. Mr. Nazrul Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, and kakra – Tk. 15,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 80 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
19. Mr. Tulu Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, and kakra – Tk. 16,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 80 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
20. Mr. Rostom Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Business of fish, and kakra – Tk. 30,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 180 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
21. Mr. Harun Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, and kakra – Tk. 30,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 80 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
22. Md. Sukur Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 25,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 70 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
23. Mr. Motaleb Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 22,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
24. Mr. Dulal Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and daily labourer – Tk. 22,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 60 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
25. Mr. Mohar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 60 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
26. Mr. Gufur Shekh Vill. Joymoni, U.P.	Cash fish, kakra and honey	Yes, wood cutting remained stopped, it is	Selective felling	Band name of tree - total collection –	Strict security of the forest department,

Chila, Thana - Mogla, Dist. Bagerhat	collection – Tk. 20,000 per year	managed to be cut		use Goran Fuel – 80 maund – use of fuel	and cannot protect the pirate
27. Mr. Maleq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 21,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 60 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
28. Mr. Isahaque Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish, kakra and honey collection – Tk. 25,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 60 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
29. Mr. Bareq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish and kakra – Tk. 20,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
30. Mr. Taher Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Cash fish and kakra – Tk. 20,000 per year	Yes, stop, wood cutting will be started, especially died trees	Selective felling	Band name of tree - total collection – use Goran Fuel – 70 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
31. Mr. Toybur Jmadder Vill. Dhariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Business of fish, and kakra – Tk. 25,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band upto 2010 years	Strict security of the forest department, cannot stop theft
32. Mr. Khalil Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Cash fish and kakra – Tk. 24,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
33. Mr. Shagir Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Cash fish, and kakra Tk. 22,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band upto 2010 years	Strict security of the forest department, and cannot protect the pirate
34. Mr. Mofazzal Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Cash fish and kakra – Tk. 23,000 per year	Yes, stop, wood cutting will be started, especially died trees	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, cannot stop theft

35. Mr. Ados Ali Munshi Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Cash fish, kakra and daily labourer – Tk. 24,000 per year	Yes, wood cutting remained stopped, it is managed to be cut	Selective felling	Band name of tree - total collection – use Goran Fuel – 50 maund – use of fuel	Strict security of the forest department, and cannot protect the pirate
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Source: Field survey report

Sundarban Forest Mawali

Appendix 6.2.11

Comment of Forest Mawali about Environmental Impact Assessment of Development Activities in the Sundarbans

Question: A = Age (years), B = Education, C = Annual income from honey collection? D = Last six years income in honey collection? E = Honey collection period: from March to May month?

Name & Address	Comments / Answers									
	A (Years)	B	C (Tk.)	D (Tk. In thousand)						Average
				2005	06	07	08	09	10	
1. Mr. Abdul Mojib Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	49	Signature knowledge	18,000	12	20	16	24	12	20	17333
2. Mr. Asgar Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	50	Signature knowledge	16,000	13	22	20	25	12	16	18000
3. Mr. Ruhul Amin Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	35	Signature knowledge	16,000	9	18	18	22	15	20	17000
4. Mr. Fazlu Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	28	Class five	24,000	10	16	19	23	15	24	17833
5. Mr. Mosharrof Hossain Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	30	Signature knowledge	20,000	9	10	19	20	13	20	15167
6. Mr. Abul Sarder Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	50	Signature knowledge	11,000	6	8	9	10	10	12	9167
7. Mr. Robiul Islam Vill. Datinakhali, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	28	Signature knowledge	12,000	7	10	10	12	12	12	10500

