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Tanguar Haor Management Plan Framework and Guidelines

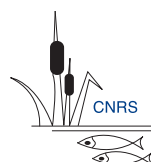


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Tanguar Haor Management Plan Framework and Guidelines

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Foreword

It is indeed a great achievement for the Community Based Sustainable Management of Tanguar Haor (CBSMTH) Project administered by the Ministry of Environment and Forests, Government of Bangladesh to be able to prepare and publish the Tanguar Haor Management Plan Framework and Guidelines (THMPFG). THMPFG has been prepared to address the challenges faced by the *haor* community in protecting its valuable biodiversity resources along with maintaining and sustaining their life and livelihoods. The Government of Bangladesh and the Ministry of Environment and Forests remain highly committed to promote and support community based management in Tanguar Haor.

Tanguar Haor is the country's leading internationally significant freshwater wetland which was designated as the Ramsar site in 2000. The Government of Bangladesh classified it as an 'Ecologically Critical Area' to highlight its ecological importance and to monitor its environmental quality in 1999. Tanguar Haor holds outstanding values not only for supporting livelihoods of a large community living in and around the *haor*, but also for being a unique habitat of migratory and resident waterfowls along with supporting high fish diversity and freshwater evergreen swamp forest.

I strongly believe this document would serve as a milestone in pulling together various resources and guidelines with a view to helping the local community to manage the resources of Tanguar Haor sustainably.

The THMPFG is a living document. It may be updated time to time keeping pace with the emerging needs of the changing time. The document has been prepared through a long consultation process and based on the experiences from the CBSMTH Project. The data and information used to prepare the document are mainly collected from different published reports, previous management plans and expert consultations. The ministries/divisions, departments/agencies, concerned research organizations, academics from the universities, civil society organizations, development partners and practitioners, local government representatives, communities, media and other relevant stakeholder were involved in different phases of the process. I would like to thank all stakeholders who were directly and indirectly involved and contributed to finalization of the document.

Dr. Kamal Uddin Ahmed
Secretary
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Preface

Wetland ecosystems are of great importance to Bangladesh due to the critical economic and ecological role they play in sustaining life and livelihoods in the country. The north-east region of Bangladesh, also known as the *haor* basin, is considered a unique ecosystem, and each of the *haor* basin wetlands is a key element of a complex hydrological, biological and ecological system, supporting a significant assemblage of rare and vulnerable species of plants and animals, including endemic species. The whole area supports large numbers of migratory waterbirds arriving from northern Palearctic regions upon the onset of winter.

Tanguar Haor is a unique wetland ecosystem with natural fresh water covering 9,727 hectares of area, and is located at the north-eastern district of Sunamganj close to the Indian border in Meghalaya hill region. This complex ecosystem, known for its many species of fish and as a staging area for at least half a million of migratory birds, supports lives of about 60,000 inhabitants in 88 villages around its periphery. Considering the national significance of Tanguar Haor as well as the threats of depletion of its natural resources, the Government of Bangladesh declared this wetland as an Ecologically Critical Areas (ECA) in 1999. In 2000, Tanguar Haor became the country's second Ramsar site - wetland of international importance.

Government's commitment to conserve the pristine resources of Tanguar Haor was demonstrated earlier in the 1990s, particularly with the first ever conservation project namely 'National Conservation Strategy Implementation Project-1' (NCSIP-1) of the Ministry of Environment and Forests (MoEF). Under the NCSIP-1, a pilot project was initiated by the MoEF in Tanguar Haor, and subsequently, a comprehensive management plan was developed with the technical assistance from IUCN Bangladesh Country Office in 2000, based on the wise-use principles of the Ramsar Convention.

Due to the status of Tanguar Haor as an ECA and Ramsar site, the Government of Bangladesh had been keen to put in place a community based management system there. It was the Ministry of Environment and Forests which took such an initiative eventually. The Swiss Agency for Development and Cooperation (SDC) supported that initiative, and with the technical support from IUCN Bangladesh Country Office, a project entitled 'Community Based Sustainable Management of Tanguar Haor' (CBSMTH) is being implemented since 2006.

Under the CBSMTH project, IUCN Bangladesh Country Office has put an endeavor to publish the 'Tanguar Haor Management Plan Framework and Guidelines' (THMPFG). This framework book is intended to provide a broad-based overview of the resource management and planning context of Tanguar Haor. This framework document is also expected to serve as a guiding point of reference for further context-specific, locally grounded planning and management decisions. The THMPFG will set an outline for updating the existing Tanguar Haor Management Plan in future. We offer our heartfelt thanks to all associated in producing the framework document. We believe that this book will get its desired outputs in the long run.

Ishtiaq Uddin Ahmad
Country Representative
IUCN Bangladesh

Acknowledgements

This book documents the results and insights of a compilation, review and collation exercise towards developing and formulating a planning framework including resource management guidelines for the Tanguar Haor. The composition of the review team and the roles of the members are mentioned elsewhere. The exercise spanned over some two years, and it has been an intense experience. I consider myself privileged to be able to lead and work with a group of diligent and committed professionals.

Many people and institutions have contributed to this work. They are too many to be individually mentioned in this brief note; but I hope each of them would accept my thanks, as they know who they are!

The analysis presented here primarily builds on the work of Giesen *et al.* (2000), complemented by several updated sectoral studies (see bibliography). Additionally (i) a series of stakeholder consultations (see 'the methodology'), (ii) short field visits, (iii) an extensive review of secondary literature and official documents, and (iv) liberal sharing of experience and expertise of the Tanguar Haor project staff have informed the process of developing this document. The contents (including technical and linguistic accuracy) of the specialized (sectoral) reports (mainly presented in Chapters 2 and 5) remain the responsibility of the respective authors and/or institutions. Beyond these sectoral studies, the views and analyses (including the limitations) contained especially in Chapters 1, 3, 4 and 6 remain our responsibility. It should be noted however, that the views and opinions expressed here (including any suggested 'model' or course of action) are not meant to be infallible 'blueprints'; these are open to debates, discussions, and scrutiny. This Framework document is essentially indicative, and intended to provide a broad-based overview of the resource management and planning context of Tanguar Haor, and serve as a guiding point of reference for further context-specific, locally grounded planning and management decisions.

We also wish to record our appreciation for the Ministry of Environment and Forests and the Deputy Commissioner's office in Sunamganj for their policy and functional support to the project and its activities. We thank the IUCN-Bangladesh senior management and the Tanguar Haor project staff and partner organizations for their effectively backstopping this exercise. The contribution of Swiss Agency for Development and Cooperation (SDC) in supporting this publication is gratefully acknowledged. The community at Tanguar Haor including the respondent 'project beneficiaries', who so kindly spared some of their precious time and ideas, deserve a special word of thanks.

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Table of Contents

Acronyms	xii
Chapter 1: Setting the Scene	1
1.1 Introducing Tanguar Haor	2
1.2 Background to Management Planning for Tanguar Haor: A Timeline	3
1.3 Summary Review of Past Literature	5
1.4 Methodological Considerations	9
1.4.1 The Management Goal and Operational Objectives Pursued	9
1.4.2 The Approach	9
1.5 The Parameters and Structure of this Framework	10
1.5.1 Rationale for the Framework	10
1.5.2 The Composition and Limitation of the Framework Document	11
Chapter 2: The Resource Profile	13
2.1 Natural Resource Settings	14
2.1.1 Geological History	14
2.1.2 Geomorphology	14
2.1.3 Topography	15
2.1.4 Soil	15
2.1.5 Geographical Location	16
2.1.6 Habitation	16
2.1.7 Climatic Features	18
2.1.8 Diversity of Flora	22
2.1.9 Wetland Vegetation Analysis Based on Habitat Classification	23
2.1.10 Cultivated Land Vegetation	27
2.1.11 Homestead Vegetation	27
2.1.12 Diversity of Phytoplankton	27
2.1.13 Diversity of Fauna	28
2.1.14 Fisheries Resources	28
2.1.15 Present Status of Wildlife	29
2.1.16 Diversity of Bird Population	32
2.1.17 Waterfowl Census in Tanguar Haor (1992-2012)	33
2.2 Community Development Settings	34
2.2.1 Introduction	34
2.2.2 Human Habitation and Settlement	34
2.2.3 Land Tenure	34
2.2.4 Land Use	35
2.2.5 Infrastructure and Social Development Services	35
2.2.6 Local Economy and Livelihood	36
2.2.7 Ecotourism and Recreation	38
2.2.8 Research and Education	38

2.3 An Indicative Economic Valuation of Tanguar Haor	39
2.3.1 Valuation of Ecosystem Services of Wetlands	39
2.3.2 Uniqueness of Tanguar Haor	41
2.3.3 Socio-Economic Conditions	41
2.3.4 Ecosystem Services Provided by Tanguar Haor	41
2.3.5 Value of Tanguar Haor Ecosystem Services	43
2.3.6 Present Value of Ecosystem Services of Tanguar Haor	45
Chapter 3: A Strategic Review of the Challenges and Risks	47
3.1 The Key Challenges and Trends in Natural Resource Co-Management	48
3.2 Recapitulation of the Findings and Observations from Past Studies	49
3.3 Summary of the Clusters of the Current Challenges	51
3.4 The Problem Trees	52
Chapter 4: The Proposed Intervention: Basic Scruples, Structure, and Logic Model	57
4.1 The Principles and Scruples for Improved Community Focused Wetlands Governance	58
4.2 Programme Action Logic: The Logic Model	59
4.3 Brief Component Description	64
Chapter 5: Selected Component Guidelines for Sustainable Resource Management	67
5.1 Guidelines on Components concerning Natural Resource Use and Management	68
5.1.1 Fisheries: Restoration and Sustainable Harvesting	68
5.1.2 Forests and Reedlands: Restoration, Management and Training	76
5.1.3 Biodiversity: Monitoring Protocol	85
5.1.4 Water Regime Management	96
5.2 Guidelines on Components Concerning Community Development	108
5.2.1 Governance	108
5.2.2 Community Based Organisation and Community Mobilisation	117
5.2.3 Income Generation and Livelihood	120
5.2.4 Resource Mobilisation and Financial Management	126
5.2.5 Training and Capacity Development	129
5.2.6 Disaster Management Guidelines	132
5.2.7 Gender Management Guidelines	139
Chapter 6: Justification for Implementation of Tanguar Haor Management Plan Framework and Guidelines	147
6.1 Socio-Economic Justification: A Focus on Poverty Alleviation and Social Equity	148
6.2 Conservation Value and Benefits to Global Biodiversity	148
6.2.1 Current Situation and Future Direction under THMPFG	149
6.3 Legal Obligations	149
6.3.1 Ecologically Critical Area	150
6.3.2 Obligations to International Conventions	150
6.4 Potential for Replication	150
6.4.1 Essential Criteria	150
6.4.2 Priority Sites for Replication	151
6.4.3 Financing of Replication Efforts	151

Bibliography	152
Appendexes	157
Appendix 1: Selected Proceedings of Consultative Meetings	157
Appendix 2: Training Manual on Sustainable Yield and Fisheries Management in Tanguar Haor	160
Appendix 3: Suggested Training Programme for the Community on Assessment and Monitoring of Reed and Tree Resources	173
Appendix 4: Tentative Drafts of the Proposed Co-management Structure, Act and Rules Concerning a Possible Tanguar Haor Authority	184

List of Tables

Table 1: Consultation meetings conducted to prepare THMPF	10
Table 2.1: Soil texture of the Tanguar Haor	15
Table 2.2: Status of land ownership and its distribution in Tanguar Haor area	17
Table 2.3: Rainfall, evaporation and temperature stations with periods of records	19
Table 2.4: Average normal rainfall (mm) and number of normal rainy days at Sylhet and Srimangal	19
Table 2.5: Value of provisional services from the Tanguar Haor	44
Table 2.6: Value of supporting, regulating and cultural services of Tanguar Haor	44
Table 2.7: Value of major products derived from Tanguar Haor (an approximation)	45
Table 3.1: Challenges for sustainable natural resources management	49
Table 3.2: Governance challenges for Tanguar Haor	50
Table 4.1: Suggested guiding principles and scruples for improved community focused NR Governance in Bangladesh	58
Table 4.2: The theory of change concerning component 1: stakeholder capacity and community livelihood	61
Table 4.3: The theory of change concerning component 2: comprehensive conservation management system	62
Table 4.4: The theory of change concerning component 3: sustainable and inclusive co-management institutions	63
Table 5.1: GPS Sampling point	77
Table 5.2 : Selected field observations on vegetation	78
Table 5.3 : Community based floral species monitoring matrix	86
Table 5.4: Bird species monitoring matrix	88
Table 5.5 : Fish species monitoring matrix	90
Table 5.6: Plant monitoring information	91
Table 5.7: Wildlife monitoring information	93
Table 5.8: Water quality parameters	99
Table 5.9: Frequency and probability of disasters (IUCN Study, 2012)	133
Table 5.10 : Challenges posed by disasters in Tanguar Haor (Source: IUCN, 2012)	136
Table 5.11 : Gender segregated reproductive activities	140
Table 5.12: Gender segregated productive activities at Tanguar Haor	141
Table 5.13: Gender segregated community activities at Tanguar Haor	143
Table 5.14: Gender segregated household activities	144
Table II a.: Tentative monitoring plan	171

List of Figures

Figure 2.1: Digital Elevation Model Map of Tanguar Haor	14
Figure 2.2: Soil Texture Map of Tanguar Haor (Source: CEGIS database 2012)	15
Figure 2.3: Map of Tanguar Haor	17
Figure 2.4 (a, b & c): Monthly, Maximum and Average Total Rainfall (mm) at Laurerghar (CL 49), Sunamganj (CL 127) and at Mohanganj (CL 121) Stations from 1980 to 2008	20
Figure 2.5 (a, b): Monthly Evaporation (mm) at Sunamganj (CL 127) and Netrokona (CL 123) Station from 2007 to 2010	20, 21

Figure 2.6: Maximum and Minimum Temperature (°C) at Sylhet Station from 1981 to 2010	21
Figure 2.7: Diversity Index of Birds at Tanguar Haor	32
Figure 2.8: Waterfowl Census in Tanguar Haor (1992-2012)	33
Figure 2.9: Wetland Resource Values and Associated Valuation Techniques	40
Figure 2.10: Ecosystem Services Provided by Tanguar Haor	42
Figure 2.11: Net Present Value of Ecosystem Services of Tanguar Haor	45
Figure 4.1: Summary Structure of the Logic Model	60
Figure 5.1: A Schematic View of an Advanced Fish Sanctuary Proposed for Rowa Beel	71
Figure 5.2: Swamp Forest Demo Block Situated at the Shore of the Advanced Fish Sanctuary (Source: Fish Sanctuary Report of 2013)	72
Figure 5.3: Seed Collection Techniques from Hijal Tree	83
Figure 5.4: Suggested Plantation Design	84
Figure 5.5: River System of Tanguar Haor	96
Figure 5.6: Rainfall Hydrograph	97
Figure 5.7: Temperature Analysis	98
Figure 5.8: Observed Water Level for Three Gauge Locations	99
Figure 5.9: Highest Water Depth of the Tanguar Haor for Year 2013	100
Figure 5.10: Locations of the Permanent Water Bodies in the Tanguar Haor	101
Figure 5.11: Flood Depth Map of the Study Area	102
Figure 5.12: Observed Water Level for the Three Gauge Locations	106
Figure 5.13: Institutional Structure	110
Figure 5.14: Structure of Three Tier Democratic Leadership at Community Level	111
Figure II a.: Sketch Map Showing Proposed Monitoring Sites by the Community	172

Acronyms

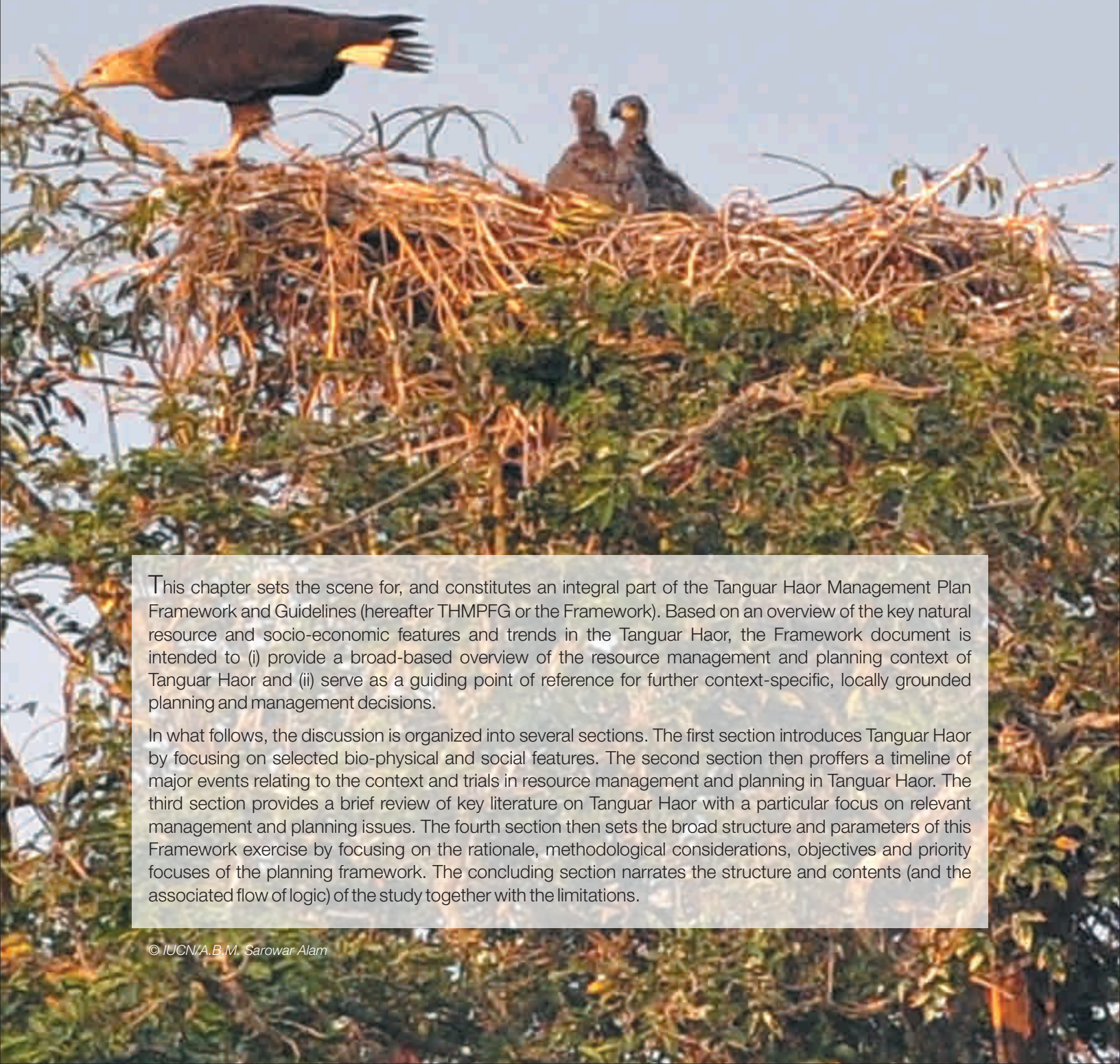
ADB	Asian Development Bank
ADC	Additional Deputy Commissioner
AIG	Alternative Income Generation
AWC	Asian Waterfowl Census
Bbc	Bangladesh bird club
BCAS	Bangladesh Centre for Advanced Studies
BCC	Biodiversity Conservation Cell
BMD	Bangladesh Meteorological Department
BNH	Bangladesh National Herbarium
BRAC	Bangladesh Rural Advancement Committee
BWDB	Bangladesh Water Development Board
CARINAM	Centre for Advanced Research in Natural Resources & Management
CBO	Community-based Organisation
CBSMTHP	Community Based Sustainable Management of Tanguar Haor Programme
CCC	Central Co-management Committee
CCBC	Central Community Based Committee
CBD	Convention on Biological Diversity
CBFM	Community-Based Fisheries Management
CFH	Commercial Fish Harvesting
CHT	Chittagong Hill Tracts
CITES	Convention on International Trade in Endangered Species of Fauna and Flora
CNRS	Center for Natural Resource Studies
DA	District Administration
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DFO	Divisional Forest Officer
DLR	Department of Land Revenue
DoF	Department of Fisheries
DoZ	Department of Zoology
DRR	Disaster Risk Reduction
EC	Executive Committee
ECA	Ecologically Critical Area
FAP	Flood Action Plan
FD	Forest Department
FGD	Focus Group Discussion
FID	Flame Ionization Detector
GB	General Body
GEF	Global Environment Facility
GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Global Positioning System
HHs	Households
IFDL	Inland Fisheries Development Limited

IGA	Income Generation Activities
IUCN	International Union for Conservation of Nature
MACH	Management of Aquatic Ecosystems through Community Husbandry
MGs	Mothers Groups
MoEF	Ministry of Environment and Forests
MoFL	Ministry of Fisheries and Livestock
MoL	Ministry of Land
MSY	Maximum Sustainable Yield
MTR	Mid-term Review
NACOM	Nature Conservation Management
NCS	National Conservation Strategy
NCSIP-1	NCS Implementation Project No. 1
NERP	Northeast Regional Water Management Project
NGO	Non-Governmental Organisation
NR	Natural Resource
NRM	Natural Resource Management
NSC	National Steering Committee
PSC	Project Steering Committee
PTA	Parents Teachers Association
PWD	Public Works Department
SCM	Social Capital Management
SDC	Swiss Agency for Development and Cooperation
SHC	Self-help Credit
SMC	School Management Committee
SPARRSO	(Bangladesh) Space Research and Remote Sensing Organisation
SYL	Sustainable Yield Level
TH	Tanguar Haor
THCC	Tanguar Haor Co-management Committee/Council
THP	Tanguar Haor Project
THMA	Tanguar Haor Management Authority
THMC	Tanguar Haor Management Committee
THMP	Tanguar Haor Management Plan
THMPF	Tanguar Haor Management Plan Framework
THSS	Tanguar Haor Shomajvittik Society
UAC	Union Adhoc Committee
UDMC	Union Disaster Management Committee
UCC	Union Co-management Committee
UC	Union Council
UCBC	Union Community Based Committee
UNO	Upazila Nirbahi Officer
UP	Union Parishad
VCF	Village Common Forests
VCBC	Village Community Based Committee
VCC	Village Co-management Committee
WI	Wetland International



Chapter 1

Setting the Scene



This chapter sets the scene for, and constitutes an integral part of the Tanguar Haor Management Plan Framework and Guidelines (hereafter THMPFG or the Framework). Based on an overview of the key natural resource and socio-economic features and trends in the Tanguar Haor, the Framework document is intended to (i) provide a broad-based overview of the resource management and planning context of Tanguar Haor and (ii) serve as a guiding point of reference for further context-specific, locally grounded planning and management decisions.

In what follows, the discussion is organized into several sections. The first section introduces Tanguar Haor by focusing on selected bio-physical and social features. The second section then proffers a timeline of major events relating to the context and trials in resource management and planning in Tanguar Haor. The third section provides a brief review of key literature on Tanguar Haor with a particular focus on relevant management and planning issues. The fourth section then sets the broad structure and parameters of this Framework exercise by focusing on the rationale, methodological considerations, objectives and priority focuses of the planning framework. The concluding section narrates the structure and contents (and the associated flow of logic) of the study together with the limitations.

1.1 Introducing Tanguar Haor

Tanguar Haor¹ is the country's leading internationally significant freshwater wetland. The *haor* territory spans over two upazilas (sub-districts) of Tahirpur and Dharmapasha in Sunamganj District (under Sylhet Division) covering more than 10,000 hectares, supporting at least 60,000 population. This *haor* was designated as the Wetland of International Importance (Ramsar Site) in 2000². The Government of Bangladesh classified it as an 'Ecologically Critical Area' to highlight its ecological importance and to monitor its environmental quality in 1999. Tanguar Haor holds outstanding values not only for supporting high population with livelihoods from its freshwater ecosystems but also for being a remarkable depository of migratory and resident waterfowls ranging from 60,000-120,000 annually, diverse biodiversity of 140 fish species and being the last vestiges of freshwater evergreen swamp forest (Alam *et al.*, 2012).

Tanguar Haor is located in the floodplain of the Surma River, which is one of the main tributaries of the Meghna in Bangladesh. Tanguar Haor lies in the northeastern part of the country adjacent to the Indian border at 25°05'-25°12' North/91°01'-91°07' East. Although several hundred kilometers from the sea, Tanguar Haor is located at an altitude of only 2.5-5.5 meters above sea level, and water movement is generally sluggish. In the wet monsoon season (June-September), Tanguar Haor is entirely flooded, except for villages constructed on hillocks, and appears as small islands in this vast inland body of water. In the dry season, when waters recede into the major rivers, all that remain are about 50 *beels*, which cover about 25-30% of the *haor*. These are deeper bodies of water in the *haor* that are heavily fished and attract many waterfowls. During the monsoon these *beels* merge into one large body of water in a natural depression between the levees of several rivers. It is an area dominated by water and characterised by an abundance of fish, boats, fisherfolk, birds and unusual plant life, all adapted to the unique spectacle of deep annual flooding.

Several rivers form the natural boundaries of Tanguar Haor. The Patlai River forms the eastern boundary; the Ghasi (Mara Gang) River forms the southern boundary, while the Maheshkhola Khal forms the western boundary. To the north and northeast, the *haor* borders on higher ground, namely slopes that gradually merge into the foothills of the Meghalaya Hills in India. For management purposes, the boundary of Tanguar Haor should follow discrete, natural features as much as possible, such as the aforementioned rivers. For practical purposes however, the border with India is taken as the northern boundary of the *haor*, while the unpaved road leading from Tekerghat to the Patlai River is to be regarded as the *haor*'s north eastern boundary.

Accessibility is generally limited and difficult. In Bangladesh context, Tanguar Haor is a remote location. Regular access roads are nearly absent. The quickest way to get there is to travel by road to Sunamganj and take a boat from there, typically diesel-powered transport boats. In the dry season, a number of unpaved trails connect the various villages and link these with Dharmapasha and Tahirpur. Apart from pedestrians, ox-carts, motorcycles and bicycles use these trails. In the wet season, all these trails are submerged.

The principal wetland habitats of Tanguar Haor include open water (with submerged and floating aquatic vegetation), seasonally inundated mixed herbaceous vegetation, reed beds and rice fields. The *haor* is characterised by some of the last remnants of swamp - dominated by *Barringtonia acutangula* (*hijal*) and *Pongamia pinnata* (*koroch*) - and reedland forests in Bangladesh. The *haor* provides a habitat for various globally threatened wildlife species, including 1 amphibian species, 3 turtles, 2 lizards, 4 snakes, 10 birds and 6 mammal species. It also provides a habitat for many species threatened in Bangladesh, including 55 fish, 31 birds and many wetland plant species. The *haor* is also exceptionally rich in waterfowl. Ninety two species have been

¹ Wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, freshwater, brackish or saline, and includes areas of marine water the depth of which does not exceed six metres. *Haors* are saucer-like depressions, subject to flooding in wetter months. *Beels* are deep lakes that retain water in the dry months. Both *beels* and *haors* are examples of floodplain wetlands. The *Haor* Basin is part of the Sylhet Basin, a trough that has been sinking for the past 12 million years. Although it is gradually accumulating sediments, much of the *Haor* Basin remains just 2-8 metres above sea level.

² The Ramsar Convention, or "Convention on Wetlands of International Importance, especially as Waterfowl Habitat", was held in Ramsar, Iran, in 1971. Bangladesh became a signatory in May 1992, and its 1st Ramsar Site is the Sundarbans mangroves. TH is the second (and the only inland freshwater wetland) site.



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A partial view of Tanguar Haor during monsoon

recorded in the area, which is the highest number in any wetland of the country. It is annually visited by around 30,000-40,000 (occasionally 60,000) migratory waterfowls, including 23 anatid (duck and geese) species. In addition, it is one of the last strongholds for the globally threatened Pallas's Fish-Eagle (*Haliaeetus leucorhynchus*). A total of 208 bird species have been recorded at Tanguar Haor, which represents about 30% of all species recorded in Bangladesh.

A total of 88 villages are located around the perimeter of Tanguar Haor, supporting a total population of about 60,000³. Most of these people are Bengali, but about 10% belong to the Garo and Hajong ethnic and live in 11 villages on the northern side of the *haor*. Homesteads are built on artificial mounds or *kandas*, which appear like islands in an inland 'sea' during the winter months. Most household incomes depend on farming, daily wage labour, fishing, duck rearing and cattle/buffalo fattening. Tanguar Haor is one of the most significant 'mother fisheries' (i.e. most important inland fisheries) and has been leased for commercial exploitation, at least since the 1930s.

An account of the major natural resources including flora and fauna as well as community and demographic profile of Tanguar Haor is given in Chapter 2, where further relevant details on the above will be found.

1.2 Background to Management Planning for Tanguar Haor: A Timeline

In consideration of its strategic and international significance and diverse values, several attempts have been made over the years to develop management plans for Tanguar Haor. A brief history is as follows:

³ Baseline report of the Community Based Sustainable Management of Tanguar Haor Project (Phase III), 2012, IUCN Bangladesh.

1991-1993 (*The (draft) National Conservation Strategy (NCS) and associated attempts at implementation*):

The Government of Bangladesh with technical assistance from IUCN Bangladesh first drafted the National Conservation Strategy in 1992. Although the strategy has been approved in principle, it still awaits final cabinet approval. NCS contains important recommendations for sustainable development of natural resources including wetland. Accordingly, the NCS Implementation Project-1 (NCSIP) was formulated with a view to systematically implement the provisions of the NCS. NCSIP-1 identified four main target areas for implementation, namely Tanguar Haor, Narikel Jinjira (St. Martin's Island), the Barind Tract (north-western Bangladesh), and the hill tracts near Chittagong.

1996-1997 (*Conduct of various background research studies*): During 1996-1997, a series of studies were carried out by such organizations as the Bangladesh Centre for Advanced Studies (BCAS), Bangladesh Space Research and Remote Sensing Organisation (SPARRSO), Bangladesh National Herbarium (BNH) and the Department of Zoology, University of Dhaka throughout the country including Tanguar Haor. These studies culminated in a series of reports on socio-economics (BCAS, 1997), plant resources (BNH, 1997), fauna (DoZ, 1997) and a series of six 1:20,000 scale land cover/land use maps. Subsequently, a further series of studies was conducted on Tanguar Haor, focusing on fisheries (Nuruzzaman, 1997), birds (M.A. Khan, 1997), land-use (M.M. Hassan, 1997), socio-economic (S.S. Ahmed, 1997), land tenure (A.N. Khan, 1997) and resource management. These studies provided the necessary background for the development of management plans and associated project management for Tanguar Haor.

1997-2000 (*Initial management plan exercises*): Under the auspices of NCSIP, attempts were made to formulate management plans for the *haor*. Although some studies (e.g. Scott and Rashid, 1992) had been done, the first sketch of such a plan was developed by Giesen and Rashid (1997). Subsequently, a team of specialists consisting of Wim Giesen (team leader; wetland conservation specialist, the Netherlands), Dr Niaz Ahmed Khan (sociologist; Department of Public Administration, University of Chittagong), Dr. Aminur Rahman (economist; School of Business, Independent University) and Dr. Md. Abdus Shahid (wetland ecologist; SPARRSO) worked to synthesize the findings of the relevant key sectoral studies on Tanguar Haor and furnish a relatively fully fledged management plan. The document (Giesen *et al.*, 2000) provides one major basis of the current attempt to develop the Tanguar Haor Management Plan Framework. This Framework document substantially draws on the document and associated background studies.

1995-2000 (*Public consultation and participatory stakeholder involvements*): The process and measures towards development of management plans for Tanguar Haor have drawn on systematic consultation with key stakeholders most notably with the local communities and local government leaders. Examples of some of the consultative events include (i) 3 seminars were held, one at Tahirpur Thana (August 1997) and two at Sunamganj (May and November 1997), to discuss management issues, test ideas and gauge sentiments. (ii) During field visits, open discussions were held with villagers at grassroots level. (iii) PRAs conducted by BCAS in few villages (iv) A National Workshop on the NCSIP-1 Tanguar Haor Management Plan was held in Dhaka on 2 December 1997, and was attended by 70+ representatives from all relevant agencies and government bodies, including BWDB, MoEF, FD, DoF, MoL, IFDL, BNH, DoZ, SPARRSO and various universities. Comments received on the circulated first draft of the Management Plan were incorporated into the first Tanguar Haor Management Plan (Giesen & Rashid, 1997). A meeting was held in Mandipota village on 3rd February 2000, at which all villagers from five villages were invited (in practice, only the men attended) to discuss *haor* management issues and solicit their views. On 9th February 2000, a workshop was held at IUCN on the draft revised Tanguar Haor Management Plan Framework, and suggestions of those attending were incorporated.

1998- Early 2000s (*Paving the way for introducing community-based management*): Tanguar Haor had traditionally been leased out to socio-economically powerful commercial operators (leaseholders) who used to manage the *haor* resources as exclusive de-facto private property. The late 1990s witnessed the beginning of change of the situation. Political elections were held in May 1998, which resulted in a change of government and a change in leaseholders at Tanguar Haor – the first in several decades. On the 19th April 1999 Tanguar Haor was declared an Ecologically Critical Area (ECA), and control was switched from MoL to MoEF in April 2000. Lastly on 20th January 2000, the Government of Bangladesh nominated Tanguar Haor as Bangladesh's second Ramsar site, bringing the area fully into the international arena. Consequently, the conditions appear much more favourable for community-based management. The first Tanguar Haor Management Plan Framework was never

implemented as the conditions were varying, but it does form a good basis for developing the next Management Plan (Giesen *et al.*, 2000). The revised plan reflected the change in administrative and legal control over the area, a speedier transition to community-based management and the guidelines of the Ramsar Bureau (Davis, 1994).

2005-2006 (Consolidating community-based management and grassroots participatory planning): The Community Based Sustainable Management of Tanguar Haor Project particularly focused on consolidating community-based activities in its field areas during this period. In the process, emphasis was laid on developing capacities and skills of the targeted local communities to develop periodic (often, annual) project activity plans in a participatory manner. This document draws on some provisions and lessons from these planning exercises, especially with regards to resource harvesting modalities and community access and regulations.

There is no “Blueprint Formula” applicable for co-management of every wetland. The definition of co-management and application of its modality are variable with the geographical and socio-economic background of the wetland domain. Tanguar Haor is no exception.

1.3 Summary Review of Past Literature

The following list summarizes selected key literature on Tanguar Haor, and includes the observations from an earlier attempt by Giesen *et al.* (2000) in review of the major studies:

Prior to 2000

During 1990-93 under the auspices of the Northeast Regional Water Management Project (NERP), the whole of the *Haor* Basin in Sylhet Division, including Tanguar Haor, was studied in some details, and in fields varying from hydrology, fisheries and vegetation, to socio-economics and investment plans (see NERP, 1993a-e).

During the first years of the NCSIP-1 (especially 1996-97), various sectoral studies were carried out at Tanguar Haor, namely on socio-economics (Ahmed, 1997), land tenure (Khan, A.N 1997), flora (Bangladesh National Herbarium, 1997), zoology (Department of Zoology, University of Dhaka, 1997), fisheries (Nuruzzaman, 1997) and birds (Khan, M.A., 1997).

Botanical Studies

Roxburgh (Hortus Benghalensis, 1814; Flora Indica, 1932; in NERP, 1993a) and William Griffith, whose 1835 collecting trip by boat passed along the Surma River to Chhatak. During a second trip in 1838 he again travelled along the Surma, and during these journeys recorded the marsh vegetation and aquatic flora of the jheels and *haors*.

In 1850, the author of the Flora of British India (Hooker, 1872-97) travelled along the Surma and visited the wetlands of Sylhet (NERP, 1993a).

Gibson undertook the first comprehensive collection of plant specimens from the *haor* wetlands in 1836, followed by Clark in 1869.

In 1903, the names and drawings of many aquatic plants from the *haors* of Sylhet appeared in *Bengal Plants* (Prain, 1903; in NERP, 1993a).

In the *Flora of Assam*, Kanjilal (1934, in NERP, 1993a) three main habitat types were recorded: upland vegetation (equivalent to vegetation of *beel* fringes and higher elevations), grasslands and aquatic vegetation.

A summary of plant life at Tanguar *Haor* is provided by the Directory of Asian Wetlands (Scott, 1989).

Bird Studies

Hume (1888; in NERP, 1993a) is one of the most useful early accounts of the birds of Sylhet; 178 species are listed, including the Pink-headed Duck *Rhodonessa caryophyllacea*, which is now globally extinct.

Baker, S. (1922-1930, in NERP, 1993a) did some work on the birds of northeastern Bangladesh, which include several references to 'plains of reeds', a habitat type now all but disappeared from the region.

Mountford. (1969) summarised the observations of the 1966 World Wildlife Fund Expedition to West and East Pakistan.

Rashid. (1967) reviews bird species status in Bangladesh by region, one of which is the *haor* basin (his North-East Lowlands), but by his own admission status information is based on assumptions more than positive records, largely due to imprecise locality information in earlier accounts.

Harvey. (1990) comprehensive listing of the birds of Bangladesh takes a cautious approach and includes only those species and records for which there is full documentation.

Sarker and Husain. (1990) also recently listed 174 bird species that found in the wetlands and mangrove areas of Bangladesh,

Forestry Department and several NGOs (notably NACOM) have carried out mid-winter waterfowl censuses in northeastern Bangladesh almost annually⁴ since 1987, as part of the Asian Waterfowl Census.

Further useful information about bird life at Tanguar Haor is provided by the Directory of Asian Wetlands (Scott 1989), Millin (1984-88, unpublished list of bird sightings at Hail *haor*), Woolner (1986-91, unpublished notes on 108 species), and Altamash Kabir (unpublished notes on scarce waterfowl in the region).

Literature since 2000

Geisen, W., Khan, N.A., Shahid, A. and Rahman, A. (2000). Management plan for Tanguar Haor, Bangladesh. Achieving community-based sustainable use of wetland resources. National Conservation Strategy Implementation Project 1. Dhaka: Ministry of Environment and Forest, Government of Bangladesh and IUCN. 218 pp.

Bavenger, K., Datta, A.K., Eid, A.T. and Shirin, M. (2001). Tanguar Haor Wetland Biodiversity Conservation Project-an Appraisal. NINA-NIKU Project Report, 16:1-37. This is an appraisal report on different initiatives (projects) undertaken on wetland biodiversity conservation in Tanguar Haor. The appraisal team suggested a minimum continuation of the support provided by the National Conservation Strategy Implementation on Project-1 (NCSIP-1). They also suggested an interim budget.

Gazi, S.M.A., Hafizuddin, A.K.M. and Habib, M.A.M. (2003). *Trichodina sytherensis* sp.n. (Cilliophora: Trichodinidac) from the Mud Perch, *Nandus nandus* (Hamilton-Buchanan, 1822) (Nandidae) in Sylhet. *Pakistan Journal of Biological Science* 6(20):1774-1777. This article focused on a taxonomic work that identified one new species of *Trichodina sytherensis* sp.n. of fresh water fish, *Nandus nandus* in the Tanguar Haor of Sylhet.

Matthew, R. (2003). Sustainable livelihoods, environmental security and conflict mitigation: Four cases in South Asia. pp. 67–71 in: Oviedo, G., van Griethuysen, P. and Larsen, P.B. eds. Poverty, equity and rights in conservation. Technical papers and case studies, Joint IUCN-IUED Project. This case study focused on ensuring sustainable livelihoods of rural people in South Asia where Tanguar Haor is one of the study sites. They identified resource rights could be a potential aspect to ensure sustainable livelihoods, environmental security and to mitigate conflict in the *haor* areas.

Muzaffar, S.B. (2003). Assessment of the feeding biology, ecology and human consumption of the migratory waterfowl of Tanguar Haor, Sylhet, Bangladesh: the path to sustainable management. Technical Report. Hawaii: Society of Wetland Scientists

Muzaffar, S.B. (2004). Diurnal time-activity budgets in wintering Ferruginous Pochard (*Aythya nyroca*) in Tanguar Haor, Bangladesh. *Forktail* 20:25–27. This study focused on some behavioral aspects and diurnal time activity budget (resting, feeding, preening and swimming) of a winter visitor Ferruginous Pochard (*Aythya nyroca*) in Tanguar Haor, Bangladesh. This study also identified anthropogenic disturbances (e.g. boat travelling, fuel wood collection, mollusks collection, cattle herding on the shores) are the significant threats for its existence.

Champion, N. (2006). River and Wetlands. Black Rabbit Books. 48 pp. This book has a small description on Tanguar Haor.

Kabir, M.H. and Amin, S.M.N. (2006). Socioeconomic Assessment of the Local People at Tanguar Haor (Wetland), Bangladesh: A Geographical Analysis. *Oriental Geographer* 50(2): 8.

Kabir, M.H. and Amin, S.M.N. (2006). Local People's Dependence on Wetland Resources: The Case of Tanguar Haor, Bangladesh. *The Journal of Bangladesh National Geographical Association* 34(1&2):13-30.

⁴ The exception is 1989, when no census was taken.

Kabir, M.H. and Shivakoti, G.P. (2007). Locals Willingness to Participate in Wetland Conservation Practices: Example of Tanguar Haor. *Oriental Geographer* 51 (1&2): 6.

Mathew, R. and Hammill, A. (2007). Resource rights and conflicts in South Asia. *Peace Review: A Journal of Social Justice*, 19(1): 43-49.

Muzaffar, S.B. and Ahmed, F.A. (2007). The effects of the flood cycle on the diversity and composition of the phytoplankton community of a seasonally flooded Ramsar wetland in Bangladesh. *Wetlands Ecology and Management* 15:81–93. This study investigated the variation of diversity and composition of the phytoplankton in Tanguar Haor during the period of inundation. This Ramsar wetland has great importance to the local economy as it is a big reservoir of inland fisheries. Annual flood cycle has measurable impacts on the abiotic and biotic components of these ecosystems. This study analyzed how phytoplankton communities of these wetlands are essential for zooplankton and fish productivity.

Chowdhury, A.H. (2008). The state of Community Based Sustainable Management of Tanguar Haor, What measures are to be taken? University of Dhaka, Bangladesh. 42 pp. This paper made a critical analysis of Community Based Sustainable Management initiative of Tanguar Haor, as this initiative is recently implemented. It also analyzed the local peoples' awareness and views about this initiative.

Alam, M., Furukawa, Y. and Akter, S. (2010). Forest-Based Tourism in Bangladesh: Status, Problems, and Prospects. *Tourism: An International Multidisciplinary Journal of Tourism* 5(1): 163-172. This study described the ecotourism potentials, problems and prospects of different forest ecosystems in Bangladesh. Tanguar Haor was one such spot in swamp forest ecosystems.

Allen, D.J. and Molur, S. (2010). The status and distribution of freshwater biodiversity in Eastern Himalaya. IUCN. 88 pp. This book has a box entitled 'Community based sustainable management in the Tanguar Haor wetlands' which is written by M. M. M. Chowdhury, Program Officer, IUCN. This write-up focused on the establishment of co-management in the Tanguar Haor with the objectives of livelihood benefits through stabilization, conservation and sustainable use of natural resources. Besides this, it contained different chapters which described different aspects of haor areas (Tanguar Haor is not an exception).

Salauddin, M. and Islam, A.K.M.S. (2011). Identification of land cover changes of the haor area of Bangladesh using MODIS image. The 3rd International Conference on Water & Flood Management (ICWFM-2011). This study made an image analysis to identify the land cover changes in the haor areas of Sylhet region in Bangladesh. They reported that vegetation cover has been increased to 8.35% as most of the water bodies had been greatly reduced and converted into alternate land uses like vegetative areas.

Sharmin, S. and Khan, N.A. (2011). Gender and development amongst a wetland community in Bangladesh: Views from the field. *International Journal of Sustainable Development* 3(4): 11-21. This study identified the status and nature of gender in the Tanguar haor their specific needs and aspirations with respect to household resource use, community decisions and political activities.

Pangare, G., Das, B., Lincklaen Arriens, W., and Makin, I. (2012). Water Wealth? Investing in Basin Management in Asia and the Pacific. New Delhi, India: Academic Foundation. 92 pp. This publication described the challenges in improving water governance and management across Asia and the Pacific. This report provided a brief description on Tanguar Haor highlighting its major productive uses, challenges and suggestions to face these challenges.

Alam, A. B. M. S., Chowdhury, M. S. M and Sobhan, I. (2012). Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh. Volume I: Wildlife, IUCN, Dhaka, Bangladesh. xi+234 pp.

Sobhan, I., Alam, A. B. M. S., and Chowdhury, M. S. M. (2012). Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh. Volume II: Flora, IUCN, Dhaka, Bangladesh. xii+236 pp.

Khatun, A., Giasuddin, M., Islam, K. M., Khanom, S., Samad, M.A., Islam, M. R., Noor, M., Bhuiyan, J.U., Kim, W.II., Eo, S.K. and Rahman, M.M. (2013). Surveillance of avian influenza virus type: A in semi-scavenging ducks in Bangladesh. *BMC Veterinary Research* 9:196 This study made a surveillance study on the semi-scavenging ducks as a transmitter of avian influenza virus type A. However, the risk of infection in human body through domestic ducks was negligible.

Elahi, R., Islam, A., Hossain, M.S., Mohiuddin, K., Mikolon, A., Paul, S.K., Hosseini, P. R., Daszak, P. and Alam, M.S. (2014). Prevalence and diversity of avian haematozoan parasites in wetlands of Bangladesh. *Journal of Parasitology Research* pp 12. This study described the distribution, abundance and transmission of avian haematozoan parasites in wetlands in Bangladesh. Wild birds were the carrier of different types of these parasites. This study argued that this type of analysis has great importance for better understanding of the disease ecology.

Chakraborty, T.R. (undated). Management of *haors*, *Baors* and *Beels* in Bangladesh: Lessons for Lake Basin Management. 15 pp. Available from wldb.ilec.or.jp/ILBMTrainingMaterials/resources/Bangladesh.pdf. This document depicted the management and conservation of different inland water bodies with respect to their ecological, economic and livelihood role in the country.

Amin, S.M.N. and Kabir, H. (undated) Community participation in the management of freshwater wetlands in Bangladesh: A case study of Tanguar Haor. This paper reviewed the past management practices in Tanguar Haor. It focused mainly on the community participation on these management practices. It also analyzed local peoples' willingness and potential to participate in these management practices.

List of Literature Concerning Management Planning

Alam, M., Furukawa, Y. and Akter, S. (2010). Forest-Based Tourism in Bangladesh: Status, Problems, and Prospects. *Tourism: An International Multidisciplinary Journal of Tourism* 5(1): 163-172.

Allen, D.J. and Molur, S. (2010). The status and distribution of freshwater biodiversity in Eastern Himalaya. IUCN. 88 pp.

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Bavenger, K., Datta, A.K., Eid, A.T. and Shirin, M. (2001). Tanguar Haor Wetland Biodiversity Conservation Project-an Appraisal. NINA-NIKU Project Report, 16:1-37.

Chakraborty, T.R. (undated). Management of *haors*, *Baors* and *Beels* in Bangladesh: Lessons for Lake Basin Management. pp 15. Available from wldb.ilec.or.jp/ILBMTrainingMaterials/resources/Bangladesh.pdf

Champion, N. (2006). River and Wetlands. Black Rabbit Books. pp 48.

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Elahi, R., Islam, A., Hossain, M.S., Mohiuddin, K., Mikolon, A., Paul, S.K., Hosseini, P. R., Daszak, P. and Alam, M.S. (2014). Prevalence and diversity of avian haematozoan parasites in wetlands of Bangladesh. *Journal of Parasitology Research* 12pp.

Gazi, S.M.A., Hafizuddin, A.K.M. and Habib, M.A.M. (2003). *Trichodina sytherensis* sp.n.(Cilliophora:Trichodinidac) from the Mud Perch, *Nandus nandus* (Hamilton-Buchanan,1822) (Nandidae) in Sylhet. *Pakistan Journal of Biological Science* 6(20):1774-1777.

Geisen, W., Khan, N., Shahid, A. and Rahman, A. (2000). Management plan for Tanguar Haor, Bangladesh. Achieving community-based sustainable use of wetland resources. National Conservation Strategy Implementation Project 1. Dhaka: Ministry of Environment and Forest, Government of Bangladesh and IUCN. 218 pp.

Kabir, M.H. and Shivakoti, G.P. (2007). Locals Willingness to Participate in Wetland Conservation Practices: Example of Tanguar Haor. *Oriental Geographer* 51 (1&2): 6.

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Khatun, A., Giasuddin, M., Islam, K. M., Khanom, S., Samad, M.A., Islam, M. R., Noor, M., Bhuiyan, J.U., Kim, W.II., Eo, S.K. and Rahman, M.M. (2013). Surveillance of avian influenza virus type: A in semi-scavenging ducks in Bangladesh. *BMC Veterinary Research* 9:196.

Matthew, R. (2003). Sustainable livelihoods, environmental security and conflict mitigation: Four cases in South Asia. pp. 67–71 in: Oviedo, G., van Griethuysen, P. and Larsen, P.B. eds. Poverty, equity and rights in conservation. Technical papers and case studies, Joint IUCN-IUED Project.

Mathew, R. and Hamill, A. (2007). Resource rights and conflicts in South Asia. *Peace Review: A Journal of Social Justice*, 19(1): 43-49.

Muzaffar, S.B. (2003). Assessment of the feeding biology, ecology and human consumption of the migratory waterfowl of Tanguar Haor, Sylhet, Bangladesh: The path to sustainable management. Technical Report. Hawaii: Society of Wetland Scientists

Muzaffar, S.B. (2004). Diurnal time-activity budgets in wintering Ferruginous Pochard (*Aythya nyroca*) in Tanguar Haor, Bangladesh. *Forktail* 20:25–27.

Muzaffar, S.B. and Ahmed, F.A. 2007. The effects of the flood cycle on the diversity and composition of the phytoplankton community of a seasonally flooded Ramsar wetland in Bangladesh. *Wetlands Ecology and Management* 15:81–93.

Pangare, G., Das, B., Lincklaen Arriens, W., and Makin, I. (2012). Water Wealth? Investing in Basin Management in Asia and the Pacific. New Delhi, India: Academic Foundation. pp 92.

Salaudin, M. and Islam, A.K.M.S. (2011). Identification of land cover changes of the *haor* area of Bangladesh using MODIS image. The 3rd International Conference on Water & Flood Management (ICWFM-2011).

Sharmin, S. and Khan, N.A. (2011). Gender and development amongst a wetland community in Bangladesh: Views from the field. *International Journal of Sustainable Development* 3(4): 11-21.