Satkhira										
8. Mr. Abdus Sattar Vill. Gabura, U.P. 9 no. Gabura, Thana - Samnogar, Dist. Satkhira.	30	Signature knowledg e	14,000	8	12	13	14	14	25	14333
9. Mr. Golzer Ali Vill. Domoria, U.P. Gabura, Thana - Samnogar, Dist. Satkhira.	55	Signature knowledg e	15,000	8	14	14	15	15	16	13667
10. Mr. Ruhul Amin Vill. Domoria, U.P. Gabura, Thana - Samnogar, Dist. Satkhira.	47	Signature knowledg e	18,000	12	12	12	13	14	18	13500
11. Mr. Amzad Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	45	Class five	16,000	9	14	14	15	16	16	14000
12. Mr. Mohammad Ali Saha Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	55	Class five	16,000	12	14	15	16	16	16	14833
13. Mr. Kuddus Ali Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	38	Class five	16,000	9	15	15	16	16	16	14500
14. Mr. Sirajul Islam Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	34	Signature knowledg e	18,000	9	16	16	17	18	18	15667
15. Mr. Marouf Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	36	Signature knowledg e	15,000	9	14	14	15	15	15	13667
16. Mr. Mannan Ali Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	35	Class five	15,000	9	14	14	15	15	15	13667
17. Mr. Shoheluddin Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	34	Signature knowledg e	14,000	9	13	13	14	14	14	12833
18. Mr. Anis Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	35	Signature knowledg e	14,000	9	13	13	14	14	14	12833
19. Mr. Mohasen Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	50	Signature knowledg e	16000	8	12	13	16	18	20	14500
20. Mr. Khaleq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla,	50	Signature knowledg e	18000	9	12	14	16	18	22	15167

Dist. Bagerhat										
21. Mr. Goni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class five	16000	7	10	10	12	14	16	11500
22. Mr. Bassu Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class five	18000	8	10	12	14	18	22	14000
23. Mr. Rofiquel Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class five	18000	9	12	13	13	18	20	14167
24. Mr. Saheb Ali Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class five	16000	10	14	14	18	22	24	17000
25. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Signature knowledg e	20000	9	12	12	14	16	18	14833
26. Mr. Harun Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	40	Class five	18000	8	12	16	20	20	22	16333
27. Mr. Motaleb Munshe Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	45	Signature knowledg e	16000	9	12	16	18	18	20	15500
28. Mr. Kabir Hawlader Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	42	Signature knowledg e	18000	12	16	16	20	22	24	18333
29. Mr. Ruhul Amin Vill. Uttar Rajapur, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	46	Class five	18000	12	14	16	20	24	24	18333
30. Mr. Jamal Fakir Vill. Uttar Tafalbari, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	40	Class five	20000	12	20	16	24	12	20	17333

Source: Field survey report

Appendix 6.2.11
Comment of Forest Mawali about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: F = What types security do you have in forest? G = What problems do you face during honey collection? H = How can improve the honey culture in Sundarban? I = What are doing in other session? Please specify the work and annual income? J = Do you need any permission from Forest Authority?

Name & Address	Comments / Answer				
	F	G	H	I	J
1. Mr. Abdul Mojid Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Various kinds	Fear of tiger, attack of pirate	Natural cause	Catch fish, Golpata, Goran Fuel, Tk. 1900	Yes
2. Mr. Asgar Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	By the people of the forest department	Attack of tiger snake and wild animals	No answer	Catch fish, Golpata, Goran Fuel, Tk. 20000	Yes
3. Mr. Ruhul Amin Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	By the people of the forest department	Fear of wild animals in the forest, attack of pirates, collecting money in illegal way	Natural cause	Catch fish, Golpata, Goran Fuel, Tk. 18000	Yes
4. Mr. Fazlu Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Get different kinds of securities	Yes	Yes	Catch fish, Golpata, Goran Fuel, Tk. 16000	Yes
5. Mr. Mosharrof Hossain Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Various kinds	Attack of tiger and honey bee	Yes	Catch fish, Golpata, Goran Fuel, Tk. 20000	Yes
6. Mr. Abul Sarder Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Various kinds	Problem of tiger, snake and pirate	If there are more flowered trees	Catch fish, Golpata, Goran Fuel, Tk. 20000	Yes
7. Mr. Robiul Islam Vill. Datinakhali, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	Get different security by the forest department	Problem of tiger, snake and pirate	If there are more flowered trees	Catch fish, Golpata, Kakra Tk. 20000	Yes
8. Mr. Abdus Sattar Vill. Gabura, U.P. 9 no. Gabura, Thana - Samnagar, Dist. Satkhira.	Various kinds	Problem of tiger, snake and pirate	If there are more flowered trees	Catch fish, Golpata, Kakra Tk. 25000	Yes
9. Mr. Golzer Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist.	Get different security by the forest department	Problem of tiger, snake and pirate	By Mawali training	Catch fish, Golpata, Kakra Tk. 20000	Yes