1.4 Methodological Considerations

1.4.1 The Management Goal and Operational Objectives Pursued

As noted earlier, this Framework document is intended to (i) provide a broad-based overview of the resource management and planning context of Tanguar Haor and (ii) serve as a guiding point of reference for further context-specific, locally grounded planning and management decisions.

The overall goal of the Framework is to provide for sustainable and community-based management of the natural resources of Tanguar Haor, in accordance with the 'wise use' principle of the Ramsar Bureau. In more specific terms, in the context of the prevailing conditions at Tanguar Haor, this translates into the following operational objectives:

- establishing equitable, community-based management;
- setting limits on allowable change in habitats, species abundance and absolute numbers;
- reinforcing and promoting management practices that do not compromise resources; and
- curbing or elimination of detrimental management or natural resource use practices.

1.4.2 The Approach

This document represents a compilation, review and collation exercise coordinated by Dr. Niaz Ahmed Khan (University of Dhaka), with assistance from Mohammed Abdul Baten (Independent University Bangladesh). The major tools and sources of information include the following;

i) **Selected review of literature:** In reviewing the literature, we primarily have drawn on the past major attempts in preparing management plans for Tanguar Haor, most notably Giesen *et al.* (2000). We substantially draw on this literature as well as several recent studies covering various sectors and dimensions of Tanguar Haor (see Chapter 5).

(ii) **Field visit:** Two short field visits were made during April 2014 and May 2015 mainly to hold community level discussions covering such locations as Sunamganj Sadar, Tahirpur and Bangalvita; (iii) extensive sharing of

experience and expertise of CBSMTH project staff have informed the process of developing this document. Eight such staff consultation meetings were held both in Sunamganj and Dhaka offices. iv) additionally a series of external consultations were held, notably the following:

Table 1: Summary of consultation meetings conducted to prepare Tanguar Haor management plan framework

SL.	Date	Place	Key Stakeholders	Major Decisions
1.	03.03.2014	Flambe Restaurant, Gulshan-2, Dhaka	IUCN-B staffs and consultants, GoB representatives (MoEF, MoL, DoE, Planning Commission, BHWDB), Teachers (DU, JU, SUST), representatives from BFRI, CREL, Arranayak Foundation, Helvetas, TARA, ERA, etc.	- The proposed framework for Tanguar Haor will act as a guiding manual for sustainable use of Tanguar Haor resources. - A comprehensive discussion on the activity and strategy of Tanguar Haor management should be addressed in the proposed framework. - The proposed framework should address the climate change impact on Tanguar Haor.
2.	30.04.2014	CBSMTH Project Office, Shologhar, Sunamganj	IUCN-B staffs and consultants, CCC leaders, representatives from PNGOs (CNRS & ERA), etc.	- The proposed framework will provide guidelines for enhancing community participation in Tanguar Haor resource management. - Role of community leaders should be specified in the framework.
3.	27.05.2015	Officers Club, Tahirpur Upazila, Sunamganj	IUCN-B staffs and consultants, community leaders of VCC, UCC & CCC, representatives from civil society, and PNGOs (CNRS & ERA), etc.	- The existing situation of Tanguar Haor including extreme poverty rate, overpopulation, low literacy rate, poor health and sanitation will be addressed in the proposed framework. - The framework should provide directions for coordinating various future project activities in Tanguar Haor.
4.	07.06.2015	Hotel Emma Nuelle's Inn, Banani, Dhaka	IUCN-B staffs and consultants	- The Tanguar Haor Management Plan Framework will be published in a book. - All Manuals developed during the project period and meeting minutes related to the Tanguar Haor Management Plan Framework will be included in the appendix. - Recommendations from various studies will be added in the framework.
5.	27.06.2015	IUCN Bangladesh Country Office, Dhaka	IUCN-B staffs and consultants	- IUCN guideline will be followed for formatting the framework. - Photographs relevant to each chapter will be added.

1.5 The Parameters and Structure of this Framework

1.5.1 Rationale for the Framework

Tanguar Haor and associated management planning deserve our special attention for several reasons.

First, the *haor* is of significant value, not only in economic terms but also because of its conservation value, cultural value and for aesthetic reasons, and its diverse ecosystem services (these are explored in reasonable

details in the next chapter). The area provides many products, performs many functions and has valuable attributes that benefit the local community, the regional economy and global biological diversity.

Second, as a declared Ramsar site, the government – as a signatory to the Ramsar Convention - has international obligation to protect Tanguar Haor and explore possible improvements in its management and utilization based on wise-use principles.

Third, recent observations suggest that Tanguar Haor (and other similar *haor* ecosystems) is particularly vulnerable to the impacts and implications to various climatic and natural hazards; the livelihood and survival capacity of an overwhelming majority of poor local inhabitants in these areas are severely threatened.

Fourth, as noted in an earlier section, there have been a few attempts in management planning and associated resource harvesting plans at Tanguar Haor. It is imperative to pull together these important plan documents into a concerted volume which may serve as a broad guideline for the future.

Fifth, in line with the above, it is also important to synthesize the existing information and research on Tanguar Haor. Most of the information are currently in disperse and unorganized state. Besides, reliable and organized information and research especially on natural resource use and community governance aspects – are strikingly limited.

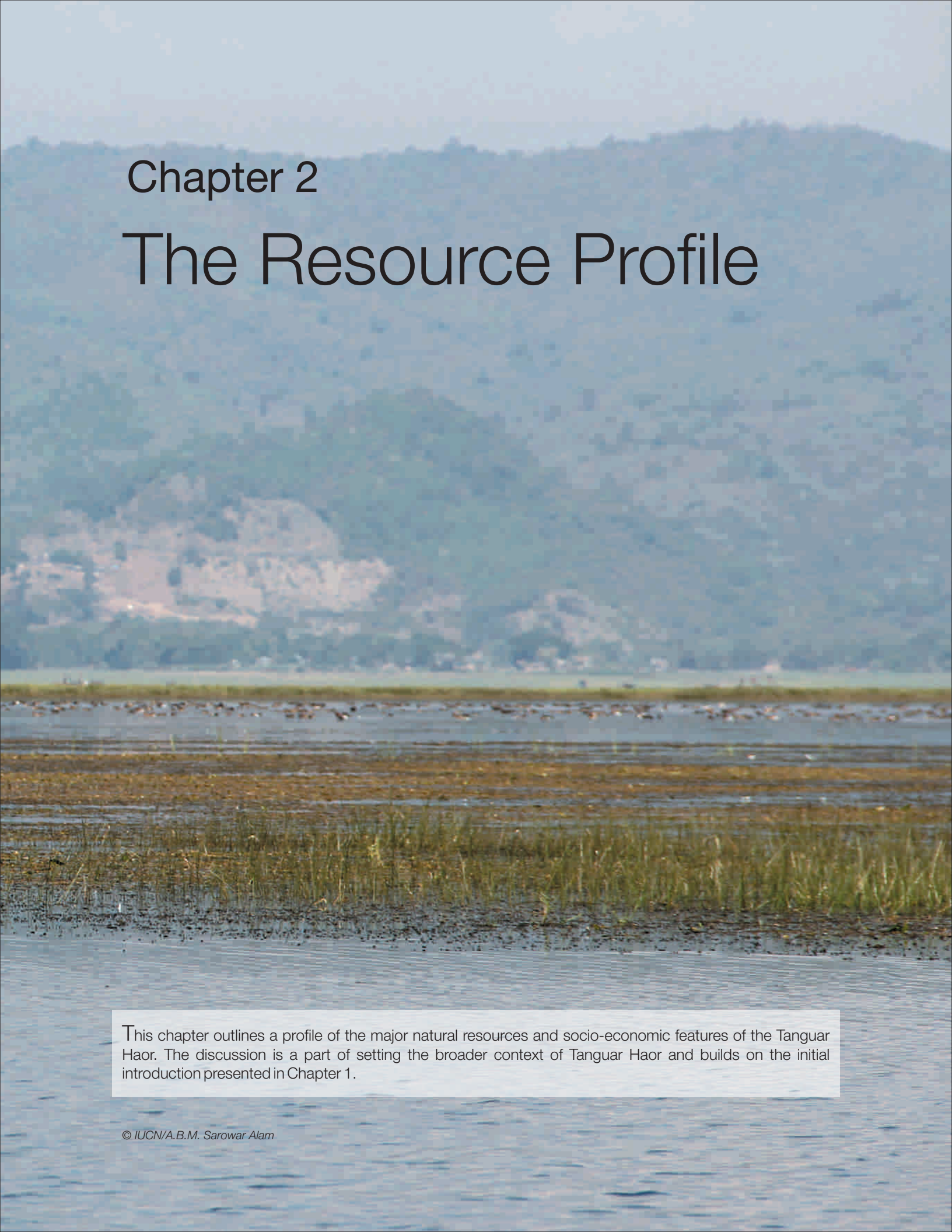
Sixth, as repeatedly noted earlier, Tanguar Haor represents some of the most resourceful parts of the country especially in terms of ecological and biological diversity, natural resource endowments, and socio-economic composition of the population. This feature of the *haor* however, also poses challenge and risk to the local communities. In the absence of appropriate and adequate provisions for community-led management and planning, these resources are vulnerable to indiscriminate and unsustainable use – even outright plunder, and/or unscientific management.

Seventh, the Tanguar Haor Programme (CBSMTHP) is scheduled to close down shortly. The project operations are currently in a winding up phase. As part of the exit strategy, the project authorities consider it vital to develop a broad framework document which may offer guidelines for formulation of context and community specific action plans after the closure of the project.

1.5.2 The Composition and Limitation of the Framework Document

This chapter has attempted to set the scene for the development of Tanguar Haor Management Plan Framework including its background, context, premises and parameters. In following the brief contextualization of Tanguar Haor, the second chapter provides further details on the natural resource and community development profiles of Tanguar Haor with a particular focus on the resourcefulness and richness of Tanguar Haor. In the backdrop of the broader setting and resource profile of Tanguar Haor (as analysed in chapters 1 and 2), the third chapter identifies and analyses the major factors and challenges facing the materialization of the Framework. The fourth chapter sets that basic structure and premise of the proposed programme in Tanguar Haor. It focuses on scruples and principles that ought to underline any programmatic intervention in Tanguar Haor, suggested strategies and actions, identification of the key stakeholders and basic considerations on governance and management structure. It then presents a Logic Model by way of suggesting a Theory of Change. In line with the above structure and premise, the Guiding Framework for the key programme components is discussed in chapter 5. A series of guidelines are proposed with regards to two broad component areas of the programme – community development, and natural resource use and management. The last chapter then focuses on the considerations of implementation of the Framework and the proposed programme. Its main focus is on the logic of implementation including the socio-economic and financial justification and potential for replication.





Chapter 2

The Resource Profile

This chapter outlines a profile of the major natural resources and socio-economic features of the Tanguar Haor. The discussion is a part of setting the broader context of Tanguar Haor and builds on the initial introduction presented in Chapter 1.

2.1 Natural Resource Settings⁵

2.1.1 Geological History

Tanguar Haor, as a part of the world largest Geosyncline Bangladesh, has its geological history of formation. The structural setting of the Bengal basin suggests that it is located in the Sylhet trough of Bengal Foredeep. At the north of it the Shillong plateau is located and on the right the Indian mobile belt.

The geological process includes uplifting and subsidence due to active tectonic plates. Therefore it is said that some parts within Bangladesh have been uplifted and some parts are still sinking. Morgan and McIntire (1959) carried out a systematic study and found uplifting and subsidence in Bengal basin. The Sylhet basin is one of the major subsidence zones.

Although the rate of subsidence is not fully known, the entire region is being fed by huge quantity of sediments carried out from the Meghalaya.

2.1.2 Geomorphology

Tanguar Haor is one of the largest wetland systems in the northeast region with relative natural resources. Approximately one-thirds lies in the Tahirpur Upazila and two-thirds lies in the Dharmapasha Upazila, both of which are located in Sunamganj District of Sylhet Division. The *haor* consists of 46-54 beels of various sizes (Akondo, 1989). The area of Tanguar Haor, including 88 villages within the *haor*, is about 100 square kilometers; of which 2802.36 ha is wetland (Sobhan *et al.*, 2012). The *haor* is located at an altitude of only 2.5-5.5 meters above mean sea level.

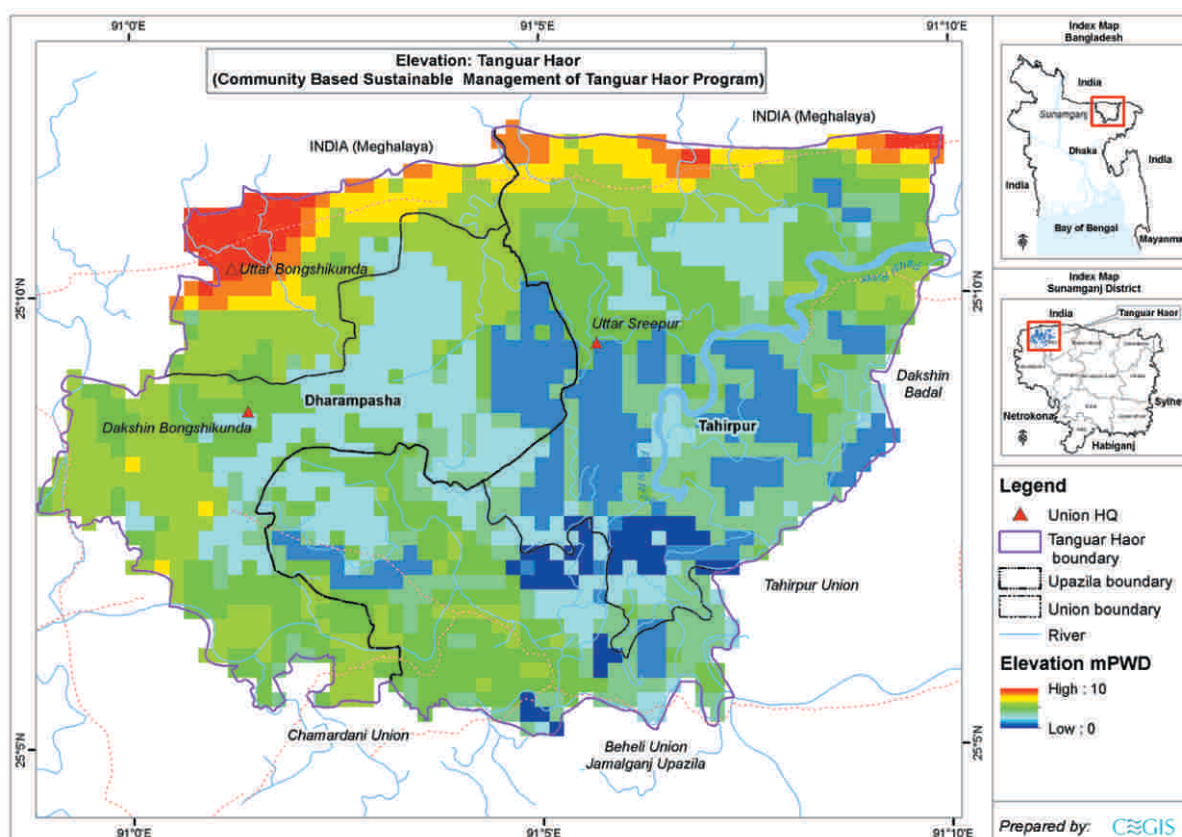


Figure 2.1: Digital Elevation Model Map of Tanguar Haor

⁵ This section mainly draws on IUCN's Publication (2012) - Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh, Volume I: Wildlife (Amphibians, Reptiles, Birds and Mammals) and Volume II: Flora.

2.1.3 Topography

Out of twenty-four physiographic sub-regions (Rashid, 1991), the North East Region comprises of six sub-regions: (i) Susang Hills and Piedmont, (ii) *Haor* Basin, (iii) Sylhet High Plains, iv) Sylhet Hills, v) Old Brahmaputra Floodplain, and vi) Madhupur Tract. Tanguar Haor belongs to Susang Hills & Piedmont and *Haor* Basin sub-regions. The elevation of the Tanguar Haor ranges from a maximum of 10 m to a minimum of 0.65 m PWD. The average elevation of the entire study area is nearly 5m PWD. The land topography map is shown in Figure 2.1.

2.1.4 Soil

Soil texture is the relative proportion of sand, silt and clay. It is very important for agriculture crop production. It is observed that the soil texture varies from clay, clay loam and loam. The soil texture has been presented in Table 2.1 below.

Table 2.1 : Soil texture of Tanguar Haor

Soil texture with depth (cm)	% of Total area		
	Clay	Clay loam	Loam
Top Soil (0-15)	51	16	11

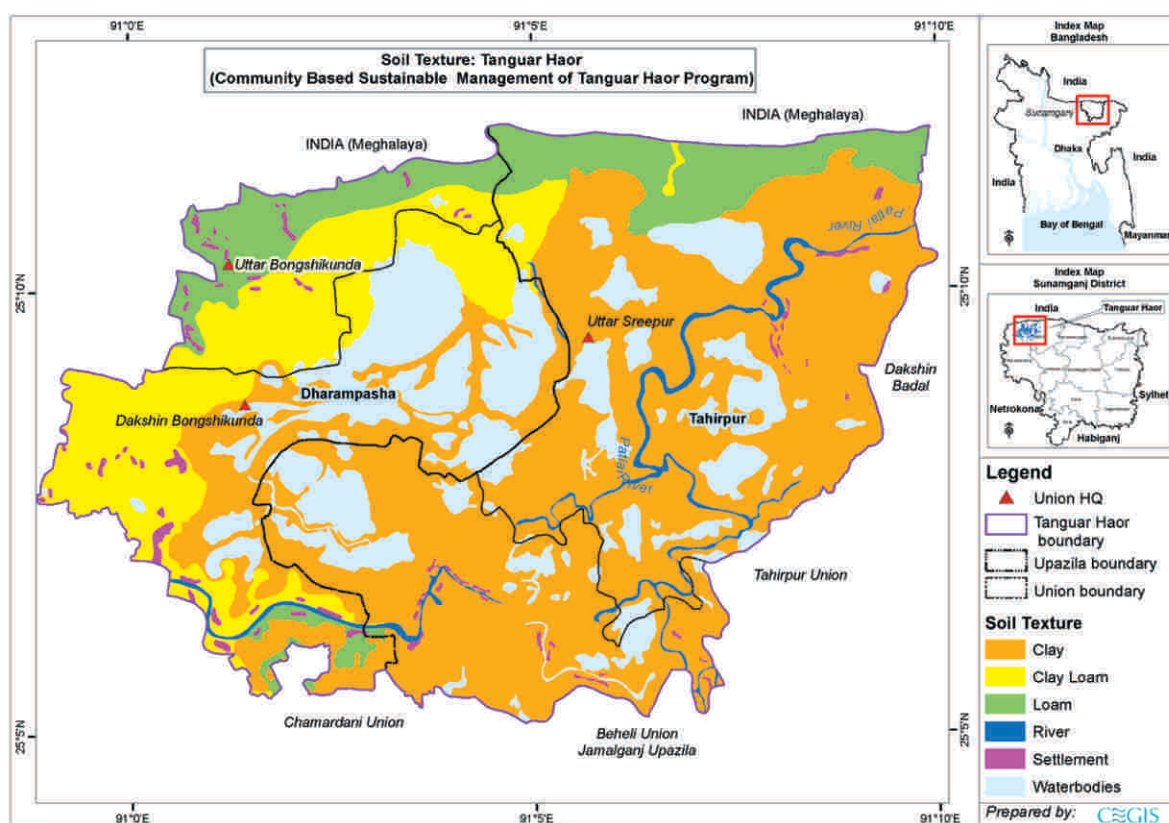


Figure 2.2: Soil Texture Map of Tanguar Haor (Source: CEGIS database, 2012)

The wetland is bounded on the north by the Shillong Plateau, an elevated block of Pre-Cambrian Basement rock which has been draped over by late Mesozoic and Cenozoic sediments. The south face of the plateau has been dissected by steep, V-shaped canyon that follows structurally controlled valleys. The southern escarpment of the plateau is bordered by the east-west trending Dauki Fault, which forms a distinct lineament separating the lowlands in Bangladesh from the mountains in India (NERP, 1993b).

Most of the *haor* area is covered by the Young Piedmont; the alluvial plain which comprises the alluvial fans of the Shillong plateau and also the adjoining basins and basin depressions. The fan soils are poorly to imperfectly drained,

strongly mottled brown, loamy sands to clay loams, poorly structured to strong to very strong acid reaction. The very poorly drained basin deposits comprise strongly reduced heavy clay lacking any sign of profile development.

Tanguar Haor is located right at the foothills of the Meghalaya Hills. Apart from these features, location of this *haor* is another factor for its high biomass production. The *haor* system is mainly rendered with the back water flow of river waters from the Baulai, Patlai and Jadukata rivers. Few hill streams flow into the *haor* system but the major water thrust comes from the south because of the back flow. The hill streams do bring in some sediment but considering the volume of water held in the *haor* and the area of the *haor* itself, it is insignificant. Because of the low quantity of silt plus its dissemination during flooding season, this *haor* is still deep enough compared to the other *haors* where the rate of sedimentation is comparatively higher.

Due to this backflow the water is relatively clean, free from suspending materials and with less residual matter. As a result the water is transparent and sunlight can penetrate to quite a considerable depth. This increases the lotic area of the water body facilitating the photosynthesis and making it the most productive area (with high biomass) within the north-eastern *haor* basin. It is because of these important physical features that this wetland is still capable of maintaining the ecosystem to its near-natural state resulting in high biomass production.

The area of Tanguar Haor harbours some of the last vestiges of natural swamp forest and is totally flooded in the monsoon season. The floral diversity in this *haor* is very rich which makes it an ideal place for the migratory birds. As a result, every winter about 200 types of migratory birds come to this *haor* and make their temporary habitat here. Some of these birds also find this area suitable for breeding.

Tanguar Haor is also extremely rich in terms of fisheries resources and is considered as one of the largest and most important 'mother fishery' (centre for recruitment and dispersal of fish and thus influence the fish production in adjacent floodplains) in the country for floodplain freshwater species. This *haor* is also a unique habitat for waterfowl.

2.1.5 Geographical Location

The location of Tanguar Haor can be described in three ways, e.g. Absolute Geographic Location, Relative Location and Physiographic Location.

Absolute Geographic Location

Tanguar Haor is located in the northeastern part of Bangladesh, between 25°12'10.572" and 25°5'47.989" North Latitude and 90°58'49.426" and 91°10'0.018" East Longitude. The total area of Tanguar Haor is approximately 160 square kilometers including all geographic features and landuse.

Relative Location

Tanguar Haor is located in the north-western part of Sunamganj district of Sylhet division. It shares a border of approximately 17 kilometers with Nongstoin, India in its north. The *Haor* is almost 2.5 kilometers away from neighboring Netrokona district in the West.

Within the total area of Tanguar Haor there are two thanas of Sunamganj district, e.g. Tahirpur and Dharmapasha and four unions, e.g. Uttar Bangshikunda, Dakshin Bangshikunada, Uttar Sreepur and Dakshin Sreepur.

Physiographic Location

The entire Bangladesh has been divided into 3 major classes' e.g. Hills of Pleistocene epoch, Terraces and Floodplain. Some scholars have stretched this class into many sub divisions. On the basis of physical features, drainage patterns and land levels, Bangladesh has been divided into 55 sub-regions. According to this classification Tanguar Haor is situated in Meghalaya Piedmont Depression under *Haor* Basin.

From the major three classifications, the flood plain division can again be classified into 9 classes. The location of Tanguar Haor falls in Surma-Kusiyara Floodplain under this sub-classification.

Considering Bio-Ecological zones entire Bangladesh is divided into 25 sub-divisions and Tanguar Haor falls in the division of *Haor* Basin (Sobhan *et al.*, 2012).

2.1.6 Habitation

Tanguar Haor is a unique habitat for wetland plants, freshwater fish and wetland associated wildlife. It is made up of about 50 small, medium and large interconnecting *beels*, some of which are perennial and others seasonal. The higher grounds located in between *beels* are locally known as *Kanda*. In the rainy season, all the *beels* are united as

one large lake or *haor*, making Tanguar Haor the larger freshwater wetland in Bangladesh. Deeper *beels* are connected with rivers in some places but these *beels* are also interlinked with each other which make it a unique character of these *beel* than elsewhere in the country. Additional information on some important habitation and land ownership status (Table 2.2), as well as a resource map of Tanguar Haor (Figure 2.3) are given below.

Table 2.2: Status of land ownership and its distribution in Tangrar Haor area

Distribution of land ownership				
Land category	Area in hectare			
	<i>Khash</i> land	Private land	Distributed land from <i>Khash</i> land	Total
Beel	524.07	4.64	3123.16	3651.87
Reed	163.49	47.25	265.02	475.76
River	348.41	1.01	0	349.42
Fallow land	13.07	0.52	46.54	60.13
Seasonal fallow land	1168.23	3617.21	783.19	5568.63
Cultivated	93.47	3097.34	141.62	3332.43
Seed bed	114.07	141.47	4.76	260.3
Human settlement area	7.3	94.1	1.57	102.97
Khal/Nala/chara	203.91	1.47	2.33	207.71
Pond/Doba	45.16	37.96	0.45	83.57

Source: Final draft report on Community Based Sustainable Management of Tanguar Haor Programme (CBSMTHP) by IUCN

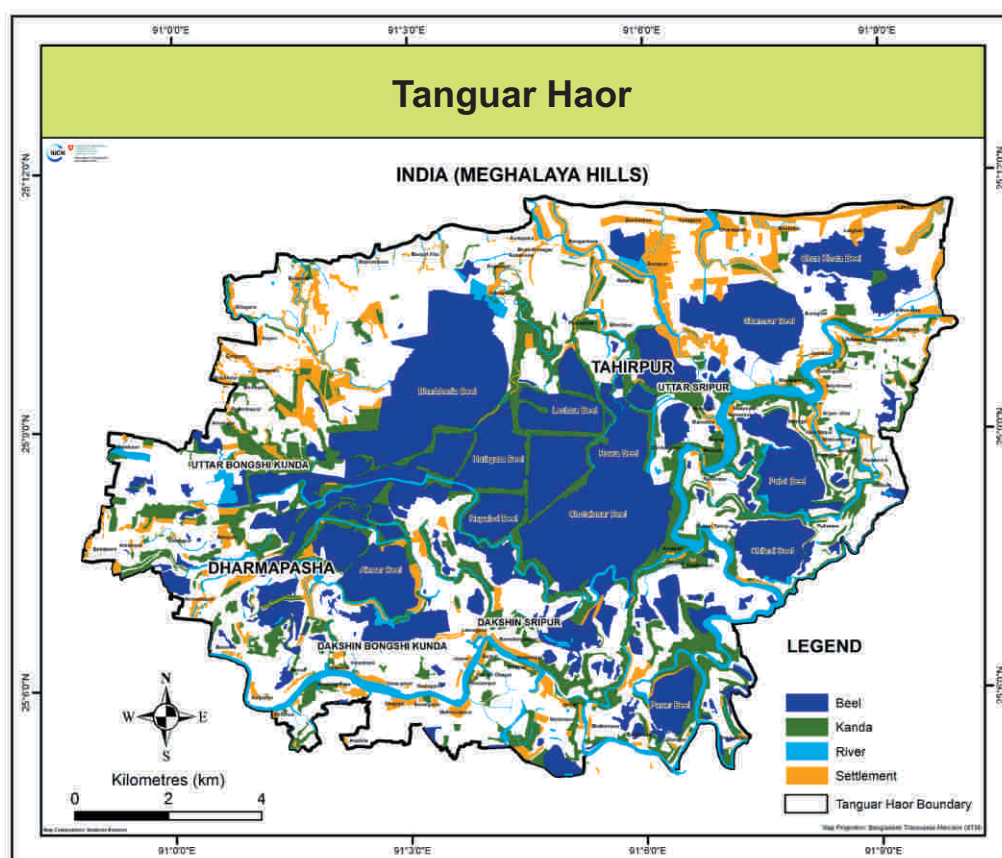


Figure 2.3: Map of Tanguar Haor

Beel

Beels of Tanguar Haor are unique because of good combinations between floral and faunal distribution. There are about 54 *beels* (Tanguar Haor Resource Mapping, 2007, CBS & TSP, IUCN) in Tanguar Haor. Among them 16 are perennial. Total area of the *beel* is 3651.91 hectares.

Kanda

Beels of Tanguar Haor retain water throughout the year. Intermediate place between the *Haor* basin and homestead land are called *kanda*. There are about 180 *kandas* (IUCN Field Survey) in Tanguar Haor. These *kandas* support the major plant communities during drier months. At the onset of monsoon or floods, all these *kandas* go under water, transforming the entire wetland into a single sheet of water, changing the whole scenario. The depth of flooding during monsoon varies from 2 to 10 meters depending on the ground elevation. Usually reed swamp plants are found in these *kanda*. *kanda* is fairly deeply flooded during the rainy season and dry out during the dry season. There are many *kandas* in the Tanguar Haor area which are *khas* land. Though some agricultural practices are undertaken, most of the area works as grazing land for cows, buffalos, birds and fish, to breed once the area is submerged.

The major *kandas* of Tanguar Haor are Lachumara, Rupaboi, Roa *beel* interconnected *kanda*, Ballardubi *beel kanda*, Tekunna and Annar *beel kanda*, Hatirghata *beel kanda* and Berberia *beel kanda*.

River

Tanguar Haor is in the north-east part of Bangladesh, adjacent to the Indian border and is part of a wetland/floodplain complex of the Meghna and Surma River basin. These two rivers are among the main tributaries of the Brahmaputra River. This site is also influenced by the Dhanu Baulai and Jadukata Rivers. Meghalayan Hills are in the North from where a number of hill streams flow into the *haor*. Other important *haors* like Matian, Shanir and Thapner are nearby and have some dependency with some degree of variation. Total river area is 359.39 hectares.

Canal/Khal

About 44 narrow water canals slope down to Tanguar Haor from Indian territory and 30% of these have constant flow throughout the year while rest only remain alive in monsoon. These water flows (narrow canals and rivers) result in huge sediments to the *beels* and adjacent upland (villages).

Chattainna Canal

This canal is located (25° 8'22.3" N 91° 05'12.3" E) at Tahirpur *Upazila* and is directly connected to Rupaboi *beel*. Reed swamps, *Nal*, *Khagra*, *Dhokalmi*, *Phutki* and other herb/shrub etc. are seen to have existed on both sides of the canal, which support a number of rare birds like Ruddy-breasted Crake, Indian Spot-billed Duck and other wildlife. Presence of Rare Glossy Ibis has attracted focus towards this canal. A big *Korocho* forest patch is observed at the Jaypur village end, adjacent to this canal.

2.1.7 Climatic Features

The climatic condition of Tanguar Haor is sub tropical-monsoon with three dominating seasons, summer, monsoon and winter. Average annual rainfall is about 8000 mm in the northern part of Sunamganj with 65-69 % of the total rainfall occurring in the summer. Evaporation enhances rainfall during the spring causing flash floods in Tanguar Haor. Summer starts from the month of April to June with temperatures ranging from 30.9 ~ 33.4°C, while monsoon from May to September and winter from October to February where the temperature ranges from 8.5 ~ 16.6°C. Humidity is about 83% in the wet season and 64% in the dry season. Climatic data (Rainfall, Evaporation and Temperature) for the following BMD meteorological stations had been collected for this study (Table 2.3).

Table 2.3: Rainfall, evaporation and temperature stations with periods of records

Data Type	Station No. (Name)	District	Periods of Records
Rainfall	CL 121 (Mohanganj)	Netrokona	1980-2006
	CL 127 (Sunamganj)	Sunamganj	1980-2008
	CL 49 (Laurergarh)	Sunamganj	1996-2010
	CL 124 (Pagla)	Sunamganj	1980-2004
	CL 123 (Netrokona)	Netrokona	2007-2011
Evaporation	CL 127 (Sunamganj)	Sunamganj	2007-2010
	CL --- (Sreemongal)		
Temperature	Sylhet	Sylhet	1981-2010

Source: BMD & BWMD, 2010

Rainfall

The north-eastern part of Bangladesh experiences higher rainfall than other parts of Bangladesh due to its physiographic considerations. Total number of rainy days in Sylhet (149) is more than that of Srimangal (116) with higher annual normal rainfall (4195.9 mm in Sylhet, 2354.8 mm in Srimangal). More than 80% of annual total rainfall occurs during May to October in both the Sylhet and Srimangal area. The rainfall distributions in from March to October, April to October and May to October for Sylhet and Srimangal stations show similar percentages (Table 2.4).

Table 2.4: Average normal rainfall (mm) and number of normal rainy days at Sylhet and Srimangal

Month	Sylhet		Srimangal	
	Amount of Rainfall (mm)	No. of Rainy Days	Amount of Rainfall (mm)	No. of Rainy Days
January	9.4	2	5	1
February	36.2	4	31.3	3
March	155.3	9	84.1	5
April	375.6	16	216.1	11
May	569.6	20	449.9	18
June	818.4	22	449.7	18
July	819.2	25	339.4	17
August	612.6	22	299.3	18
September	535.9	18	278.5	14
October	223.9	8	150	7
November	30.4	2	40.3	3
December	9.4	1	11.2	1
Annual Total	4195.9	% of Total	2354.8	% of Total
Mar-Oct	4110.5	98	2267	96
Apr-Oct	3955.2	94	2182.9	93
May-Oct	3579.6	85	1966.8	84

Source: BMD & BWMD, 2010

According to the rainfall analysis, highest rainfall occurs in the months from June to August occurring at Laurergarh (CL 49), Sunamganj (CL 127) and Mohanganj (CL 121) stations [Figure 2.4 (a,b,c)]. Highest average rainfall (1242.47 mm in August) was found at the Laurergarh station. The Mohanganj station shows peak during the months of June and July with a sudden rise in the months of August and September. Sunamganj station records show general trend of rainfall distribution similar to other parts of the country.

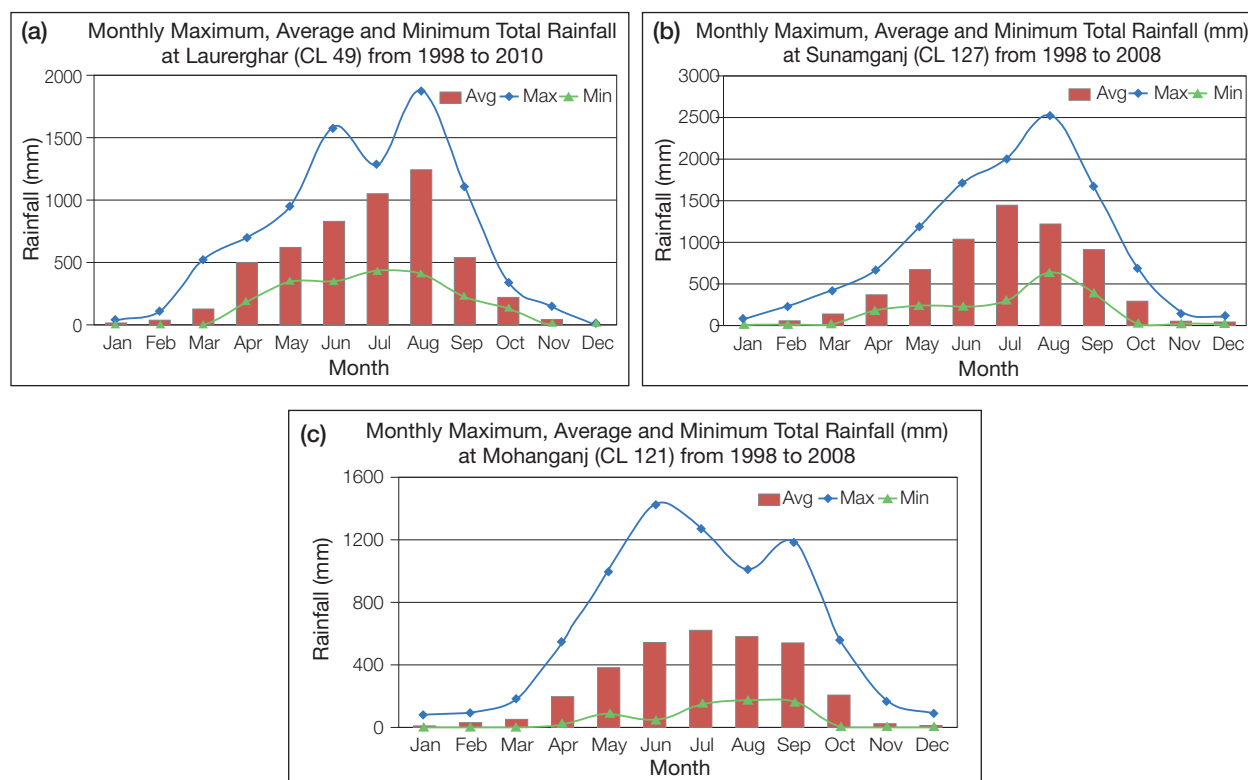
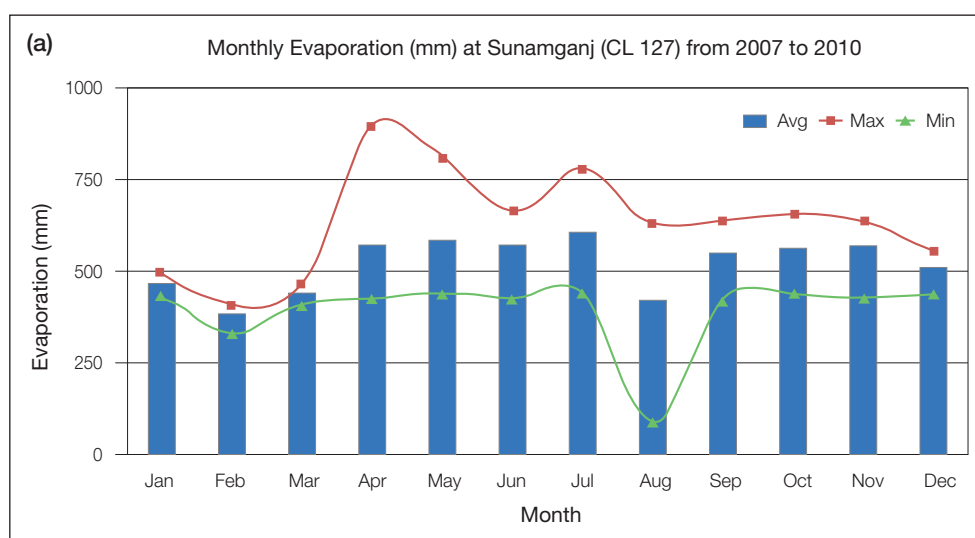


Figure 2.4 (a, b & c): Monthly, Maximum and Average Total Rainfall (mm) at Laurerghar (CL 49), Sunamganj (CL 127) and at Mohanganj (CL 121) stations from 1980 to 2008

Evaporation

Balance amongst rainfall, temperature and evaporation maintains the hydro-meteorological system in Tanguar Haor area. Evaporation from open water and transpiration from vegetation are functions of solar radiation, temperature, wind speed, humidity and atmospheric pressure, characteristics of the surrounding environment, and type and condition of vegetation. Monthly distributions of evaporation for Sunamganj shows average monthly evaporation of about 522.19 mm. Highest monthly evaporation at Sunamganj station has been observed during the months of March to June and lowest during the months from December to February (Figure 2.5a).



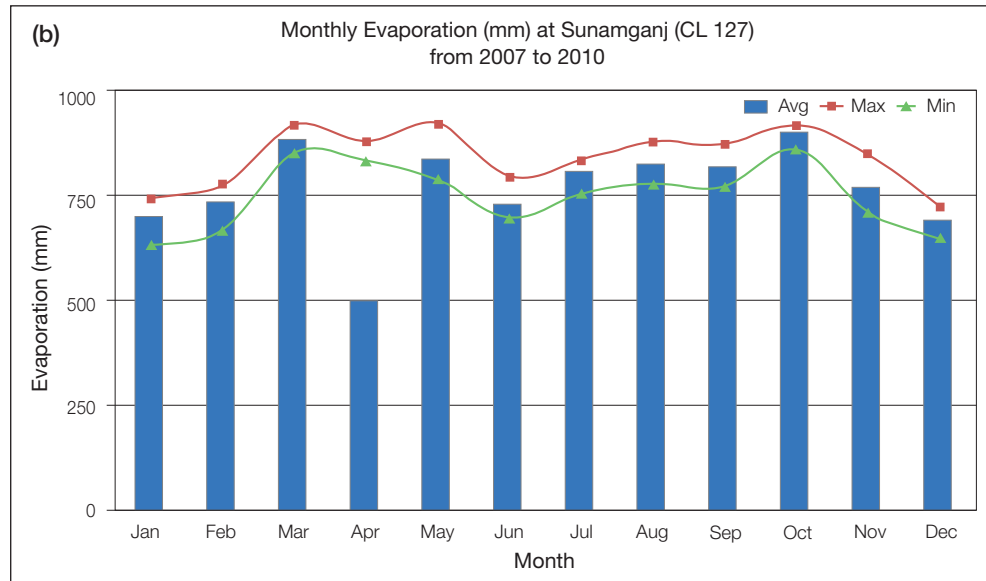


Figure 2.5 (a, b): Monthly Evaporation (mm) at Sunamganj (CL 127) and Netrokona (CL 123) Station from 2007 to 2010

Monthly average evaporation at Netrokona station (CL 123) shows the similar pattern as the Sunamganj station. The evaporation ranges from 647.19 ~ 940.73 mm with an average monthly evaporation of about 812.29 mm from the year 2007 to 2010 (Figure 2.5b).

Temperature

Temperature is an important meteorological parameter for maintaining ecological balance in Tanguar Haor. The Sylhet area has been experiencing temperature range from 9.68 ~ 35.7°C (from January to December).

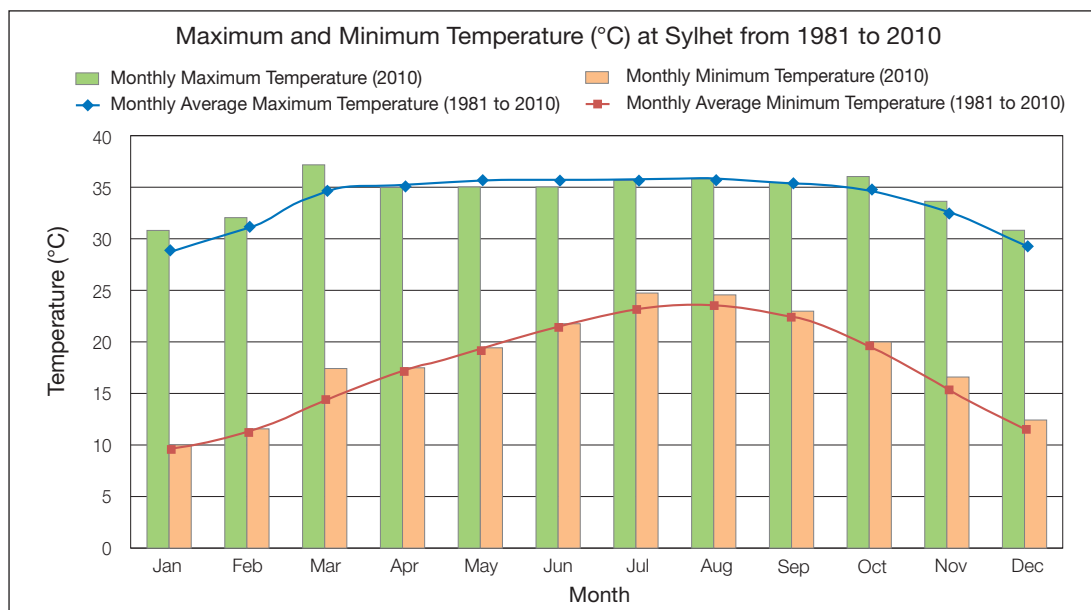


Figure 2.6: Maximum and Minimum Temperature (°C) at Sylhet Station from 1981 to 2010

According to the historical monthly maximum and minimum temperature analysis (from 1981 to 2010), maximum temperature occurs in the month of March-April while minimum temperature occurs in December and January (Figure 2.6).

2.1.8 Diversity of Flora

Principal wetland habitats of Tanguar Haor include open water (with submerged and floating aquatic vegetation), seasonally inundated, and mixed herbaceous vegetation, reed beds and rice fields. Formerly *Pongamia*, *Hijol Barringtonia racemosa*/ and *Koroch Milletia pinnata* (old name *Pongamia pinnata*) were dominant species in swamp forests, but these have now disappeared except for an occasional isolated tree and a pure formation in the Rongchi 'forest', which is an 8-hectare stand of 800 severely-lopped and old trees (Giesen and Rashid, 1997). During the last couple of years, *Barringtonia racemosa* species were replanted on different *kandas*.

Box 2.1: The present status of floral diversity in the *haor* area

Very Rare	Rare	Common	Very common	Abundant
<i>Duchesnea indica</i> and <i>Hydrocotyle sibthorpioides</i>	<i>Alternanthera ficoidea</i> , <i>Aniseia martinicensis</i> , <i>Aponogeton undulatus</i> , <i>Asparagus racemosus</i> , <i>Azolla pinnata</i> , <i>Calamus longisetus</i> , <i>Cardiospermum halicacabum</i> , <i>Ceratophyllum demersum</i> , <i>Chylocalyx perfoliatus</i> , <i>Cissampelos pareira</i> var. <i>hirsuta</i> , <i>Clerodendrum indicum</i> , <i>Crateva magna</i> , <i>Enhydra fluctuans</i> , <i>Hygroryza aristata</i> , <i>Marsilea quadrifolia</i> , <i>Mazus pumilus</i> , <i>Nymphaea nouchali</i> , <i>Nymphoides indicum</i> , <i>Pistia stratiotes</i> , <i>Potamogeton mucronatus</i> , <i>Rorippa heterophylla</i> , <i>Salix tetrasperma</i> , <i>Salvinia cucullata</i> , <i>Schumannianthus dichotomus</i> , and <i>Vitex negundo</i>	<i>Alternanthera sessilis</i> , <i>Aponogeton nutans</i> , <i>Centella asiatica</i> , <i>Chenopodium album</i> , <i>Coix lacryma-jobi</i> , <i>Coccinia grandis</i> , <i>Commelina benghalensis</i> , <i>Cotula hemispherica</i> , <i>Crotalaria pallida</i> , <i>Cryptocoryne retrospiralis</i> subsp. <i>albida</i> , <i>Cyperus compressus</i> , <i>Cyperus rotundus</i> , <i>Echinochloa crusgalli</i> , <i>Eclipta alba</i> , <i>Eichhornia crassipes</i> , <i>Glinus oppositifolius</i> , <i>Hedyotis corymbosa</i> , <i>Heliotropium indicum</i> , <i>Ipomoea aquatica</i> , <i>Lemna perpusilla</i> , <i>Leucas indica</i> , <i>Limnophila heterophylla</i> , <i>Lindernia antipoda</i> , <i>Lippia alba</i> , <i>Ludwigia octovalvis</i> , <i>Ludwigia perennis</i> , <i>Merremia gemella</i> , <i>Nechamandra alternifolia</i> , <i>Nymphaea capensis</i> , <i>Nymphaea pubescens</i> , <i>Nymphaea rubra</i> , <i>Nymphoides hydrophylla</i> , <i>Ottelia alismoides</i> , <i>Oxystelma secamone</i> , <i>Panicum paludosum</i> , <i>Persicaria lanata</i> , <i>Persicaria lapathifolia</i> , <i>Persicaria viscosa</i> , <i>Phragmites karka</i> , <i>Phyla nodiflora</i> , <i>Potamogeton crispus</i> , <i>Pongamia pinnata</i> , <i>Potamogeton crispus</i> , <i>Rosa clinophylla</i> , <i>Rumex dentatus</i> , <i>Schoenoplectus junccoides</i> , <i>Senna tora</i> , <i>Sida rhombifolia</i> , <i>Solanum americanum</i> , <i>Trewia nudiflora</i> , <i>Utricularia aurea</i> , <i>Vicia sativa</i> , <i>Xanthium indicum</i> and <i>Vetiveria zizanioides</i>	<i>Barringtonia acutangula</i> , <i>Cleome hassleriana</i> , <i>Cynodon dactylon</i> , <i>Eleocharis dulcis</i> , <i>Fimbristylis aestivalis</i> , <i>Gnaphalium luteo-album</i> , <i>Hemarthria protensa</i> , <i>Ipomoea fistulosa</i> , <i>Ludwigia adscendens</i> , <i>Najas minor</i> , <i>Persicaria glabra</i> , <i>Persicaria orientalis</i> , <i>Phyllanthus reticulatus</i> , <i>Physalis angulata</i> , <i>Polygonum plebeium</i> , <i>Pteris vittata</i> , <i>Ricinus communis</i> , <i>Saccharum munja</i> , <i>Sagittaria sagittifolia</i> , and <i>Trapa bispinosa</i>	<i>Ficus heterophylla</i> , <i>Hydrilla verticillata</i> , and <i>Vallisneria spiralis</i>

Note: Four species (i.e. *Rosa clinophylla*, *Calamus longisetus*, *Cissampelos pareira* var. *hirsuta*, and *Cleome hassleriana*) occurring in the *haor* area are vulnerable in national context. Moreover, three other species (i.e. *Aponogeton nutans*, *Aponogeton undulatus* and *Asparagus racemosus*) are near threatened in national context. However, none of the species are threatened in the *haor* area.

2.1.9 Wetland Vegetation Analysis based on Habitat Classification

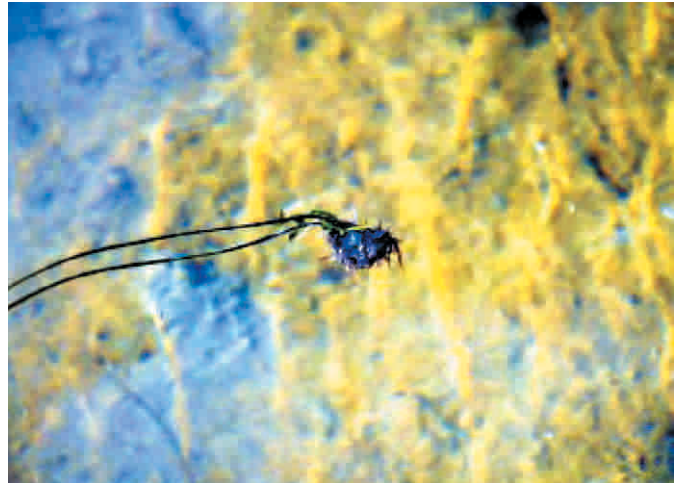
Wetlands are dynamic environments that can experience natural fluctuations in both water level and water quality. As a consequence, some wetland plants are able to tolerate both flooding and short periods of drought within a single year. As primary producers, wetland plants have a vital role in wetland ecology. Wetland plants perform a number of other significant functions including: (a) maintaining water quality by filtering out nutrients and sediments; (b) providing food, shelter and breeding habitat for both aquatic and terrestrial fauna; and (c) preventing soil erosion. Wetland areas are also valued for their landscape amenity, a large part of which is a consequence of the specialized and diverse plant species that are found in them. Bangladesh is a country of wetlands having 7 percent of land permanently under water. In Bangladesh, two sites have been recognized as internationally important wetlands under the Convention on Wetlands of International Importance Especially as Waterfowl Habitats ('Ramsar' Convention). Tanguar Haor is one of those two 'Ramsar' sites.