Satkhira.					
10. Mr. Ruhul Amin Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	Various kinds	Problem of tiger and pirate	No answer	Catch fish, Golpata, Goran Fuel, Tk. 15000	Yes
11. Mr. Amzad Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Various kinds	Problem of tiger snake and pirate	By encouraging the Mawali	Catch fish, Golpata, Kakra, Tk. 20000	Yes
12. Mohammad Ali Saha Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Get different kinds of securities	Problem of tiger, snake and pirate	By Mawali training	Catch fish, Golpata, Kakra Tk. 20000	Yes
13. Mr. Kuddus Ali Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Get different kinds of securities	Problem of tiger, snake and pirate	By Mawali training	Catch fish, Golpata, Kakra Tk. 20000	Yes
14. Mr. Sirajul Islam Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Get different kinds of securities	Problem of tiger, snake and pirate	If there produced more	Catch fish, Golpata, Kakra Tk. 20000	Yes
15. Mr. Marouf Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Various kinds	Problem of tiger, snake and pirate	By Mawali training	Catch fish, Golpata, Kakra Tk. 22000	Yes
16. Mr. Mannan Ali Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Get different kinds of securities	It will be solved / faced the problem of pirates, snake, honey bee, and tiger	By Mawali training	Catch fish, Golpata, Kakra Tk. 20000	Yes
17. Mr. Shoheluddin Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Various kinds	It will be solved / faced the problem of pirates, snake, honey bee, and tiger	By Mawali training	Catch fish, Golpata, Kakra Tk. 20000	Yes
18. Mr. Anis Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	Various kinds	It will be solved / faced the problem of pirates, snake, honey bee, and tiger	By Mawali training	Catch fish, Golpata, Kakra Tk. 18000	Yes
19. Mr. Mohasen Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	By the people of the forest department	Attack of tiger snake and wild animals	Natural cause	Catch fish, Golpata, Goran Fuel, Tk. 24000	Yes
20. Mr. Khaleq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Various kinds	Problem of tiger, snake and pirate	By Mawali training	Catch fish, Golpata, Kakra Tk. 25000	Yes
21. Mr. Goni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla,	By the people of the forest	Attack of tiger snake and wild animals	By Mawali training	Catch fish, Golpata, Kakra Tk.	Yes

Dist. Bagerhat	department			22000	
22. Mr. Bassu Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	By the people of the forest department	Attack of tiger snake and wild animals	If there are more flowered trees	Catch fish, Golpata, Goran Fuel, Tk. 25000	Yes
23. Mr. Rofiquel Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Various kinds	Problem of tiger, snake and pirate		Catch fish, Golpata, Kakra Tk. 24000	Yes
24. Mr. Saheb Ali Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	Get different kinds of securities	Problem of tiger, snake and pirate	Natural cause	Catch fish, Golpata, Kakra Tk. 20000	Yes
25. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	By the people of the forest department	Attack of tiger snake and wild animals	Natural cause	Catch fish, Golpata, Goran Fuel, Tk. 24000	Yes
26. Mr. Harun Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Get different kinds of securities	It will be solved / faced the problem of pirates, snake, honey bee, and tiger	By Mawali training	Catch fish, Golpata, Kakra Tk. 22000	Yes
27. Mr. Motaleb Munshe Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Various kinds	It will be solved / faced the problem of pirates, snake, honey bee, and tiger	Natural cause	Catch fish, Golpata, Kakra Tk. 24000	Yes
28. Mr. Kabir Hawlader Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Various kinds	Attack of tiger snake and wild animals	By Mawali training	Catch fish, Golpata, Goran Fuel, Tk. 22000	Yes
29. Mr. Ruhul Amin Vill. Uttar Rajapur, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Get different kinds of securities	Problem of tiger snake and pirate	Natural cause	Catch fish, Golpata, Kakra Tk. 22000	Yes
30. Mr. Jamal Fakir Vill. Uttar Tafalbari, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	Various kinds	Problem of tiger snake and pirate	If there are more flowered trees	Catch fish, Golpata, Kakra Tk. 20000	Yes