Aquatic macrophytes are plants that live either completely submerged or floating or have some small portion of the plant emerging from the water. They may be attached (i.e. *Potamogeton*) or unattached to the sediment (i.e. *Lemna*). This category of vegetation can be further divided into three types.

Submerged vegetation

Submerged plants spend their entire life cycle beneath the surface of the water. Nearly all are rooted in the substrate. The term 'submerged aquatic vegetation' (SAV) refers to all underwater flowering plants. Submerged vegetation is confined to the shallow water bodies where enough light penetrates the water column to allow plant growth on the bottom. Those flowering plants are rooted in the sediment and therefore, require a sandy or soft substrate for growth. Submerged vegetation plays a key role in influencing the structure and ecology of aquatic ecosystems. Some important ecological functions of these are: (a) Modification of water flow and reduction in wave turbulence, (b) Accelerated deposition of sediment and organic matter, (c) Physical binding of sediments beneath the canopy, and (d) Nutrient cycling between the water column and sediments.

Because of their high rates of primary production and particle deposition, SAV beds are important nutrient sources and sinks. Submerged vegetation constitutes recruitment areas and shelter for benthic fauna, zooplankton and fish fry and provides important food sources for waterfowl. Some ducks, Jacanas swamp hen, fishes, shrimp and snails, graze directly on the living grasses, while other animals (i.e. clams and oysters) filter bacteria-laden detritus (dead plant tissue) from the water to obtain nutrients. The plants form dense beds that restrict fishing. Large areas of these plants provide too much cover for bluegill and other forage fish. Different types of submerged vegetation have found in Tanguar



Aponogeton nutans

© IUCN/A.B.M. Sarowar Alam



Limnophila heterophylla

© IUCN/A.B.M. Sarowar Alam

*Ottelia alismoides*

© IUCN/A.B.M. Sarowar Alam

*Hydrilla verticillata*

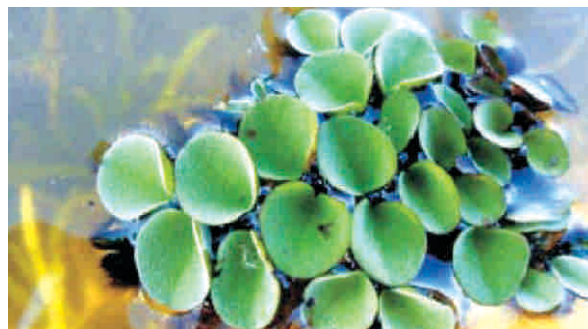
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Haor. Different *beels* of Tanguar Haor viz. Berberia, Hartirgata, Lachumara, Balirdubi and Roa are highly covered with these types of vegetation. On the other hand Tekunna, Rupaboi, Anna are less dense with submerge vegetation because of human pressure and different types of *beel* physical factors.

Twelve submerged species have been recorded from Tanguar Haor area during the study period. These are: *Hydrilla verticillata*, *Aponogeton nutans*, *Limnophila heterophylla*, *Nechamandra alternifolia*, *Ottelia alismoides*, *Utricularia aurea*, *Aponogeton undulatus*, *Ceratophyllum demersum*, *Potamogeton mucronatus*, *Najas minor*, *Vallisneria spiralis*, and *Potamogeton crispus*.

Free-floating vegetation

This type of vegetation floats freely in the water. Leaves and stems of floating plants float on the water's surface. Roots may or may not be present and there is no connection to the bottom substrate. Most floating plants have a suitable counterpoise to prevent the plant from being turned upside down by ripples and waves. For example, *Azolla pinnata* and most of the duckweeds that counterpoise, consists of one or more dangling roots. In *Salvinia cucullata* dissected leaves looking much like hanging roots act as counterpoises. There are various adaptations to afford protection against wetting. The larger duckweeds have a very smooth and glistening surface from which water rolls in the spheroid form. There are some free floating vegetations found in Tanguar Haor which are used as nesting ground by some aquatic insect and other aquatic animals. These types of plants can reproduce quickly under favorable condition completely covering the water surface. Vegetative propagation is usually effected with great rapidity by the branching and budding of the stem and the separation of these branches. The duckweeds and other free-floating plants frequently cover great areas very closely and largely prevent the formation of waves when one throws a stone into the water. In the south, the water hyacinth covers

*Salvinia cucullata*

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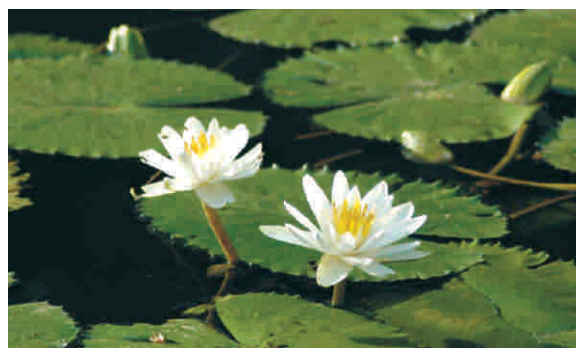
*Azolla pinnata*

© Sourav Mahmud

large areas of *beels*, causing much inconvenience to navigation. Invasion by mats of free-floating plants is among the most important threats to the functioning and biodiversity of freshwater ecosystems. Free floating plants can reduce *haor* productivity and contribute to oxygen depletion resulting in fish death. These types of plants are found in almost all the *beels*. However, most of them are found in the Berberia, Luchamara, Rowa, Rupaboi, Hatirgata, Tekunna and Anna *beels*, nine free-floating species have been found in the Tanguar Haor area during the study period. These species are *Azolla pinnata*, *Hygroryza aristata*, *Eichhornia crassipes*, *Lemna perpusilla*, *Nymphoides hydrophylla*, *Nymphoides indicum*, *Pistia stratiotes*, *Salvinia cucullata*, and *Trapa bispinos*.

Attached-floating vegetation

Attached-floating plants have leaves that float on the water's surface while the roots are anchored in the substrate. Stems connect the leaves, which are circular or oval and have a tough leathery texture to the bottom. These plants sometimes spread so vigorously and reaching nuisance levels particularly in shallow or clear *beels*. This type of vegetation is seen more or less in all *beels*. However, greater dense vegetation is found in Berberia, Lechuamara, Hatirgata and Rowa *beels* than in remaining other *beels*. Aquatic birds such as Pheasant-tailed Jacana, Purple Swamphen, and Whiskered Tern build their nests on these types of vegetation. A number of such attached-floating species have been found in Tanguar Haor area to form this community. Some of them are: *Enhydra fluctuans*, *Ipomoea aquatica*, *Nymphaea nouchali*, *Nymphaea rubra*, *Nymphaea pubescens*, and *Ludwigia adscendens*.



Nymphaea pubescens

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Ipomoea aquatica

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Emergent macrophytes are wetland plants which are always rooted in the sediment and whose growth habit results in the plant protruding above the water surface. They are able to reproduce by either vegetative means or by the production of seed. Vegetative reproduction is more common and much more rapid than reproduction by seed. It involves growth of a below ground rhizome which grows parallel to the ground and produces a clone of its parent a short distance away. This mechanism allows emergent plant populations to change their distribution in response to changes in the wetland's hydrological regime. Emergent macrophytes such as

sedges and rushes are able to respond to long term changes in water levels with the recruitment of new individuals taking place either further upslope or down slope in response to higher or lower water levels. This category of vegetation can be further divided into three types.

Sedges meadows vegetation

Sedge Meadows and Marshes are open wetlands with less than 25 percent shrub or tree cover, and in many cases woody plants are absent. They are a common wetland community type occurring along *haor* margins. They tend to be a part of larger wetland complexes. They are permanently saturated and seasonally flooded. The soils are typically shallow, well-decomposed sedge peat, but also occur on mineral soils with a high organic content in the surface layers. The vegetation is firmly rooted in the organic or mineral substrate, and they typically do not form floating mats when they are inundated. These types of



Eleocharis dulcis

© Internet



Ludwigia perennis

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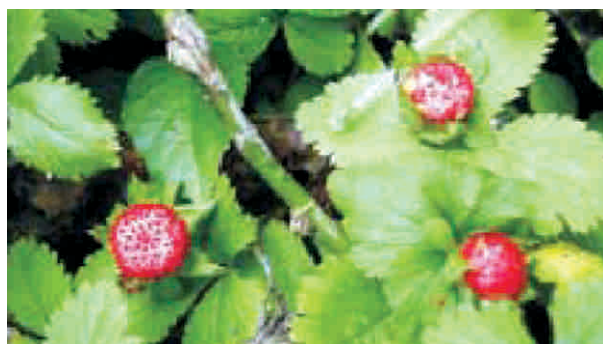
vegetation provide as shelter and food source for some aquatic animals. Local people also use some plants as vegetables. Lechuamara, Berberia, Hatirgata and Rowa *beels* have these types of vegetation.

The study has identified 35 plant species in sedge meadow vegetations in Tanguar Haor area. Usually sedge meadow vegetation in the area are dominated by the sedges (Cyperaceae) growing on saturated soils. Most of the sedges present are *Eleocharis dulcis* (spike-rushes), but *Schoenoplectus mucronatus* (bulrushes), *Fimbristilis dichotoma* and *Cyperus compressus* are also found. Grasses (Poaceae), especially *Hemarthria protensa*, *Vetiveria*

zizanioides and *Echinochloa crusgalli* can also be present. Other herbaceous plants that are frequently found in this community include *Alternanthera philoxeroides*, *Eclipta alba*, *Ludwigia perennis*, *Persicaria glabra*, *Xanthium indicum* etc.

Reedbeds

Reedbeds are a wetland habitat dominated by the Common Reed (*Phragmites karka*). Reeds are tall grass and they can grow up to 3 meters. Reeds can grow both in salt or fresh water but tend to grow at the water's edge where their roots are wet for most of the year. They grow close together in thick mats of vegetation, forming islands often surrounded by open water.



Duchesnea indica

© IUCN/A.B.M. Sarowar Alam



Phragmites karka

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Reed beds are a threatened habitat as the land is often in demand for agriculture. Reed beds are a very important habitat for birds viz. Spot billed duck, Cotton pygmy goose. They build nests among the reed stems to stop the young from being thrown out by the reeds swaying in the wind. Many insects such as moths, beetles and snails also depend on them. Reed beds can help with water purification by trapping sediment in the water, using up the nutrients which help to clean the water. Reeds are used for basket weaving and for thatching the roofs of houses.

Only a few other plants grow among the reeds. Few of such plant species are: *Oxystelma secamone*, *Asparagus racemosus*, *Ficus heterophylla*, *Lippia javanica*, *Duchesnea indica* and *Saccharum spontaneum*.

Freshwater swamp forest

Freshwater swamp forest habitat is typically found on the low lying alluvial plains and is associated with the river and stream systems. These Freshwater swamp forests covered significant portions of lowland in Bangladesh and have suffered significant depletion through logging, sand mining and reclamation for other commercial uses. Freshwater swamp forests come about due to flat low lying land becoming inundated due to rainfall runoff and inflow from the surrounding river system. In swamp forests, the water table is typically very close to the surface. This continuous inundation gives rise to a habitat that is floristically distinct from the surrounding forests. The trees that reside in the swamp forest exhibit different strategies for survival in the soft and water logged conditions, typical tricks include growth of buttresses, stilt roots as well as different types of pneumatophores.

This type of vegetation can be seen in the Chattania khal, Rupaboi beel and Tenkunna beel in Tanguar Haor area. Some birds and mammals use this forest type as a resting and nesting place. However, there is a great concern for this swamp forest habitat due to over logging and suspected seepage from upstream reservoirs resulting in significantly changed circumstances for many swamp forest species. This swamp forest is all that



Barringtonia acutangula

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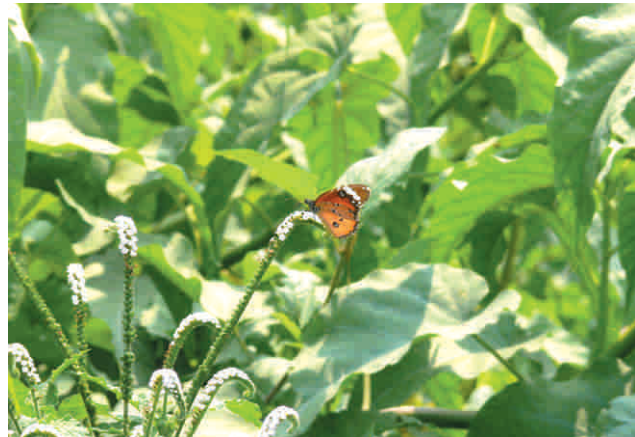
remains of this habitat reside conservation, status of which is vulnerable even though some may be considered common within the swamp forest habitat, examples of these include *Rosa clinophylla*. Common swamp forest tree species such as *Pongamia pinnata*, *Barringtonia acutangula*, *Crataeva magna* and *Salix tetrasperma* reproduce by the production and dispersion of seed. As a consequence, they are unable to respond to rapid changes in water levels. They can however tolerate several years of continuous inundation before tree death occurs. One cultivated shrubby plant is also found among that vegetation (i.e. *Schumannianthus dichotomus*).

There are another two types of vegetation which are common in the *haor* area e.g. cultivated land vegetation and homestead vegetation.

2.1.10 Cultivated Land Vegetation

A large number of cultivated lands are seen throughout Tanguar Haor area during the winter season when most of the part of the *haor* becomes dry. These seasonal wetlands often have a higher diversity of aquatic and fringing vegetation in comparison to permanent wetlands.

This is because there are a greater number of microhabitats in seasonal wetlands. Those lands act as important ground for the migratory ducks and also for local people. Local people cultivate rice and other crops during that season. This type of land is found in Lechuamara beel, Berberia beel, Rupaboi beel and Kalma beel area. This ground is very rich in species diversity. A total of 60 herbaceous taxa have been recorded from that area during the study. Some of them include: *Alternanthera sessilis*, *Cotula hemispherica*, *Cynodon dactylon*, *Heliotropium indicum*, *Leucas zeylanica*, *Kyllinga nemoralis*, *Eleocharis dulcis* etc.



Heliotropium indicum

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2.1.11 Homestead Vegetation

Like most villages in Bangladesh, homestead vegetation of Tanguar Haor is rich in species diversity. The backyards of village homes often have dense growth of planted and natural vegetation and are particularly important in supporting a number of wildlife. This wildlife use the homestead vegetation and surrounding crop fields (Rice, Wheat, Jute, etc.) for their food and shelter. The common species that constitute homestead vegetation are *Mangifera indica*, *Artocarpus heterophyllus*, *Syzygium cumini*, *Litchi chinensis*, *Ziziphus mauritiana*, *Antgocephalus cadamba*, *Albizia procera*, *Bambusa* spp., *Bombax ceiba*, *Diospyros perigrina*, *Erythrina variegata*, *Borassus flabellifer*, *Cocos nucifera*, *Barringtonia acutangula*, *Ficus hispida*, and *Ficus racemosa*.

The ecological characteristic, particularly of the vegetation patterns, differs sharply between permanent and seasonal water bodies. In the monsoon, the permanent water body shows higher species diversity than in the winter season. However, seasonally dried land shows highest species diversity in the winter season and lesser in monsoon. Seasonal variation has enormous effects on the species growth. Different plant species grow in different season and some species can grow all the year round.

Plant species which appear winter include: *Chenopodium album*, *Cleome hassleriana*, *Crotalaria pallida*, *Eclipta alba*, *Heliotropium indicum*, *Physalis angulata*, *Rorippa heterophylla*, *Solanum americanum* etc.

Plant species appearing in the summer are: *Phyla nodiflora*, *Sagittaria sagittifolia*, *Trapa bispinosa* etc.

Plant species occurring all the year round are: *Asparagus racemosus*, *Calamus longispinosa*, *Coix lachrym-jobi*, *Cynodon dactylon*, *Ficus heterophylla*, *Ipomoea fistulosa*, *Lippia alba*, *Saccharum munja* etc.

2.1.12 Diversity of Phytoplankton

In any aquatic ecosystem the phytoplankton works as the backbone of all zooplankton that in turn keep the predatory animals alive in wetlands and other aquatic environments. The phytoplankton communities of the

Tanguar Haor wetlands are very much linked with zooplankton and fish productivity. Several studies have highlighted these issues. One among these, Muzaffar and Ahmed (2006) so far found 107 genera of phytoplankton representing five classes. These are as follows:

- **Chlorophyceae:** *Radiofilum, Eudorina, Gonium, Pandorina, Pleodorina, Platydorina, Volvox, Pyrobotrys, Sphaerocystis, Gloeocystis, Palmodictyon, Nannochloris, Ulothrix, Chlorococcum, Mycanthococcus, Golenkinia, Dictyosphaerium, Characium, Pediatrurum, Euastropsis, Ankistrodesmus, Cerasterias, Glaucocystis, Kirchneriella, Pachycladon, Selenestrum, Trochiscia, Westella, Coelastrum, Crucigenia, Scenedesmus, Mougeotia, Eremosphaera, Spirogyra, Gonatozygon, Closterium, Pleurotaenium, Cosmarium, Sirocladium, Micrasterias, Staurastrum, Xanthidium, Arthrodesmus, Spondylosium, Desmidium, Hyalotheca, Sphaerosozma, Euglenoidea, Trachelomonas* and *Pyrobotrys*.
- **Xanthophyceae:** *Botryococcus*.
- **Chrysophyceae:** *Synura, Uroglenopsis, Dinobryon, Gloeobotrys* and *Phaeosphaera*.
- **Bacillariophyceae:** *Melosira, Coscinodiscus, Biddulphia, Fragilaria, Synedra, Navicula, Pinnularia, Nitzschia, Amphora, Cymbella* and *Suriella*.
- **Dinophyceae:** *Ganyaulux, Ceratium, Peridinium, Glenodinium* and *Attheya*.
- **Cyanophyceae:** *Chroococcus, Gloeocapsa, Synechocystis, Aphanocapsa, Synechococcus, Microcystis, Merismopedia, Eucapsis, Dactylococcopsis, Coelosphaerium, Spirulina, Oscillatoria, Borzia, Lyngbia, Schizothrix, Trichodesmium, Anabaena, Nostoc, Anabaenopsis, Nodularia, Tolypothrix, Rivularia* and *Gloeotrichia*. Blooms of *Microcystis* dominated the phytoplankton community throughout the study period but were particularly acute during the early part of the high water period.

2.1.13 Diversity of Fauna

Based on Nishat (1993), Karim (1993), NERP (1993a) and BNH (1997), it is estimated that a total of 200 wetland plant species, 141 fish species, 11 amphibians, 34 reptiles (6 turtles, 7 lizards and 21 snakes), 206 birds and 31 mammals occur in this *haor* (Giesen and Rashid, 1997).

Wetland International (WI) conducts waterfowl census every year in different wetlands in Bangladesh with the help of Bangladesh Bird Club (Bbc). On an average, fifty thousand individuals of around 70-80 species are found every year from Tanguar Haor. Every winter about 60 species of migratory birds come to this Tanguar Haor as this *haor* is an ideal place for their food and habitat.

2.1.14 Fisheries Resources

The fisheries resources of Tanguar Haor is very rich and has a high importance level in terms of fish production, fish habitat, breeding support, national economy and livelihood support. It is one of the 'Mother Fisheries' of a total of six of the country. The *haor* is very important in terms of fish species diversity. Based on DoZ (1997), Nurazzaman (1997) and Khan (1997) the estimated number of fish species is 141 under 35 families. The number is around half of Bangladesh's total 350 freshwater fish species. Not only number, the *haor* supports very important fish species, many rare species and some threatened species. It supports 10 IUCN Red Data Book

and 22 CITED-listed species. The critically endangered species like *Bagarius bagarius*, *Clupisoma garua*, *Crossocheilus latius*, *Ctenops nobilis*, *Eutropiichthys vacha*, *Labeo boga*, *Mystus seenghala*, *Notopterus chitala*, *Pangasius pangasius*, *Rasbora elanga*, *Rasbora*, *Rita rita*, *Rohtee cotio*, *Silonia silondia* and *Tor tor* can be found in Tanguar Haor.

Tanguar Haor is dominant with indigenous fish species though there are evidences of exotic fish species



Local fisherman with push net

© IUCN

which include Rui (*Labeo rohita*), Mrigel (*Cirrhinus cirrhosus* or *Cirrhinus mrigala*), Shoal (*Channa striatus*), Puti (*Puntius ticto*), Chanda (*Chanda nama*), Boal (*Wallago attu*) and invertebrate Chingri or shrimp (*Penaeus* spp). The other important fish species are Aier (*Mystus aor*), Magur (*Clarius batracus*), Baem (*Anguilla bengalesis*), Gutum (*Lepidocephalus guntea*), Lasu (*Cirrhinus reba*), Fali (*Notopterus notopterus*) etc. In the 1999-2000 fiscal year, the government earned Tk 70,73,184 as revenue just from fisheries of the *haor* (Talukder, 2006). Three species *Channa barca* (Pipla, or Tila Shol), *Labeo boggut*, and *Labeo nandina* (Nandina) are considered as extinct, 16 species are critically endangered and 26 are endangered (Giesen and Rashid, 1997).

2.1.15 Present Status of Wildlife

In 2011 a field survey was conducted which identified 19 mammal species in Tanguar Haor. The seven mammal species (Indian Flying Fox, Greater Bandicoot Rat, Lesser Bandicoot Rat, House Rat, House Mouse, Fishing Cat and Small Indian Mongoose) were found by direct field visit.

Birds of Tanguar Haor are harmoniously linked and adapted with the seasonal hydrological cycle. These linkages and adaptations are closely interlinked with the birds feeding, breeding and migratory behaviours. A total of 219 birds species were found in Tanguar Haor. During 2011 survey period, 167 species (total individuals-65,010) were identified. Among them 50.08% are aquatic and 49.10% are terrestrial. The survey team found 50.29% migratory and 49.70% resident birds. Of all the birds 12.57% were ducks, 6.58% were raptorial and 18.56% were waders.

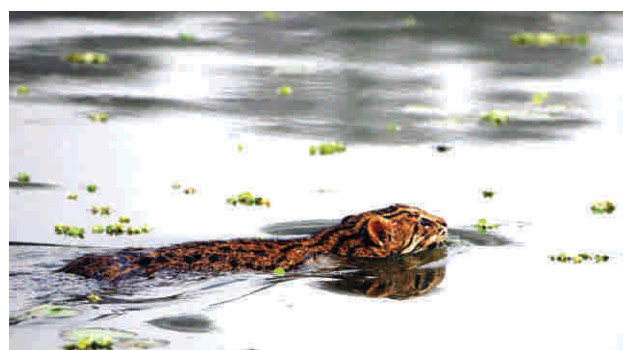
During the survey (2011) period, 24 species of reptiles and 8 species of amphibians were recorded from Tanguar Haor. (Alam *et al.*, 2012)

Survey of wildlife has been conducted in selected major *beels* and adjacent terrestrial areas of Tanguar Haor. The status and distribution has also been recorded accordingly. As Tanguar Haor is recognized as a unique place being home to thousands of resident and migratory water birds, survey of bird fauna had been given priority during this study. Details of observations and findings are as follows.

Mammalian Fauna

Based on NERP (1993a) and DoZ (1997) the number of mammals is 34 under 15 families. Among these 17 are considered as few, 7 are fairly common, 5 are rare and 5 are occasional.

During the survey (2011) out of 19 species of mammals recorded, 10 were from direct field visits and 9 from focus group discussion and literature review. The seven mammal species found during field visits are Indian Flying Fox, Greater Bandicoot Rat, Lesser Bandicoot Rat, House Rat, House Mouse, Fishing Cat and Small Indian Mongoose.



Fishing cat



Jungle cat

Tanguar Haor is a very suitable habitat for Fishing Cat. During dry season the *kandas* of the *haor* get visibility. The Fishing Cats hide in these *kandas* at day times. Tekunna Kanda, Rupaboi, Golabari-Jaipur and Chattannai Kanda are very important shelters for this globally threatened species.

Plenty of bushy undergrowth in and around homestead areas supports Golden Jackal and Small Indian Mongoose. Besides this, number of cultivated lands and paddy fields exist in the *haor* adjacent areas, which also provide food supplements to other lower mammals like rats, mice etc.

Avian Fauna

Tanguar Haor is the home to thousands of resident and migratory water birds. A large number of these birds use the aquatic vegetation for shelter, food and nesting. Status and diversity of birds in different *beels* in this *haor* area were analysed. We have also identified some rare sighting birds which are nationally and globally threatened.

Earlier Geisen & Rashid (1997) estimated the number of bird species in Tanguar Haor as 213. Their records included ducks, geese, shelduck, wigeon, shoveler, pintail, teal, pochard, woodpecker, flameback, barbet, hoopoe, roller, kingfisher, bee-eater, coucal, koel, swift, swallow, pigeon, dove, crane, rail, swamphen, moorhen, coot, snipe, godwit, sandpiper, greenshank, stint, jacana, plover, lapwing, gull, grebe, cormorant, egret and herons etc. It is estimated that the influx of migratory birds has declined by about 65% since independence (1971), and the primary reason for this is regarded to be indiscriminate hunting.



Common Kingfisher (*Alcedo atthis*)

© Samiul Mohsanin

Migratory birds

Tanguar Haor is a unique habitat for migratory birds especially ducks. The current survey team has recorded 84 migratory birds from different *beels* including some adjacent grounds of this *haor*. Among the globally threatened birds, Baer's Pochard, Baikal Teal, Falcated Duck, Greylag Goose, Red-crested Pochard, Black-tailed Godwit, Bar-tailed Godwit, Long-toed Stint, Peregrine Falcon, Black Bittern and Glossy Ibis were found in the survey. Maximum (36 species) migratory birds were observed in the Lechuamara *beel*.



Common Pochard (*Aythya farina*)



Lesser Whistling Duck (*Dendrocygna javanica*)



Black-tailed Godwit (*Amauromis phoenicurus*)

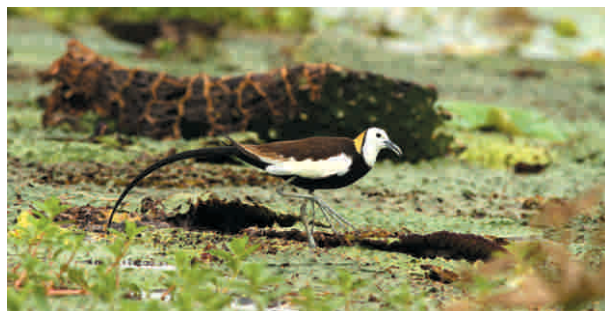
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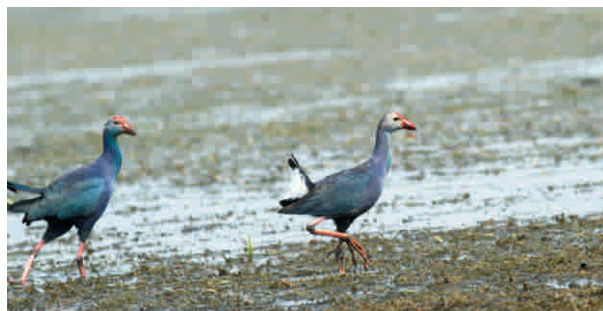
Resident birds

Tanguar Haor is blessed with a number of resident birds. The current survey identified 83 resident species (including aquatic and terrestrial birds) which were found in different *beels* together with some terrestrial habitats of this *haor*. Among the duck species, Indian Spot-billed Duck and Cotton Pygmy-Goose were found during the



Pheasant-tailed Jacana (*Ninox scutulata*)

© Sayam U. Chowdhury



Purple Swamphen (*Porphyrio porphyrio*)

© IUCN/A.B.M. Sarowar Alam

survey. Large number of Little Grebes was also encountered. Purple Swampphen, White-breasted Waterhen, Ruddy-breasted Crake, Pheasant-tailed Jacana, Bronze-winged Jacana, Black Bittern were notable sightings of the survey. Grey-headed Fish Eagle and Oriental Darter are threatened resident birds which were found in this survey. Little Cormorant (3648) and Purple Swampphen (3419) were found as dominant resident birds at Tanguar Haor during the survey.

Terrestrial birds

Apart from searching the aquatic habitat the survey was also carried out in terrestrial areas in and around the *haors* viz. Indrapur, Birendranagar, Bangalvita, Bakatola, Rupnagar, Lamagaon, Golgaon, Golabari, Joipur, Rongchi, *Kandapara*, Ratanpur, Binodpur, Paniakhali. Little over 49.10% birds were recorded from these terrestrial sites. Among the raptorial birds, two globally threatened viz. Pallas's Fish Eagle and Greater Spotted Eagle were found in this survey.



Pallas's Fish Eagle (*Haliaeetus leucoryphus*)

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Reptiles

Based on NERP (1993a) and DoZ (1997) the number of turtles species are six under two families, lizards are seven under four families, snakes are 21 under five families. According to Giesen and Rashid (1997), many species are threatened, such as, turtles, monitor lizards and Rock Python. The Rock Python is classified as Vulnerable, and the Spotted Pond Turtle and Yellow Monitor Lizard are classified as intermediate threatened species. Common Roof Turtle, Peacock Softshell, Spotted Flapshell and Bengal Lizard are listed under CITES I or II.



Bengal Monitor Lizard (*Varanus bengalensis*)

© Reza Khan



Spotted Flapshell Turtle (*Lissemys punctata*)

© Reza Khan

Several freshwater turtle breeds in Tanguar Haor. These include Common Roof Turtle, Spotted Mud Turtle, Spotted Flapshell Turtle, Bengal Eyed Turtle and the Peacock Softshell Turtle. They lay their eggs in vegetated levees.

During this present survey period (2011) we recorded 24 species of reptiles of which 17 were from direct field visits and 7 from focus group discussions and literature reviews. Our survey of 10 species revealed three Snakes, four lizards and two turtles.

Tanguar Haor is a suitable habitat for turtles. Of the two recorded turtles, Peacock Soft-shell turtle is threatened globally. For turtle surveys, early winter season is most important because turtles come out for basking at this time. In late rainy season, turtle hunters hunt turtles with *hajari barshi*, so for turtle surveys it is necessary to conduct the surveys during these two seasons.

Amphibians

Based on NERP (1993a), DoZ (1997) the estimated numbers of amphibian species are 11 under four families. Among these Bull Frog is threatened and listed under CITES Appendix I, II.

During this present survey period (2011) we recorded 8 species of amphibians of which all species were from direct field visits. The present survey was conducted in the late summer which is why only a partial assessment of amphibian fauna was done.

Indian Bullfrog (*Hoplobatrachus tigerinus*)Common Skittering Frog (*Euphlyctis cyanophlyctis*)

After analyzing the wildlife census data and diversity index, it is clear that there is a need to improve the habitat (*beels* and adjacent *Kandas*) which supports thousands of resident and migratory birds as well as other wildlife which dwell in Tanguar Haor.

2.1.16 Diversity of Bird Population

During our survey period, some globally important birds were recorded from different *beels* in Tanguar Haor. These include Bar-tailed Godwit, Long-toed Stint, Pallas's Fish Eagle, Peregrine Falcon and Black Bittern. The present study shows that Lechuamara *beel* has the highest diversity index of 2.31 while Hatirgatha *beel* has the lowest value with 1.56. The following graph (Figure 2.7) shows the diversity index of the *beels* surveyed at this time. The diversity status of the Lechuamara, Roa and Ballardubi is in quite good state but the indexes of the other *beels* viz. Tekunna (1.58), Berberia (1.87), Bagmara (1.89) and Rupaboi (1.97) are not satisfactory. Ulan *beel* also represents very low diversity of bird population.

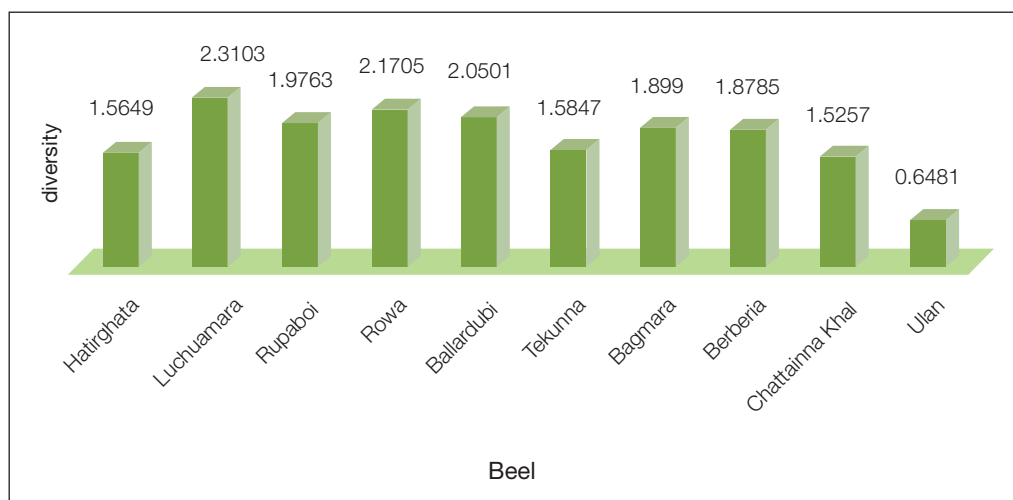


Figure 2.7: Diversity Index of birds at Tanguar Haor (IUCN, 2012)

Nesting Sites of Birds

Tanguar Haor is a suitable nesting habitat for various birds including Purple Swampphen, Pheasant-tailed Jacana, Cotton Pygmy Goose, Indian Spot-billed Duck and Pallas's Fish Eagle. These birds are seen nesting in Tanguar Haor at a greater extent than in comparison to the other nesting sites in Bangladesh.

Rare Sightings

Baer's Pochard: Globally endangered bird, Waterbird survey 2011 by Wetland International (A team of Bangladesh bird club conducted the survey in Bangladesh) recorded eight of these species in Bangladesh. Among them five were recorded from Tanguar Haor. During our survey, we found one individual.

Baikal Teal: Globally Vulnerable bird. Only one individual recorded during our survey in Tanguar Haor. This is the only finding of this bird this year in Bangladesh. It is the second sighting in Bangladesh for the last 10 years. Previously the bird was seen at Dhaka National Zoo in 2003. It is a vagrant species in Bangladesh.

Falcated Duck: This is a rare migratory bird which is globally near threatened. Three individuals were recorded in our survey.

Glossy Ibis: This is a vagrant species. Only three individuals recorded from Tanguar Haor during our survey period. In 2001 only one individual was seen in the coastal belt.

Ferruginous Pochard: Globally, this bird is considered as Least Concern. It is assumed that its world population is about one hundred thousand. During 2002 water bird survey, 92,000 individuals were recorded at Tanguar Haor. This species occurred abundantly at Tanguar Haor. During our survey we have recorded 3060 individuals of this species from Tanguar Haor.

Black-tailed Godwit: This is an important shorebird and almost a globally threatened. In all 1214 individuals were recorded during our current survey.

Greylag Goose: This is an uncommon bird. It is known as Least Concern globally. Only one individual was recorded during our survey.

Whiskered Tern: 1975 individuals were recorded from Tekunna beel of Tanguar Haor during our current survey. Such a huge number with breeding plumage is rarely seen in our country.

2.1.17 Waterfowl Census in Tanguar Haor (1992-2012)

As the part of Asian Waterfowl Census Programme, Bangladesh bird club conducts this survey in Bangladesh and is carried out in January. Waterfowl Census from 2001 to 2005 shows that birds population status is observed to be higher, but the trend has been somewhat decreasing since then. From 2006, bird population is decreasing at an alarming rate. The management team of the Tanguar Haor project took some special initiatives to conserve waterfowls, which involved the declaration of [bird sanctuary] awareness campaign etc. The current survey was conducted after a long period of the project implementation phase. The following figure (Figure 2.8) represents the status of birds recorded from Tanguar Haor in different years.

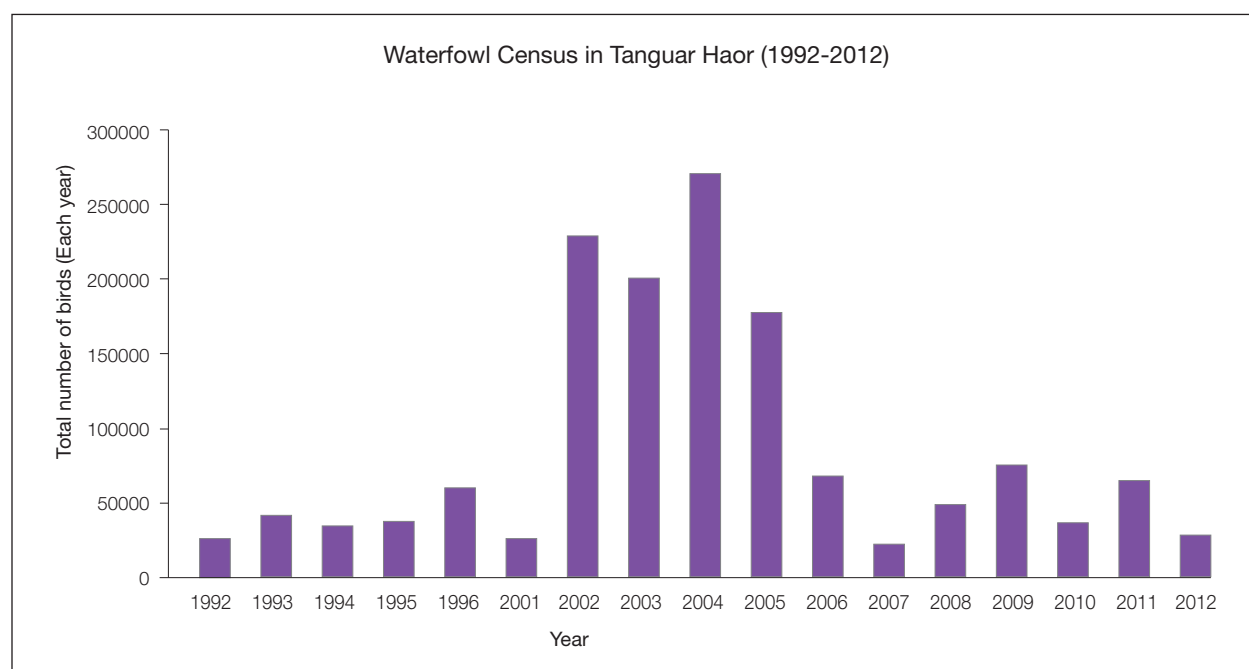


Figure 2.8: Waterfowl Census in Tanguar Haor (IUCN, 2012)

2.2 Community Development Settings

2.2.1 Introduction

With an estimated area of 10,000 ha, Tanguar Haor has been classified as a wetland of international importance under the Ramsar Convention since 2000. About 50% of the area (5,682 ha) of Tanguar Haor is water bodies, followed by 31% crop land (Phase I Completion Report, IUCN 2010). Being located in the north-eastern district of Sunamganj and at the foothill of the Khasi hills, the complex ecological system of the Tanguar Haor provides livelihood to some 77,000 population living in 88 island-like villages with as low as 5 households in a village to as big as 571 households (Census Data, Tanguar Haor, 2007) which administratively falls under two Thana (police station) and 4 unions. Recent estimate (BBS, 2011) shows that about 350,000 people live in these four unions. Having dominance by Bengali people, a small quantity of 10% belongs to the Garo and Hajong ethnic minority groups and live in 11 villages on the northern side of the *haor*. Depending on religion, majority of the population is Muslim (about 78%) and rest others are Hindu (BCAS, 1997). These peoples are totally dependent on the *haor* for their income, employment and livelihood. Paddy cultivation and fishing are the two major income sources with many other minor sources such as duck rearing and cattle/buffalo fattening. The socio-economic structure of the *haor* villages is influenced by its length, breadth, remoteness and low level of education. Having an average household size of nearly 6, average income is about BDT 7306 per month (IUCN, 2012). Compared to national average income condition, the statistics show a good position but Haque and Kazal (2008) argued that the income distribution is highly unequal and followed a skewness, with few large farmers and a majority of rather small farmers.

2.2.2 Human Habitation and Settlement

The known history of human habitation in Tanguar Haor is of recent time. During the period 1780-1900 there was a considerable outward migration from the *haor* due to successive natural calamities that result in decreased population number (Nishat, 1993). But the situation started changing by the second half of the 19th century; the *haor* basin ecosystem recovered from this environmental stress regained its productivity. From the first quarter of the 20th century, the area began to attract settlers again from surrounding densely populated regions (Nishat, 1993), which is still ongoing (Talukdar, 1993). However, outward seasonal migration is still rampant in the area, particularly in the dry season. BCAS (1997) found that 17.8 % of adult males and 5.2 % of adult females had been engaged in such seasonal migration. In addition, a large number of fisherfolk (1200-2000) and their families annually established temporary fishing camps at Tanguar Haor in the fishing season (4-5 months), who afterwards returned to their home.

2.2.3 Land Tenure

The land tenure system of Tanguar Haor is complex and often found in competing claims between public and private entities. Historical chronology is important to understand the tenure system in Tanguar Haor. So far known, the area was under control of the Zamindars of Bangshikunda until 1920 and later on, it was transferred to the Zamindars of Gouripur. With the abolition of the Zamindar system (State Acquisition & Tenancy Act 1950), the area came under the control of the government as *khas* (government) land. However, land administration was mostly informal until 1960.

In independent Bangladesh (after 1971), the status of Tanguar Haor continues as *khas* land and is controlled by two local government agencies, the Department of Land Revenue (Ministry of Land) and the District Commissioner's Office (Ministry of Establishment). A major shift in control over Tanguar Haor has been observed in the year 2000 when the Ministry of Environment and Forests (MoEF) took management charge of it as part of the enactment of the Environmental Conservation Act (1995) and Rules (1997) concerning Ecologically Critical Areas. The MoEF exercises its responsibilities through the District Administration in Sunamganj, under the direction of the Deputy Commissioner, Sunamganj.

Under the auspices of Sunamganj district administration, two-third (about 7,500 hectares) of Tanguar Haor is leased out as a commercial fishery (*jalmahal*), although accurate figures are lacking. Before MoEF intervention in 2000, the leaseholders controlled the area through buying concession from government. Interestingly, the leasehold area would vary according to the season. Even though in the dry season the leasehold was confined to

the concerned *beels*, while in the wet season this jurisdiction extended to the entire water body. To impose their control over all the resources throughout the year, the leaseholders maintain their surveillance team who are often found in violent situations with other competing groups and villagers.

Since Tanguar Haor is a government land, the local community at Tanguar Haor generally does not possess legal documentation, proving ownership of land such as land rights or deeds. Rather, they practice ancestral or historic rights to land in and around the village, usually based on the traditional *likhon* system. Ownership of certain resources is sometimes unclear. In addition to managing Tanguar Haor, the Forest Department leases a small area (23 ha) of *chonmahal* (grassland) and reed land.

Surrounding land areas of Tanguar Haor are mostly privately owned. These holdings are generally small. BCAS (1997) has found that 45 % land holdings were smaller than 0.5 acres, 25.9 % in the range of 0.5-2.0 acres, 20.0 % in the range 2.01-5.0 acres and 8.9 % larger than 5.0 acres.

2.2.4 Land Use

Land (and water bodies) use in Tanguar Haor is diverse and it changes with the seasons. Even though agriculture and fishing are the dominant land use for this region, other practices such as forests and pastures and reed-beds are also common and provide a considerable amount of livelihood depending on season. A combination of topography and the annual cycle of flooding and receding of waters dictate the land use patterns. Generally, elevated ground (*Kandas*) is cultivated with a variety of *rabi* (winter) crops, trees (e.g. fruit trees) and is used for habitation. In the north of Tanguar Haor, near the border to India, wheat is extensively cultivated in the winter months. Low-lying areas are generally used for rice cropping, and deeply flooded areas (*beels*) are used for fishing activities. Even though some areas have been designated as 'forestry land', they consist of reed land and grassland and the only remaining forest area is a small patch of 8 ha near Rangchi, which is not managed by the Forestry Department. BCAS (1997) carried a survey and found that in between 1947 and 1996 the forest area has decreased from 18 % to 5 %, while agricultural land has increased from 58 % to 67 %. During the period, settlement area doubled in Tanguar Haor.

2.2.5 Infrastructure and Social Development Services

Kanda

The villages at *haor* are built on elevated land, mostly artificial hillocks, locally known as *kandas*. Many of the villagers built reinforced structure along the perimeter with rocks or bricks to prevent wave erosion or plant locally available swamp trees and shrubs that also serve as buffer to wave action. Another interesting practice is placing mats of coarsely woven reeds or grass along the edge of the *kandas*, to protect their homesteads from erosion, particularly in Monsoon. Despite highlands during peak floods, some of the *kandas* also submerged and giving the whole hoar the look of a vast sea.

Roads

The communication system in Tanguar Haor is also highly dependent on seasons. There is no permanent paved road network in the *haor*, but a number of unpaved trails connect the various villages and link these with Dharmapasha and Tahirpur in the dry season. In the winter season, pedestrians, ox-carts, motorcycles and bicycles are able to use these trails, however all these trails are submerged and access becomes limited in the wet season, allowing only boat supported communication for the *haor* inhabitants. In addition, large diesel powered boats – usually with a cabin along the entire length – provide for regular transport of goods and passengers between Tahirpur and Sunamganj and from Dharmapasha.

Fuel and Electricity

None of the village around Tanguar Haor is linked to the national electricity grid, and there are no diesel powered generators either. Even though few solar connections exist in the locality, they are mostly used by and are accessible to the rich farmers. Majority of the households (88%) use kerosene based Hurricanes for lighting at night (Haque and Kazal, 2008). Similarly, fuel for cooking is scarce in the region and most of the households depend on freely available fuel sources collected from the *haor* such as twigs, branches, reed, etc. However, the availability of wood fuel is decreasing day by day because of large scale deforestation that had been taking place in the *haor* for many years. Therefore, many households are now partially dependant on other sources like

kerosene, branches and twigs from homestead gardens. Haque and Kazal (2008) found that majority of the households used more than one sources of supply for their fuel for cooking. 60 percent of the households still collect it from *haor*, 66 percent from village forests, 30 percent buy them from the market.

Water

“Water, water everywhere but not a drop to drink”- this is very true for the people of Tanguar Haor. Despite being a large wetland, pure drinking water is a crisis for the people of Tanguar Haor in all seasons. In dry seasons, they suffer from water scarcity and in wet seasons from flooding. In the past, communal ponds and wells were used to fulfill drinking water demand. With the assistance from many development organizations and government, a considerable portion of the population is now using tube wells for drinking water. However, the tube well use rate is below the national average. At Tanguar Haor 88.3% people have access to tube well, whereas the national average is 97% (Haque and Kazal, 2008). As a result of this development, communal ponds are generally in a state of neglect and are mainly used for bathing or duck keeping.

Sanitation

Sanitation is a major problem in Tanguar Haor villages. Use of sanitary latrines is limited, but open latrines above waters (e.g. communal ponds) are found in many villages. Only 10.7% of the household or 11.6% of the people have access to sanitary latrines (there is strong doubt whether the water-sealed sanitary latrines are at all functional in these villages). Another 12.8% of the people use ring-slab latrines while the rest 77% defecate directly to the local rivers, canals and creeks using bamboo-made, or semi-open or open latrines (Haque and Kazal, 2008). Different water borne diseases therefore are rampant in the Tanguar Haor villages.

Health

Availability and accessibility to health services in Tanguar Haor is lower than other rural areas. An overwhelming majority of *haor* people therefore, depend on traditional healers. At the village level, AYURVEDA medicine (ancient medicine in Indian-subcontinent) is most prominent. Imam and other religious leaders also provide treatments to the ill people as holly healers. IUCN (2012) survey has found almost half of the people of Tanguar Haor to be dependent on local quacks, while only 39% receive services from the Union health complex. But in the wet season, due to communication difficulty, their dependency on local quacks and traditional healers increases many folds. The study also found that 25.5% households went to private MBBS doctors and 14.1% to district hospitals for receiving treatment considering the nature of sickness of household's members.

Education

Poor infrastructure, overwhelming poverty, poor communication system exerts challenges for the education system in Tanguar Haor, reflected to having high degree of illiteracy. IUCN (2012) survey has found that almost half of the population is illiterate. On the other hand, among the literate, 35% received only primary education, 12.2% have got secondary education and rest 2.2% have got education of higher secondary and above level. The survey further reveals that the illiteracy rate for female (51.5%) is higher than that of the male (49.5%) population. But it is interesting to note that a greater number of females have attained education at higher secondary or above level (12.4%) than the males (11.9%).

2.2.6 Local Economy and Livelihood

Local economy of Tanguar Haor is natural resources based and the community is either fully or partially dependent on these resources for their livelihood. BCAS (1997) found that 75 % of the population depend on natural resources for fuel, 90 % for construction material and 28 % for saleable products. Products collected both for consumption or sale are birds, fish and *panifall* (fruit growing in water; usually refers to fruit of *Trapa*).

Fisheries Resources

In terms of Fisheries Resources production, Tanguar Haor contributes about 14% of total fish production of Sunamganj District and about 0.67% of National Fish production (TARA 2008, FRSS, DoF 2006), but less than 5% adult males are engaged in fishing and majority of the adult males are mainly dependent on farming or employment as daily wage labourers (BCAS, 1997; IUCN, 2012). Probably the scenario was different before the present leaseholder took charge of Tanguar Haor's fisheries, when local fishermen from around the *haor* were employed by the leaseholder. With the current leaseholder, this changed abruptly and all fishermen are now employed as seasonal labourers.

Agriculture

Almost 12.5 % of Tanguar Haor's land that dries up in winter is used for rice cultivation; the cultivated land is characterized by high yielding capacity for its fertility. Historically, the area within Tanguar Haor has been a single crop area, but with the development in agricultural science and extension activities, and with the introduction of HYV rice, the cropping pattern has changed considerably. Damage of crops due to early flooding is a concern each year for the Tanguar Haor community, with the risk of losing all their crops (paddy) sometimes just 7-10 days before harvesting.