Source: Field survey report

Appendix 6.2.11

**Comment of Forest Mawali about
Environmental Impact Assessment of Development Activities in the Sundarbans**

Question: K = How much do you pay for one season? L = What types of plants, animals and birds are decreasing? Why? M = How can overcome this problem? N = What are the strength and weakness of present Sundarban Forest Management System?

Name & Address	Comments / Answer			
	K	L	M	N
1. Mr. Abdul Mojid Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	For honey Tk. 3000, for wax Tk. 2000	The deer and bird become reduce	Crisis of treatment, arms and proper environment	No answer
2. Mr. Asgar Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	No	No	No answer
3. Mr. Ruhul Amin Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	Yes	By supervision	No answer
4. Mr. Fazlu Ali Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	No	No answer	No answer
5. Mr. Mosharrof Hossain Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	No	No answer	No answer
6. Mr. Abul Sarder Vill. Burigoalini, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
7. Mr. Robiul Islam Vill. Datinakhali, U.O, Burigoalini, Thana - Samnagar, Dist. Satkhira	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
8. Mr. Abdus Sattar Vill. Gabura, U.P. 9 no. Gabura, Thana - Samnagar, Dist. Satkhira.	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
9. Mr. Golzer Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist.	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate

Satkhira.				
10. Mr. Ruhul Amin Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	For honey Tk. 3000, for wax Tk. 2000	Reduce	No answer	Provide good management
11. Mr. Amzad Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
12. Mr. Mohammad Ali Saha Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
13. Mr. Kuddus Ali Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
14. Mr. Sirajul Islam Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
15. Mr. Marouf Hossain Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
16. Mr. Mannan Ali Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
17. Mr. Shoheluddin Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
18. Md. Anis Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
19. Mr. Mohasen Gazi Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	For honey Tk. 3000, for wax Tk. 2000	The deer and bird become reduce	Crisis of treatment, arms and proper environment	Provide good management
20. Mr. Khaleq Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	Crisis of treatment, arms and proper environment	Intensive supervision of forest department cannot protect the pirate
21. Mr. Goni Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	By supervision	Provide good management
22. Mr. Bassu Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla,	For honey Tk. 3000, for wax Tk. 2000	The deer and bird become	By supervision	Provide good management

<i>Dist. Bagerhat</i>		<i>reduce</i>		
23. Mr. Rofiqul Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	No answer	No answer
24. Mr. Saheb Ali Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	Crisis of treatment, arms and proper environment	Intensive supervision of forest department cannot protect the pirate
25. Mr. Rosul Kha Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Intensive supervision of forest department cannot protect the pirate
26. Mr. Harun Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	By supervision	No answer
27. Mr. Motaleb Munshe Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	No answer	Provide good management
28. Mr. Kabir Hawlder Vill. Sarankhola, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	The deer and bird become reduce	Crisis of treatment, arms and proper environment	Intensive supervision of forest department cannot protect the pirate
29. Mr. Ruhul Amin Vill. Uttar Rajapur, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	No answer	No answer
30. Mr. Jamal Fakir Vill. Uttar Tafari, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	For honey Tk. 3000, for wax Tk. 2000	No	By supervision	Provide good management

Source: Field survey report

Local People of the Sundarban Forest

Appendix 6.2.12

Comment of the Local People about
Environmental Impact Assessment of Development Activities in the Sundarbans

Question: A = Age (years), B = Education, C = Annual income, D = Do you want to protect forest and animals? How? E = What are the main causes of forest cutting and animal hunting? F = How can overcome these? Please give suggestions?