Traditionally, deep-water rice was planted in the area, but this practice has disappeared completely. Planting of *boro* rice starts with the recession of water, usually from November, but due to slow drainage and stagnation, the actual planting time is often delayed. Because of this delay, there remains a risk of crop damage due to early flash floods in February-March. Planting rice however, continues even later and harvesting usually takes place from April to June. The planting of *aman* rice takes place from August in areas that are comparatively elevated and harvesting of *aman* is done in November-December. Apart from rice, other seasonal crops and vegetables are grown during the drier months after the floodwater recedes between December and April. Crops such as various spices (e.g. mustard, caraway) onions, groundnut, wheat and chili are grown during this time. Sweet potatoes and potatoes are grown in March-April.

Livestock & Ducks

Approximately 1,000-1,500 head of cattle and a small number of buffalo are kept in the *haor* area during most of the year. During floods in the monsoon, they are kept in pens on the higher *Kandas* and are fed on hay, collected in the drier months. In the drier winter months, there is an influx of livestock into the area. These are traditionally fattened in the *haor* grasslands and the total number of livestock may swell to 3,000-5,000 head. In the past, their numbers used to be greater, but these have dropped since 1993, when the leaseholder of Tanguar Haor imposed fees for the fattening of cattle in the *haor* of up to Tk. 10,000-12,000 per 100 head for one season. Children generally herd the cattle, although adults may too be involved at times, especially with the collecting of fodder.

Domestic duck are widely kept in the *haor* and their numbers are estimated to be in the range of 10,000-20,000. These are generally kept in flocks of up to several hundred and mainly tended by children, especially boys. In the dry winter months, ducks are herded into the remaining waterways and *beels*, for feeding on aquatic weeds and shellfish collected by their keepers. Since 1993, the leaseholder of Tanguar Haor has imposed a fee of Tk. 3,000 (about US\$ 60) per 100 ducks per season, for keeping these animals in the *haor*'s waterways and *beels*.

Occupation Pattern

The *haor* community is engaged in multiple occupations round the year. IUCN (2012) study revealed that households do not have income scope round the year. People work for 10.2 months a year whose profession is 'day-labor in non-agriculture sector' of 'fishery' and 6.5 months a year as 'domestic servant'. The longest period of scope of work for the people of agriculture profession is 6.8 months in a year. The households of small trade, livestock husbandry and handicrafts profession, work for 9.4 months, 8.4 months and 8.2 months a year respectively. In Tanguar Haor, the major occupation has been agriculture due to the banning on fishing at *haor* during lease regime. However, this trend is shifting towards more fishing households for their recent fishing right under community organization's membership (Haque, 2012).

Occupation of Tanguar Haor changes with seasons. In the dry season, agriculture (46%) and agriculture labourer (26%) constitute the major group, followed by wage labourer (7%) and small scale traders (8%). Fishing constitutes only 3% of local occupation. But in the wet season the scenario changes and 41.7% households are identified as engaged in fishing and they are fully dependent on the *haor* resources for managing their livelihood. Agriculture profession lies in 36.3% households and they are dependent on their own income as well as natural resources collected from Tanguar Haor including fishing. Small trade and livestock husbandry are 10.4% and 10.1% of households respectively (IUCN, 2012). Moreover, during peak fishing season, a large number of fishermen migrate into the Tanguar Haor with fishing nets, boats and families, to live in temporary fishing camps. This is organised by the major leaseholder of the *haor*. These immigrant fishermen along with their family members usually come every year from Nasirnagar and Austagram of Brahmanbaria District, Lakhai of Hobiganj District, Nikhli and Bajitpur of Kishoreganj District, and Kalma Kanda of Netrakona District.

Generally the fisherfolk are provided with an amount per family head and this is used for transportation to Tanguar Haor, food and construction of a temporary house (usually at the main fishing camp in Tanguar Haor). At the end of the fishing season, 3/8th of the net profits are divided among the fisher folk, after deduction of the advance amount. The heads of some of the teams – who often own the gear – may obtain a larger share, but in some years they may also make a loss. Local community members report that previously (15-30 years ago), when they were involved in the commercial fisheries, they were often cheated and conflicts that arose from this lead to their exclusion from Jalmahal fisheries.

According to Jalmahal lease regulation, the leaseholders are allowed to fish in the *haor* only every third year, but in practice fishing is carried out every year. Another concern is *katha* fishing, whereby piles of branches and bushes are placed on the bottom of a *beel* to attract fish. This is also known as 'pile fishing' or fishing with 'entrenchments'. Fishes are probably attracted by the shelter provided and by the increased food supply (periphyton and bark) and fishermen report that bark of the hijal (*Barringtonia acutangula*) particularly attracts fish. To catch a fish, a blocking net is erected to encircle the *katha*, after which the branches are removed and fishing within this enclosure is carried out with various smaller nets. A large amount of hijal wood (mainly branches) is required for the *katha* fisheries.

All fish caught at Tanguar Haor are brought to the landing site at the main fishing camp late in the afternoon/early evening, when they are weighed and distributed to the traders, at previously agreed upon prices. Large fish are kept in iceboxes and marketed directly as fresh fish, while small fish are dried and salted and sold at the end of the fishing season.

2.2.7 Ecotourism and Recreation

Recreation and tourism at Tanguar Haor have over the past years, focused mainly on the area's bird resources. Tanguar Haor is listed in the Asian Wetland Directory (Scott, 1989) as a wetland of major importance and is described in travel guides (e.g. Lonely Planet Guide for Bangladesh) and bird guides (Thompson & Johnson, 1996) as a prime area for bird viewing, especially in the winter season when the area is visited by tens-of-thousands of migratory waterfowl. As a result, Tanguar Haor is visited by at least several dozen birders annually, both Bangladeshi nationals and foreign visitors. The numbers are however, too small to have any impact on the local economy, especially as the major costs - hiring of boats and purchase of food - are made in Sunamganj and not in local villages.

2.2.8 Research and Education

Being a wetland of international importance (Ramsar site since 2000), Tanguar Haor has been an area of interest for ornithologists, plant scientists, fisheries experts, wildlife specialists and socio-economists. The environmental importance of Tanguar Haor was first emphasized by the wetland study of Flood Action Plan 6 (FAP 6 Wetland Specialist Study, 1993). However, the first ever conservation initiative undertaken by the Government in Tanguar haor was the National Conservation Strategy Implementation Project (NCS IP) in mid 1990s, where IUCN Bangladesh Country office worked as a technical partner. Many studies have been made because of projects in the area or region, such as the Northeast Regional Water Management Project (NERP, or FAP 6) and the NCSIP-1, but the Asian Waterfowl Census is one study that is implemented annually, usually by a number of environmental NGOs. Many of the studies have been by private consultants, but the agencies such as the University of Dhaka (Zoology Department), the Bangladesh National Herbarium and NGOs such as the Bangladesh Centre for Advanced Studies (BCAS; socio-economic studies), Nature Conservation and Management (NACOM) and the Centre for Advanced Research in Natural Resources & Management (CARINAM) have also been involved. The biggest effort so far taken by the Government was represented by the Ministry of Environment and Forests (MoEF) and IUCN, when jointly they put in place a project called 'Community Based Sustainable Management of Tanguar Haor'. A number of studies have been carried out under the project, ranging from bio-physical settings to socio-economic conditions. The project was designed with three different phases in which the entry point was to develop a resource governance system for the wetland. The three phases were preparatory, development and consolidated phase.

2.3 An Indicative Economic Valuation of Tanguar Haor

Both ecologically and economically Tanguar Haor is very important freshwater wetland in Bangladesh. Tanguar Haor not only supports livelihoods for thousands of people, but also an important biodiversity rich freshwater ecosystem that generates many ecosystem services (Alam *et al.*, 2012). This section provides an overview of these benefits using general framework of economic valuation. However, dearth of literature on economic valuation of Tanguar Haor and diversity in resource provision makes it difficult to estimate real value of product and services derived from it; rather an impressionistic valuation is attempted as a basis for developing a management framework for Tanguar Haor. To mean resources, this paper focuses on ecosystem services as outlined in Millennium Ecosystem Assessment (MEA, 2005). As a background for this section, Baten (2013) compiled previous studies namely Haque *et al.* (2012) and Giesen *et al.* (2000) targeted towards combining valuation of both use and non-use values in terms of function and services of Tanguar Haor ecosystems in light of the present management system intended to be used as an instrument for new management framework and finally the summary is presented here.

2.3.1 Valuation of Ecosystem Services of Wetlands

'Valuing' a wetland essentially means valuing the goods and services it produces (Barbier, 1994). Ecosystem services provided by wetlands consist of flows of materials, energy and information from natural capital stocks, combined with manufactured and human capital services to produce human welfare (Costanza *et al.*, 1997). Dasgupta (2004) understands ecosystem services as stock or wealth and flows of goods and services from these services are similar to income. Therefore, depletion in stock would risk sustainability of the flow of goods and services. In ecology, a distinction is usually made between the regulatory environmental functions of an ecosystem (e.g., nutrient cycles, microclimatic functions, energy flows, etc.) and its structural components (e.g., biomass, abiotic matter, species of flora and fauna, etc.). This distinction is useful from an economic perspective, as it corresponds to the standard categories of resource stocks or assets (i.e., the structural components) vs. environmental flows or services (i.e., the ecological functions). In addition, ecosystems as a whole often have certain attributes (biological diversity, cultural uniqueness/heritage) that have economic value either because they induce certain economic uses or because they are valued in themselves. It is therefore helpful to distinguish between: (a) direct use values (e.g., the values derived from direct use or interaction with a wetland's resources and services); (b) indirect use values (the indirect support and protection provided to economic activity and property by the wetland's natural functions or regulatory 'environmental' services); and (c) nonuse values (the values derived neither from current direct or indirect use of the wetland (Barbier, 1994).⁶ Thus, the total economic value of a wetland system may comprise of all three types of values- use (direct and indirect), option, and existence values (Figure 2.9)⁷.

⁶ A special category of value is option value, which arises because an individual may be uncertain about his or her future demand for a resource and/or its availability as a wetland in the future. There is a general consensus in the economics literature that option values are not a separate form of value but represent a difference between ex ante and ex post valuation (Smith, 1983; Freeman, 1984). If an individual is uncertain about the future value of a wetland but believes it may be high or that current exploitation and conversion may be irreversible, then there may be quasi-option value derived from delaying the development activities. Quasi-option value is simply the expected value of the information derived from delaying exploitation and conversion of the wetland today. Again, there is a consensus that quasi-option value is not a separate component of benefit but involves the analyst properly accounting for the implications of gaining additional information (Fisher and Hanemann, 1987). In contrast however, there are individuals who do not currently make use of tropical wetlands but nevertheless wish to see them preserved 'in their own right.' Such an 'intrinsic' value is often referred to as existence value. It is a form of non use value that is extremely difficult to measure, as existence values involve subjective valuations by individuals unrelated to either their own or others' use, whether current or future. An important subset of non use or preservation values is bequest value, which results from individuals placing a high value on the conservation of tropical wetlands for future generations to use. Bequest values may be particularly high among the local populations currently using a wetland, in that they would like to see the wetland and their way of life that has evolved in conjunction with it passed on to their heirs and future generations in general. (Barbier, 1994)

⁷ In Figure 2.9, option and quasi-option values are indicated with a dotted line, since these values are not strictly a separate component of total economic value in the sense that direct and indirect use values can be separated from existence value. Moreover in most cases, the preferred approach for incorporating option values in the cost-benefit analysis would be to develop well-specified models of individual choice, through reasoning about how marginal utilities of income differ in the various contingency states (Freeman, 1984). Similarly, quasi-option value can be calculated by an analysis of the conditional value of information in the decision problem (Fisher and Hanemann, 1987). Such approaches are particularly valid in the case of uncertainty surrounding 'decrements' in natural environments, e.g., the losses in value that might occur if a tropical wetland is converted to an alternative use. In contrast, Brookshire, Eubanks and Randall (1983) have argued that in cases of 'supply-side uncertainty' surrounding 'increments' in natural environments, e.g., a project to protect wetlands might provide additional future values such as recreation, contingent valuation methods (CVM) might be employed. However, Freeman (1985) has argued that this scenario is only one of four possible patterns of supply uncertainty and has cautioned against the use of CVM in cases where either the project can only reduce but not eliminate supply uncertainty or where there is a positive probability of supply even without the project.

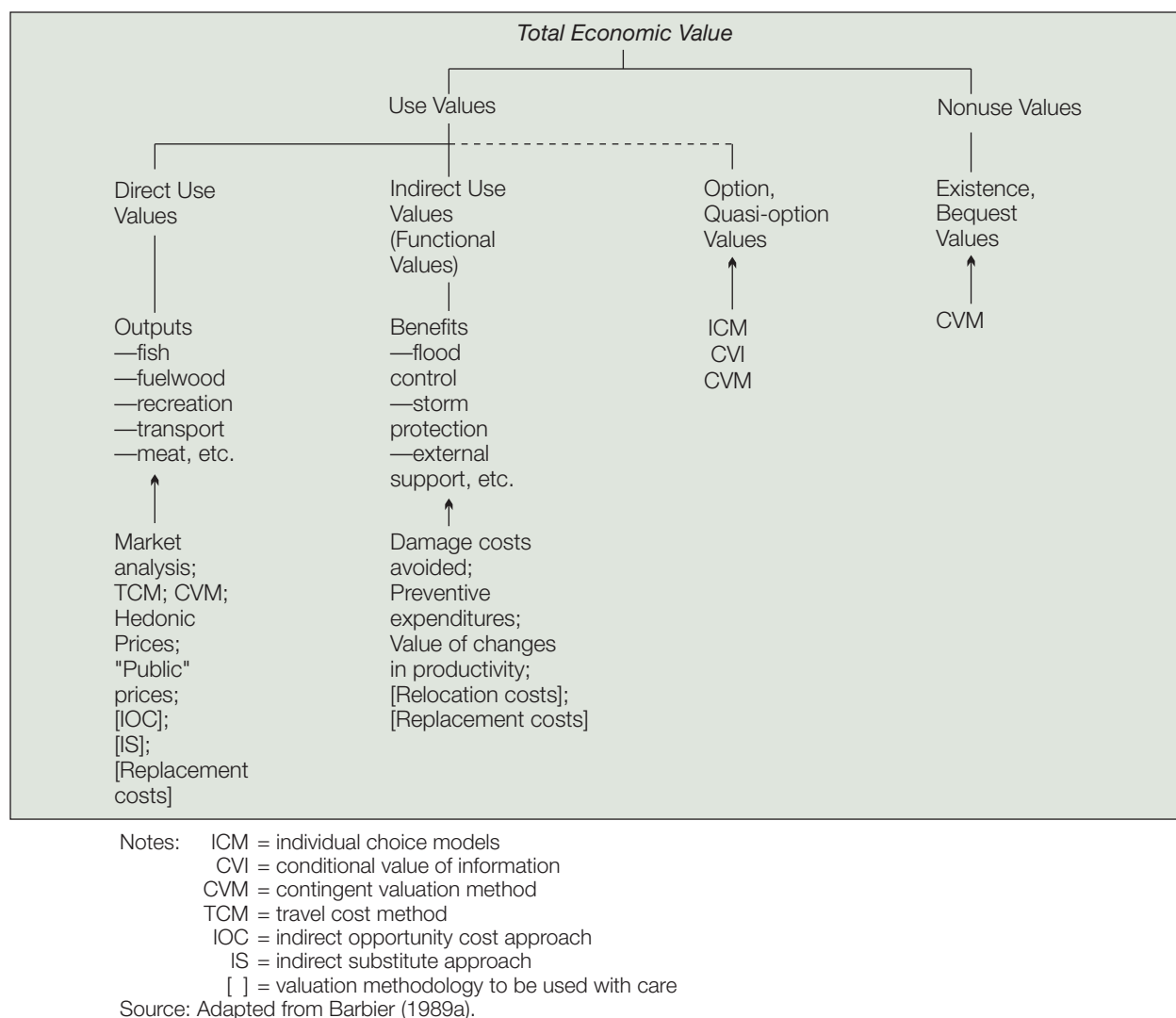


Figure 2.9: Wetland resource values and associated valuation techniques

Ecosystem services are classified under different categories that include resource-material provisioning, delivery of food, water and goods, control and maintenance of natural cycles, stimulating and bio-banking of diverse species essential for resource sustenance and cultural services close knitted to life and livelihoods (MEA, 2005)⁸. It is now commonly recognized that if ecosystem services were actually paid for, in terms of their value contribution to the global economy, the global price system would be very different from what it is today (Costanza *et al.*, 1997). When properly measured, the total economic value of a wetland's ecological functions, its services and its resources may exceed the economic gains of converting the area to an alternative use (Barbier, 1994).

⁸ Millennium Ecosystem Assessment has established a clear linkage between ecosystem services and human well-being (MEA, 2005). To classify the goods and services of the ecosystems provided to people and society are classified into four categories of ecosystem services (MEA, 2005):

1. Provisioning (goods and) services: tangible goods (foods, water, fuels, fibers, raw materials, genetic resources, etc.) that are obtained from ecosystems, a large proportion of which has structured markets where they are traded;
2. Regulating services: services (water purification, and regulation of floods, drought, land degradation, and disease, etc.) related to ecosystem processes and their contribution to regulating the natural system;
3. Supporting services: services (hydrological regulation, etc.) necessary for ecosystem functioning and the adequate production of provisioning goods and services and regulating services. Their effects on welfare show in the long run through impact on the provision of other ecosystems goods and services; and,
4. Cultural services: services that humans obtained from ecosystems through education and research, local lifestyles, spiritual enrichment, cognitive development, inner reflection, recreation and aesthetic enjoyment. They are closely linked to human values, identity and behavior.

Tanguar Haor delivers a great diversity of ecosystem services which covers: flood control, bank stabilization and storm protection, sediment and nutrient retention and export, water purification, reservoirs of biodiversity, wetland products, cultural values, recreation and tourism, climate change mitigation and adaptation (Haque *et al.*, 2012). Direct use value of Tanguar Haor includes fisheries products, water supplies, crops, household material supplies etc. Indirect use value includes flood control or hydrological services, natural filtration, waste recycling etc. Non-use values with two subcategories are: existence value and option value. Existence value is what people are willing to pay to ensure existing environment to sustain. Option value holds the potential use and availability of resources open for future generations in case of threats arising then. These values of ecosystem goods and services are dependent on: on-site and off-site location of goods and services.

2.3.2 Uniqueness of Tanguar Haor

Among all the *haors* of Bangladesh, Tanguar Haor's ecosystem is rare as it is one of the last semi-natural *haors* which retains original natural habitats and a more-or-less natural hydrology. In case of habitat diversity, Tanguar Haor is playing a critical role through providing a habitat for many rare or uncommon plant and wildlife species, some of which are simply rare in Bangladesh (Giesen *et al.*, 2000). Tanguar Haor is a hot spot for biodiversity and one of the richest areas in Bangladesh, having at least: 150 wetland plant species, 135 fish species, 11 amphibians, 34 reptiles, including 6 turtles, 7 lizards and 21 snake species, 208 bird species, several dozen mammal species (Giesen and Rashid, 1997). Tanguar Haor provides a habitat for at least 26 globally threatened wildlife species listed on IUCN Red Data lists and CITES Appendices, including 1 amphibian species, 3 turtles, 2 lizards, 4 snakes, 10 birds and 6 mammal species. All of these species can be regarded as either rare or uncommon (Giesen and Rashid, 1997). Of the total 260 freshwater fish species, the *haor* serves as mother fisheries, spawning, staging and migratory routes for 141 species of 35 families (Alam *et al.*, 2012). Annually Tanguar Haor provides a refuge for around 30,000-40,000 (occasionally 60,000) waterfowl, many of which are migratory. Dominated by hijal (*Barringtonia acutangula*) and korocho (*Pongamia pinnata*), Tanguar Haor supports the last stronghold of swamp forest in the *haor* region that occurs at Rangchi, to the west of the *haor*.

2.3.3 Socio-Economic Conditions

People living in and around Tanguar Haor are mostly poor and lack basic amenities of energy, pure potable water, sanitation, education, communication infrastructures and thriving markets. With varying sizes, the villages remain disconnected from mainland for at least six months in a year, basically in the monsoon season. Average size household is 6 (Haque and Kazal, 2008). In the region, about 95% people are directly dependent on *haor* for their livelihood. Surveying on 800 people, IUCN (2008) found that the 67% of households are earning Tk. 21,212 annually from agriculture, whereas 5% engaged in fish business have higher income of Tk. 25,441 annually, 18% of small business holder's are earning Tk. 32,782. The study further found that nearly 72% households earn living from *haor* resources is more linked to occupations such as fishing, fish trading and boating than agriculture.

2.3.4 Ecosystem Services Provided by Tanguar Haor

Provision of various ecosystem services makes Tanguar Haor as critical livelihood source to the peoples living adjacent to that area (Figure 2.10). In addition, many ecosystem services as produced through complex ecological process have national and international importance. Most economic activity carried out in the area including commercial fishing, trade in fuel wood, hunting and trapping waterfowl, the harvesting and sale of grasses and reeds and farming, is based on these resources. Fishing and farming are the principal occupations of people living in Tanguar Haor. Traditionally, in the winter season, residents of Tanguar Haor were able to graze their cattle in fallow land (*kanda*)⁹ situated between paddy fields and the *beels*. Grasses, reeds, twigs and leaves are harvested for fuel, thatching and erosion proofing. Branches or whole tree-tops are collected from swamp forests for use in constructing enclosures, called *khola* or *katha*, which entice fish to breed in them although such use of swamp forest trees are becoming limited.

⁹ Intermediate place between the *haor* basin and homestead land are called *Kanda*. There are about 180 *Kandas* (IUCN database) in TH. These *Kandas* support the major plant communities during drier months. At the onset of monsoon or floods all these *Kandas* go under water transforming the entire wetland into a single sheet of water changing the whole scenario. The depth of flooding during monsoon ranging is from 2 to 10 meters depending on the ground elevation. Usually, reed and swamp plants are found in these *Kanda*. *Kanda* is fairly deeply flooded during the rainy season and dry out during the dry season. There are many *Kandas* in TH area which are khas land though some agricultural practices are done but mainly the area serves as cattle grazing grounds or pastures for cows, buffalos, and birds and fish to breed once they started submerged.

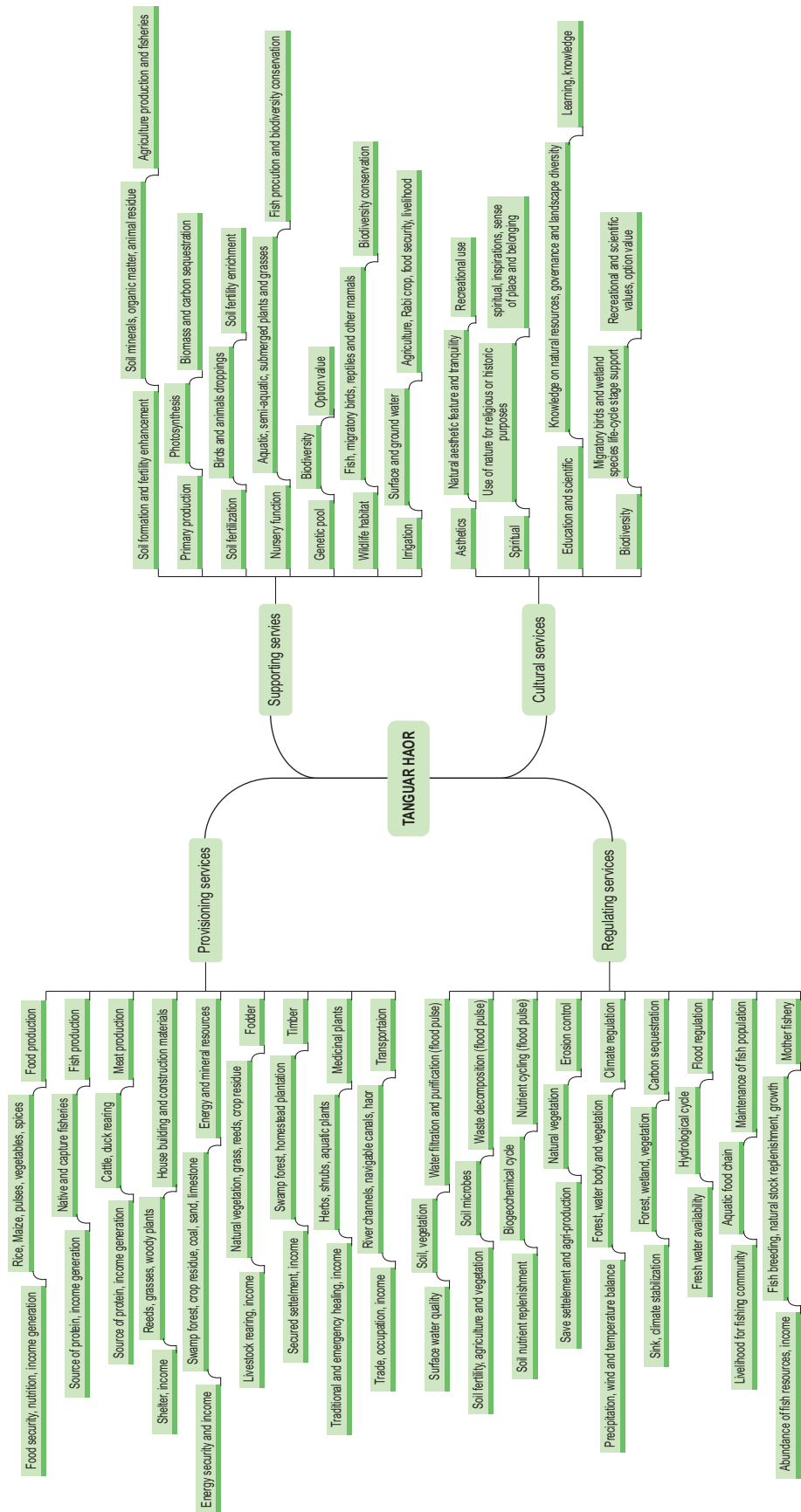


Figure 2.10: Ecosystem services provided by Tanguar Haor

2.3.5 Value of Tanguar Haor Ecosystem Services

Tanguar Haor provides all four types of ecosystem services including habitat for a vast number of invertebrate, fish, amphibian, reptile, bird and mammal species, of which a number are rare and/or endangered. The *haor* also functions as a water storage area, providing drinking water and irrigation water (especially for rice), while helping to maintain river levels in the Patlai and Surma in the dry months. In the wet season, it absorbs floodwaters, thereby mitigating the impact of floods in downstream areas and in addition, recharging the area's ground waters. Silt, especially from the Jadukata River, is deposited in the *haor* and water quality (of outflowing water) is thereby improved. These functions, though of immense value are difficult to quantify. Haque *et al.* (2012), using existing literature attempted to estimate economic value of Tanguar Haor based on Ecosystem services. In the study he estimates an annual income per hectare of specific land use with respect to a particular ecosystem product or service. Direct economic activities in the *haor* such as rice/crop production, fishing or agriculture small business including dry fish business, tea stall, vegetable selling, fishing gear business etc. have direct market value and easy to quantify. But regulating, supporting and cultural services are estimated using indirect methods. For instance, recreational value is estimated using 'Willingness to pay' or value of flood protection service is estimated using 'Opportunity cost' of constructing dams.