Name & Address	Comments / Answer					
	A (years)	B	C	D	E	F
1. Mr. Mizanur Rahman Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	30	Class five	Tk. 80000	Yes, 100 percent	(1) Inadequate law, (2) Lack of implementation of law, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	Strict law
2. Mr. Sofiquel Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	40	Class seven	Tk. 90000	Yes	(1) Inadequate forest guards	It will be better if there are forest guard
3. Mr. Abdul Khaleq Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	65	Signature knowledge	Tk. 80000	Yes	(1) Inadequate forest guards	Strict security, other job
4. Mr. Amzad Mollah Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	55	Signature knowledge	Tk. 90000	Yes, 100 percent	(1) Inadequate law, (2) Influential political person (3) Inadequate forest guards, (4) Corruption of UP member and chairman	Strict law
5. Mr. Lutfar Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	50	Class seven	Tk. 80000	Yes, 100 percent	(1) Lack of implementation of law, (2) Inadequate forest guards, (3) Corruption of UP member and chairman	Growth of population
6. Mr. Ismail Hossain Vill. Datina, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	40	S.S.C. pass	Tk. 90000	Yes, 100 percent	(1) Inadequate law, (2) Influential political person (3) Corruption of UP member and chairman	Strict law
7. Mr. Mostofa Vill. Datina, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	30	Class seven	Tk. 80000	Yes, all	(1) Inadequate communication, (2) Influential political person, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	It will be better if there are forest guard
8. Mr. Motaleb Hossain Vill. Datina, U,P,	40	S.S.C. pass	Tk. 90000	Yes, all	(1) Inadequate communication, (2) Influential political	By strict supervision

Burigoalini, Thana - Samnagar, Dist. Satkhira					person, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	
9. Mr. Afsar Ali Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	50	Class six	Tk. 80000	Yes, 100 percent	(1) Inadequate communication, (2) Influential political person, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	By strict supervision
10. Mr. Abdur Rahim Vill. Domoria, U.P. Gabura, Thana - Samnagar, Dist. Satkhira.	35	Class seven	Tk. 90000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By make conscious
11. Mr. Ibrahim Mollah Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	27	Class eight	Tk. 80000	Yes, 100 percent	(1) Lack of implementation of law, (2) Lack of implementation of law, (3) Inadequate communication, (4) Influential political person, (5) Inadequate forest guards, (6) Corruption of UP member and chairman	By strict supervision
12. Mr. Gopal Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	42	Class seven	Tk. 10000 0	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	It is necessary for the forest department to have a separate court
13. Mr. Gour Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	35	B.A. pass	Tk. 12000 0	Yes, all	(1) Inadequate law, (2) Lack of implementation of law, (3) Inadequate communication, (4) Influential political person, (5) Inadequate forest guards, (6) Corruption of UP member and chairman	By supervision
14. Mr. Nuruzzaman Shekh Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	27	Class seven	Tk. 10000 0	Yes, all	(1) Inadequate law, (2) Inadequate communication, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	By stick law
15. Mr. Habibur Rahman Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	38	Class eight	Tk. 70000	Yes, all	(1) Lack of implementation law, (2) Inadequate communication, (3) Inadequate forest guards, (4) Corruption of UP	By stick law

					member and chairman	
16. Mr. Roni Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	25	S.S.C. pass	Tk. 80000	Yes, all	(1) Lack of implementation law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By make conscious
17. Mr. Alam Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class eight	Tk. 60000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
18. Mr. Aynal Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 80000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
19. Mr. Kamal Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	38	Class five	Tk. 80000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
20. Mr. Moker Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Signatur e knowled ge	Tk. 10000 0	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
21. Mr. Azahar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 12000 0	Yes, all	(1) Inadequate law, (2) Lack of implementation of law, (3) Inadequate communication, (4) Influential political person, (5) Inadequate forest guards, (6) Corruption of UP member and chairman	By stick law & supervision
22. Mr. Toyub Ali Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	Class five	Tk. 80000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political	By stick law

					person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	
23. Mr. Zohorul Islam Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	40	Class eight	Tk. 100000	Yes, all	(1) Inadequate communication, (2) Influential political person, (3) Inadequate forest guards, (4) Corruption of UP member and chairman	By stick law
24. Mr. Akbar Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	S.S.C. pass	90000	Yes, 100 percent		
25. Mr. Jobbar Bepari Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class eight	Tk. 80000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
26. Mr. Kudus Matabbar Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	Class seven	Tk. 100000	Yes, all	Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5)	By stick law
27. Mr. Lutfar Hawlader Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	45	S.S.C. pass	Tk. 80000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
28. Mr. Rofiq Matabbar Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50	Class five	Tk. 90000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By stick law
29. Mr. Moslem Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	55	Class five	Tk. 100000	Yes	(1) Inadequate communication	Natural causes
30. Mr. Nasir Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	35	S.S.C. pass	Tk. 12000	Yes	(1) Inadequate law, (2) Lack of implementation of law, (3) Inadequate communication, (4) Influential political	By stick law

					person, (5) Inadequate forest guards, (6) Corruption of UP member and chairman	
31. Mr. Kashem Khalifa Vill. Raiynda, U.P. Raiynda, Thana - Sarankhola, Dist. Bagerhat	50	S.S.C. pass	Tk. 120000	Yes, all	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	Natural causes
32. Mr. Panna Akon Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	60	Signature knowledge	Tk. 100000	Yes, 100 percent	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	Natural causes
33. Mr. Jakir Munshi Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	35	Class nine	Tk. 130000	Yes, all	1) Inadequate law, (2) Influential political person (3) Corruption of UP member and chairman	By stick law
34. Mr. Mojibor Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	45	S.S.C. pass	Tk. 110000	Yes, all	1) Inadequate law, (2) Influential political person (3) Corruption of UP member and chairman	By stick law
35. Mr. Tuhin Boyati Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	40	S.S.C. pass	Tk. 120000	Yes, 100 percent	(1) Lack of implementation of law, (2) Inadequate communication, (3) Influential political person, (4) Inadequate forest guards, (5) Corruption of UP member and chairman	By make conscious

Source: Field survey report

Appendix 6.2.12

Comment of the Local People about

Environmental Impact Assessment of Development Activities in the Sundarbans

Question: G = Do you want to participate in plantation programme in the degraded forest area? How? What sharing do you like? H = When do you want to get your sharing? After 10 years, after 15 years, after 20 years, I = Do you actively protect the new forest under sharing system? J = What is your opinion about this sharing? Will it help in reforestation? K = What are the strength and weakness of present forest management? Please specify?

Name & Address	Comments / Answer				
	G	H (years)	I	J	K
1. Mr. Asgar Ali Vill. Burigoalini, U.P., Burigoalini, Thana - Samnagar, Dist.	50%	15	Various kinds	Yes	No answer

Satkhira					
2. Mr. Sofiqul Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	No answer	No answer	No answer	Yes, it need plant more tree	No answer
3. Md. Abdul Khaleq Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	50%	10	Made guard, strict laws	Yes	The function runs by rules, weak, cut in illegal ways, education
4. Mr. Amzad Mollah Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	50%	15	It is need plant tree and supervise them	Yes	Strict security of the forest department and wood stealing
5. Md. Lutfar Ali Vill. Burigoalini, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	50%	15	No	Yes	Strict security of the forest department
6. Mr. Ismail Hossain Vill. Datina, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	Local people 60% Govt. 40%	15	No answer	Yes	Strict security of the forest department and wood stealing
7. Mr. Mostofa Vill. Datina, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	50%	15	No answer	Yes	Intensive supervision of forest department can not protect the pirate
8. Mr. Motaleb Hossain Vill. Datina, U,P, Burigoalini, Thana - Samnogar, Dist. Satkhira	Local people 60% Govt. 40%	15	By take care of the forest	It need plant more tree	Intensive supervision of forest department can not protect the pirate
9. Mr. Afsar Ali Vill. Domoria, U.P. Gabura, Thana - Samnogar, Dist. Satkhira.	50%	15	New plantation	Yes	Intensive supervision of forest department can not protect the pirate
10. Mr. Abdur Rahim Vill. Domoria, U.P. Gabura, Thana - Samnogar, Dist. Satkhira.	50%	15	New plantation	Yes	Intensive supervision of forest department can not protect the pirate
11. Mr. Ibrahim Mollah Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	50%	15	New plantation	Yes	Intensive supervision of forest department can not protect the pirate
12. Mr. Gopal Sarder Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	50%	15	We can help in many ways	Yes	Intensive supervision of forest department can not protect the pirate
13. Mr. Gour	50%	15	I can help in	Yes	Intensive

Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna			various means		supervision of forest department can not protect the pirate
14. Mr. Nuruzzaman Shekh Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	50%	15	Good	Yes	Intensive supervision of forest department can not protect the pirate
15. Mr. Habibur Rahman Vill. Nolian, U.P. 5 no. Suterkhali, Thana - Dacop, Dist. Khulna	50%	15	Another way	Yes	Intensive supervision of forest department can not protect the pirate
16. Md. Roni Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	No answer	Yes	Intensive supervision of forest department can not protect the pirate
17. Mr. Alam Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	No answer	Yes	Intensive supervision of forest department can not protect the pirate
18. Mr. Aynal Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	No answer	Yes	Intensive supervision of forest department can not protect the pirate
19. Mr. Kamal Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	No answer	Yes	Intensive supervision of forest department can not protect the pirate
20. Mr. Moker Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	Stop stealing and prevent the pirate	Yes	Intensive supervision of forest department can not protect the pirate
21. Mr. Azahar Shekh Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	By take care of the forest and stop stealing	Yes	Intensive supervision of forest department can not protect the pirate
22. Mr. Toyub Ali Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	By take care of the forest	Yes	Intensive supervision of forest department can not protect the pirate
23. Mr. Zohorul Islam Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	By take care of the forest	Yes	Intensive supervision of forest department can not protect the pirate
24. Mr. Akbar Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	By take care of the forest	Yes	Intensive supervision of forest department can not protect the pirate
25. Md. Jobbar Bepari	50%	15	Stop stealing	Yes	Intensive

Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat					supervision of forest department can not protect the pirate
26. Mr. Kudus Matabbar Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	Stop stealing	Yes	Intensive supervision of forest department can not protect the pirate
27. Mr. Lutfar Hawlader Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	Stop stealing and protect pirate	Yes	Intensive supervision of forest department can not protect the pirate
28. Mr. Rofiq Matabbar Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	Stop stealing	Yes	Intensive supervision of forest department can not protect the pirate
29. Mr. Moslem Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	No answer	No answer	Intensive supervision of forest department can not protect the pirate
30. Mr. Nasir Gazi Vill. Joymoni, U.P. Chila, Thana - Mogla, Dist. Bagerhat	50%	15	Stop stealing	Yes	Intensive supervision of forest department can not protect the pirate
31. Mr. Kashem Khalifa Vill. Raiynda, U.P. Raiynda, Thana - Sarankhola, Dist. Bagerhat	50%	10	By take care of the forest and stop stealing	Yes	Strict security of the forest department and wood stealing
32. Mr. Panna Akon Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	50%	15	Stop stealing	Yes	Intensive supervision of forest department can not protect the pirate
33. Mr. Jakir Munshi Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	50%	15	I can help in various means	Yes	Intensive supervision of forest department can not protect the pirate
34. Mr. Mojibor Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	50%	10	By take care of the forest and stop stealing	Yes	Strict security of the forest department and wood stealing
35. Mr. Tuhin Boyati Vill. Ghariakhali, U.P. Southkhali, Thaka - Sarankhola, Dist. Bagerhat	50%	15	I can help in various means	Yes	Intensive supervision of forest department can not protect the pirate

Source: Field survey report

28/2/17