Table 2.5 illustrates the values of different provisional services derived from Tanguar Haor per year, which includes direct production and trading activities from these produces. The next important services of Tanguar Haor is its regulatory services which includes regulating services like the water shed services and the flood-regulating services in the lower riparian regions. Tanguar Haor protects the crops in the lower catchment areas by keeping the water from the flash flood in its *beels*, creeks and rivers. In case, the *haor* management chooses to use barriers to stop water coming inside its *beel*s during early days of May, the boro crop in the lower riparian zone will be damaged. As such, Tanguar Haor protects these services by stopping early flash flood water run-down to lower riparian regions (around 8400 ha of agricultural land), which will be considered as regulating service benefits of Tanguar Haor management (Haque, 2012). In case of supporting services, value estimation is difficult as most of the supporting services are embedded in the value of other goods and services. Hence separate values for supporting services may give double counting values. Regarding cultural value, Haque (2012) conducted a household survey which did not find significant evidence of cultural services at Tanguar Haor. Even though Tanguar Haor provides safe habitat to the large number of migrating birds, Haque (2012) did not estimate the value. Rather, using a proxy value from similar regions in other areas, the study shows that such benefits are also about 1% of the total value¹⁰. To estimate value of few regulatory, supporting and cultural services, Haque (2012) adjusted values from other studies were with inflation rate of 5% per annum and population of the *haor* was adjusted for a growth rate of 2% per annum (Table 2.6).

Total annual benefit from Tanguar Haor based on different ecosystem services is estimated as BDT 1.59 billion or USD 20.46 million (Haque *et al.*, 2102). The estimate shows that provisioning services alone constitutes 78% of the total benefits derived from Tanguar Haor which accounts for USD 15.71 million.

¹⁰ In 2006, the biodiversity benefits of Hakaluki *Haor* which is almost double the present area wise coverage of TH was estimated BDT. 4174.63 per hectare (Haque, 2006). The biodiversity included migratory bird, waterbirds, aquatic and non-aquatic flora and faunal diversity except for commercial values of fish resources. In 2001, Hail *haor* economic value was estimated based on allocation of biodiversity fund in the project with proxy indicators transferable to non-consumables goods of wetlands from USA to Bangladesh. According to and fauna surpassed the total *haor* value of BDT 37,666,526. Biodiversity conservation practices at *haors* have been limited to awareness raising, wetland forest or *Kanda* restoration, canal excavation, alternative income generation to reduce pressure on the *haor* resources except for fisheries, ban on hunting water birds and ducks etc. Therefore, the values of biodiversity in all of these sites have been based on bequest values or species depository values that have been adjusted with market prices

Table 2.5: Value of provisional services from the Tanguar Haor

Service provision	Land area in Ha	Production in Taka per Ha	Annual income in Taka	Percent of household engaged	Income per household per year
Rice production	4803	36000.00	172908000.00	67	19908.81
Duck rearing	3943.2	11.89	46884.65	5.10	70.93
Small business	318.74	652.26	845382.22	18.00	362.36
Aquatic vegetation	3943.2	118.94	469000.00	2.70	1340.00
Pasture	587.32	4025.06	2364000.00	5.10	3576.40
Vegetable (non rice production)	5	304229.17	1521145.83	2.30	5140.52
Navigation, boat	359.39	9488.89	3410211.78	4.00	6570.74
Swamp forest, bamboo and reed lands for housing	735.11	177320.40	130350000.00	57.20	17579.23
Energy (fuel wood)	735.11	338144.63	248573500.00	45.80	41868.54
Fish harvest	4320.59	136308.18	586478221.41	92.80	48751.31
Fish trade	4302.59	17822.39	76682447.56	5.00	118337.11
Others	587.32	3063.27	1799119.74	2.30	6037.31
Total			1225447913		
15710870.68 USD (Conversion rate 1 USD=78 Taka)					

Table 2.6: Value of supporting, regulating and cultural services of Tanguar Haor

Ecosystem services types	Ecosystem products/ components	Land area in Ha	Monetary value of the benefits per Ha (Taka)	Total annual benefits (Taka)
Supporting (Not valued yet)	Biodiversity (Migratory birds, water fowls)	3651.91	---	----
Cultural	Biodiversity for community	10421	4174.63	43503819.23
Supporting	Watershed	14398.65	1020.93	14700013.74
Regulating	Flood protection in lower riparian	8423.22	36000	303235920
Cultural	Aesthetic	14398.65	671.91	9674596.92
Total				371114349.9
4757876.281 USD @ 78 Taka				

Giesen *et al.* (2000) has estimated Tanguar Haor's annual harvested wetland products as more than Taka 80 million (and perhaps as much as Taka 200 million) annually (US\$ equivalent of 1.6-4.0 million). He found that fish and water birds form a large part - 64 % - of the net value of the utilised wetland resources (Table 2.7). Peoples are dependent on Tanguar Haor for multiple uses; 75 % of the respondents depended on natural resources for fuel, 90 % for construction material, and 28 % for saleable products (Giesen *et al.*, 2000).

Table 2.7: Value of major products derived from Tanguar Haor (an approximation)

Resource	Annual harvest or numbers raised	Net value (in million Taka)	Notes
Fish	800-1000 tons	50(-80)	This is a minimum value; the net value, i.e. income from fisheries minus costs for lease fee and investment, is 37.5-45 million Taka.
Waterfowl	10,000 - 15,000 head (1996/97)	2.25	Mainly hunting of wild duck. Value indicates worth on local market.
Duck keeping	10,000-20,000 head	2.6	The leaseholder charges Tk. 3000 per 100 head of duck per season. Estimated is that half of the ducks kept in the haor are sold and/or consumed.
Cattle fattening	1,000-1,500 head	3.2	This amount swells to 3,000-5,000 in dry months. Fee charged by leaseholder is Tk. 10,000-12,000 per 100 head per season. This is used to calculate the value of this resource; plus annual sale of 1/4 of local stock.
Rice	2,500 tons	23.4	12-15 % of the haor (9,700 ha) is planted with rice, and the harvest is 1.8 tons/ha.

Source: Giesen *et al.* (2000)

2.3.6 Present Value of Ecosystem Services of Tanguar Haor

Using a 10% discount rate¹¹, Haque *et al.* (2012) shows a Net Present Value (NPV)¹² of 97.8 million Taka or 377 million USD for Tanguar Haor. Present value of Tanguar Haor ecosystem services have been projected including all these 4 types of services over 30 years of time starting from 2006 as IUCN's intervention in post leasing ban period. It is assumed that the projected benefits from the services will remain constant throughout the period as of now and the year 2036; benefits are seen highest in terms of accruing (increased) income from provisional services followed by supporting, regulatory and cultural services (Figure 2.11).

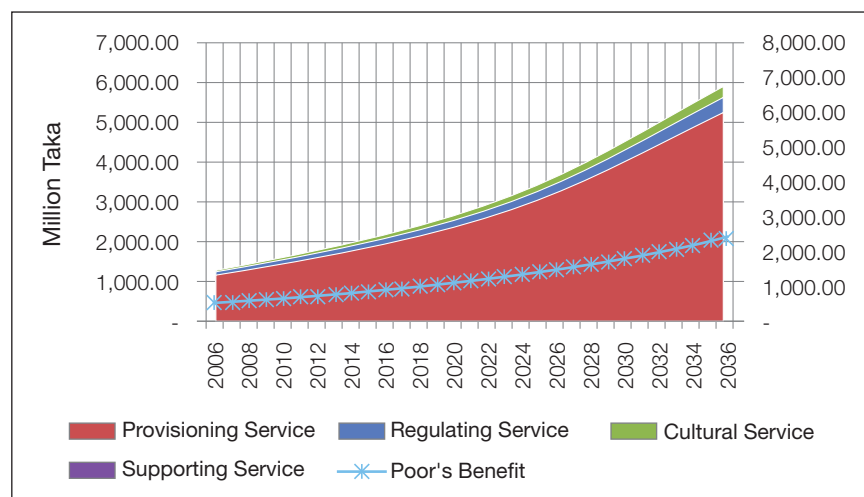


Figure 2.11: Net Present Value of Ecosystem Services of Tanguar Haor (Haque *et al.*, 2012)

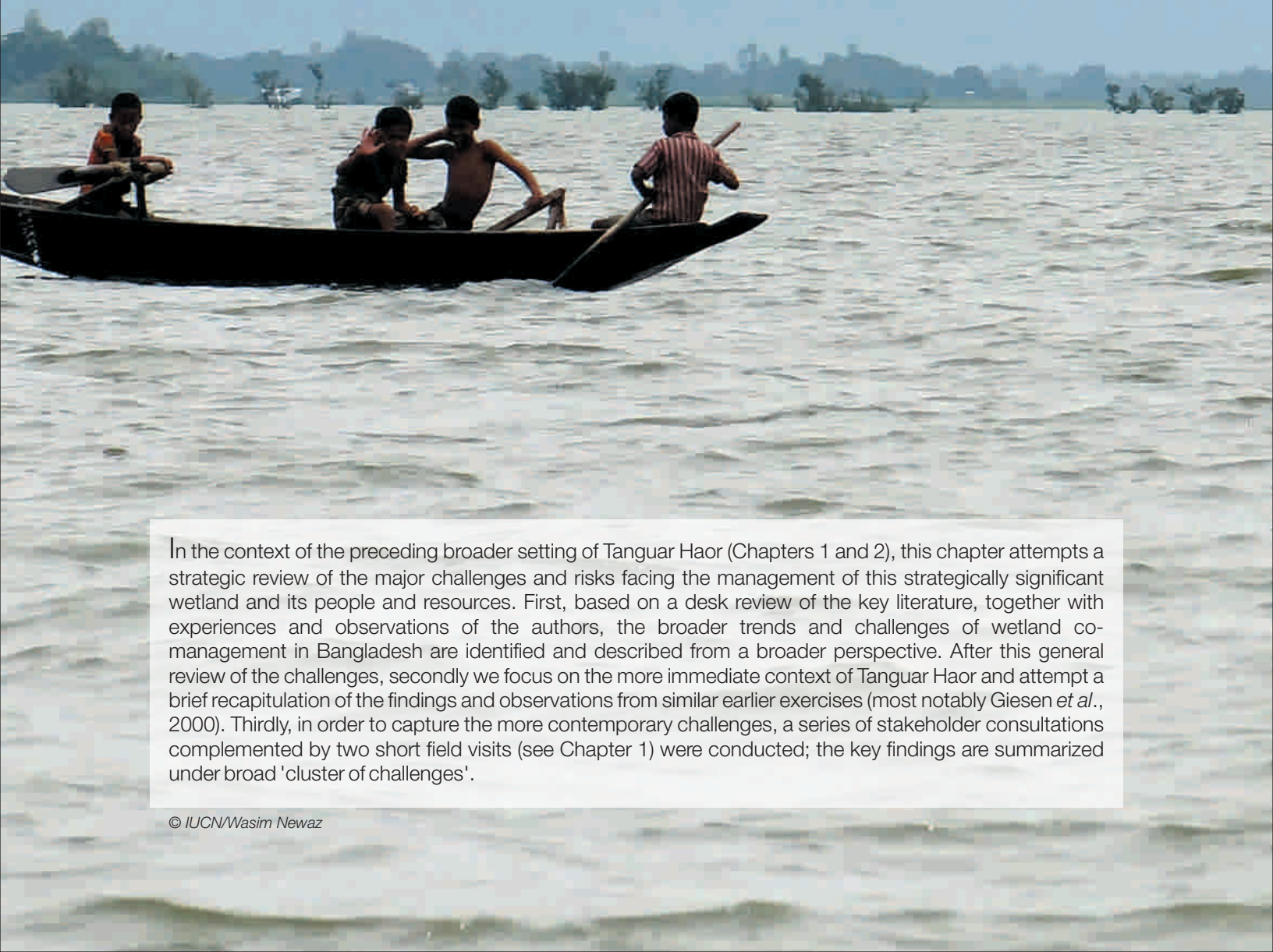
¹¹ The discount rate is a rate used to convert future value into current or present value. This is realized through the mechanism known as discounting. For instance, if somebody offers to pay to you 105 USD one year from now, the present value is 100 USD at a discount rate of 5%. This is because you would earn interest of 5 USD on a deposit of 100 USD.

¹² NPV is a calculation technique used to estimate the value or net benefit over the lifetime of a particular project, often for long-term investments, such as installing energy efficient machines. It allows the decision-maker to compare different alternatives on a similar time scale by converting all options to current monetary figures. A project is considered acceptable (or unacceptable) if the NPV is positive (or negative) over the expected lifetime of the project



Chapter 3

A Strategic Review of the Challenges and Risks



In the context of the preceding broader setting of Tanguar Haor (Chapters 1 and 2), this chapter attempts a strategic review of the major challenges and risks facing the management of this strategically significant wetland and its people and resources. First, based on a desk review of the key literature, together with experiences and observations of the authors, the broader trends and challenges of wetland co-management in Bangladesh are identified and described from a broader perspective. After this general review of the challenges, secondly we focus on the more immediate context of Tanguar Haor and attempt a brief recapitulation of the findings and observations from similar earlier exercises (most notably Giesen *et al.*, 2000). Thirdly, in order to capture the more contemporary challenges, a series of stakeholder consultations complemented by two short field visits (see Chapter 1) were conducted; the key findings are summarized under broad 'cluster of challenges'.

3.1 The Key Challenges and Trends in Natural Resource Co-Management

First, based on a desk review of relevant key literature as well as the experience and observations of the authors as practicing natural resource managers, we try to identify and elicit some key lessons that have particular relevance and implications for co-management that may provide guidance and illuminate the process of formulation of appropriate programmes for Tanguar Haor in the future.

The commercial orientation of the state and bureaucratization of the management of Natural Resources (NRs): this has a number of implications: (i) resultant alienation of the local communities from the management and use of NRs; (ii) creation and patronization of an elitist aristocracy who, in connivance and collaboration of the bureaucracy, enjoyed *de facto* privatized control and authority over NRs and acted as the intermediary between the state and local communities; (iii) systematically undermined local institutions, community initiatives, (customary) rights and wisdom in Natural Resource Management (NRM); and (iv) overshadowed the broader sustainability and environmental considerations in the management of NRs.

Inadequate focus on an ecosystems or landscape based perspective on NRM planning: In managing and planning for the country's NRs, the approach has often been of an ad-hoc nature, short range – missing the 'big picture'. The considerations of integration of various NR sectors and ecosystems have received little attention. This has also contributed to the endemic problem of inadequate institutional coordination.

(Re) inventing the role and salience of community based management: Since the first half of the 1990s, several programmatic efforts have been made to engage local communities in the management of NRs with varying degrees of success (some of these projects will be further reviewed in a later section). Despite many limitations, these efforts have refocused the attention on community engagement and documented the benefits arising of such engagements. Comparing the performance between the traditional system of leasing to 'highest bidders' and the community management efforts, a recent assessment observed the following:

In most cases, community based management has established sanctuaries and closed seasons and restored habitat (limited empirical data is available). Where surveys have been done as in the MACH. Such measures have been shown to have restored fishery productivity (by more than double) and biodiversity, improved the livelihoods and fish consumption of local communities (most fishers are poor) and the CBOs have continued to function and operate their management plans after project support ended. By comparison, the majority of Jalmohals leased under the traditional competitive system have experienced over exploitation, declining catches and a lack of conservation measures, since fishers are usually poor and leases have to be paid at the start of the year. Access for fishers has been compromised, as middlemen pay the lease and take effective control using lists of their "fishers" (USAID, 2010:66).

We have by now considerable experience of co-management covering forests, fisheries and wetlands sectors. A number of specific lessons regarding the co-management arrangements may be elicited (based mainly on Thompson undated, Halder and Thompson, 2006):

- Capacity and understanding in habitat protection and management are important, but for sustainability the major effort has been on developing equitable, democratic, transparent and accountable procedures and practices.
- Links with local government and formal recognition of CBOs are important in establishing their legitimacy to represent community interests and in overcoming conflicts.
- For sustainability, continued sources of funds are needed. Establishing CBOs and their fishery management actions requires funds, while without funds local government has little incentive to take an active interest in the CBO activities.
- Functional cooperation amongst relevant government agencies is vital for managing the resources.
- All agencies need to consider, understand and adopt best practices and principles of good governance and of conservation and sustainable use of the respective NRs.
- Typical project durations such as five years are not sufficient to establish capable sustainable CBOs. Concentrated efforts and support are needed over reasonable time - including a start up period to understand the communities, institution building, improving resource management and phasing out.
- Learn from and documentation of experiences, regular monitoring and review processes are needed that involve CBOs, facilitation teams and external agents.

3.2 Recapitulation of the Findings and Observations from Past Studies

After the above general review of challenges, here we move on to focus on the more immediate context of Tanguar Haor and attempt a brief recapitulation of the findings and observations from similar earlier exercises (most notably Giesen *et al.*, 2000).

Although Tanguar Haor has retained a high value to conservation, the signs of ecological degradation are obvious. The amount of silt deposited by rivers flowing from the adjacent Meghalaya Hills in India has increased significantly, threatening crops and water quality in the northeastern part of the *haor*. Swamp forests are down to a few last vestiges, reed beds are in decline, and at least three aquatic plant species have disappeared. Fisheries production has declined, probably due to over-fishing and habitat decline, leading to annual restocking over the 5-6 years and the introduction of exotic fish species. Subsequently, 23 fish species have possibly disappeared from the area over the past decade. Waterfowl numbers are still in the range of 20,000-40,000 annually, but are declining, mainly due to excessive hunting. In the 1996-97 seasons, an estimated 10,000+ birds were taken from Tanguar Haor, which far exceeds sustainable levels. Due to a combination of hunting and habitat change, reptile, amphibian and mammal numbers are low and far below what the area could sustain.

Although over-exploitation of natural resources appears to be the main cause of environmental degradation, the underlying mechanisms that have led to this decline are the current leasing system and the exclusion of the local community from fisheries. The short-term lease of 2-3 years means that leaseholders have little incentive to invest in habitat management, and are strongly inclined to maximise exploitation levels. In the absence of monitoring by government agencies, leaseholders have also gained control of non-fisheries resources, to the detriment of the local villagers. The exclusion of the local community from fisheries has resulted in impoverishment, and led to over-exploitation of other natural resources.

Table 3.1: Challenges for sustainable natural resources management

Resource	Status check	Reason for degradation
Water	Decline in water quality, higher incidence of waterborne diseases, effects on fish and other aquatic life	Deforestation in sub-basin, lack of sanitation, absence of latrines, large fishing camp in centre of haor
Swamp forest	Only 800+ old trees remain at Rangchi; the rest of this once common habitat type has disappeared	Cutting, clearing and burning. Lack of alternative fuel resources. Illegal use of cut trees for <i>katha</i> fish trap construction
Reed beds	Many have been cleared, and only a relatively small area remains	Cutting, clearing and burning. Lack of alternative fuel sources or construction material (<i>thatch</i>)
Desirable aquatic plants	Certain useful aquatic plants such as <i>Nelumbo nucifera</i> (lotus or padma), <i>Euryale ferox</i> (fox nut or makhana), <i>Nymphaea</i> species (waterlilies or padma, nilshapla, sada) have disappeared or are rare	Over-utilisation, dis-use of village ponds, decline in water quality
Fish	Many species have become rare, or have disappeared altogether. Possible loss of 23 species (out of 135) since 1988	Over-fishing, destruction of wetland habitat (especially breeding, spawning and feeding areas), decline in water quality, restocking with commercial fish (including exotics), accidental introduction of fish disease with restocked fish
Amphibians	Numbers have reportedly decreased significantly; certain species now rare	Habitat destruction, decline in water quality; in past: harvesting for export
Reptiles	Numbers have reportedly decreased significantly; certain species now rare	Hunting for food (turtles and tortoises); persecution because perceived as threat (snakes); habitat destruction/cover
Birds	10,000-15,000 trapped annually; numbers have reportedly declined by about 2/3's	Hunting for food and income generation (by local community) and sport (outsiders)
Birds	10,000-15,000 trapped annually; numbers have reportedly declined by about 2/3's	Hunting for food and income generation (by local community) and sport (outsiders)

Source: Giesen *et al.* (2000)

Table 3.2: Governance challenges for Tanguar Haor

Issue	Challenges	Characteristics
Poverty	The inhabitants of the 88 villages in and around Tanguar Haor are generally in a state of abject poverty	Nearly all of the people living in and around the haor are dependent on its natural resources to some extent. The poorest groups are those whose primary source of income is derived from fishing, service or daily labour, while those that can farm are generally slightly better off. However, farming is not available to many, as 45 % of the population of Tanguar Haor possesses less than 0.5 acre of land, and is technically “landless”.
Lack of financial resources	Lack of financial resources for sustainable management of Tanguar Haor	The local community is very poor, having an average family income that is only half the national average. MoEF, in collaboration with other stakeholders, has allocated some resources, but at present has only been able to initiate a project in the area. The current level of investment by other public natural resource management institutions- notably Departments of Fisheries and Forests has been modest and insignificant. There is a plan for establishing a dedicated unit for biodiversity conservation under the auspices of MoEF; but the progress towards implementation has been painfully slow. Besides, such an entity will first need to secure core funding and develop into a viable agency before significant GoB resources are channeled for the purpose.
Poor infrastructure	Remoteness of the location and lack of infrastructure make it difficult to manage the resources efficiently	The area is mainly served by several unpaved trails that can be used only in the dry season. Currently, however, some road infrastructural projects are underway, but it may take quite some time for the benefits to actually reach to the local communities. There is no mainline electricity and regular land telephone lines. This remoteness has contributed to the relative intactness of the haor ecosystem. From the point of management and co-ordination of projects in the area, however, this remoteness creates difficulties, as communication is difficult and permanent positioning of either project or management staff often becomes an issue.
Institutional mismatch	Multiplicity of relevant organizations and overlapping and uncoordinated character of their operations result in ineffective resources management	The Forest Department has had marginal involvement in the management of natural resources at Tanguar Haor, namely via the lease of the 26 ha of chonmahal (grassland and reedland) in the area, and via limited field support provided to the team that produced the first THMP in 1996-97. There is no representation in the field at Tanguar Haor, nor is there any budget for field-related activities dedicated to Tanguar Haor. In the past the Department of Fisheries (DoF) was involved at Tanguar Haor by carrying out a programme of restocking the haor with major carp species. In the recent years, however, DoF has been nominally involved in occasional protection campaigns via conducting 'mobile courts' and providing some technical supports to the fish sanctuaries. The DoF office in Sunamganj reported that they do not have adequate funds to carry out inspections, and cannot do so unless they receive external support. District Administration (DA) is in charge of day to day resource administration of Tanguar Haor. Dedicated resources for Tanguar Haor in the Deputy Commissioner's office, however, is grossly insufficient and the level of technical expertise and subject specific knowledge is also modest- to say the least. The extent of functional coordination between DA and other NRM departments (for example DoF and FD) is low and discreet. There are also cases of conflicting management priorities: for example, between commercial orientation and conservation goals. More generally, there is insufficient understanding of co-management and broader conservation issues in the field level public agencies. Despite the favourable central political and administrative commitment to Tanguar Haor co-management, this low degree of motivation and understanding at the field level has stood on the way of benefitting from such central commitment and support.

Issue	Challenges	Characteristics
Political will for change	Despite some progress in political commitment and support- especially at a rhetorical level to advance conservation in Tanguar Haor, corresponding actual actions towards materializing such political commitments in the field remain limited and insignificant	- Although MoL has temporarily allowed MoEF to manage Tanguar Haor, it has not fully relinquished control of Tanguar Haor to MoEF and/or appropriate conservation agency - Inadequate level of engagement and support of Local Government. - Difficulty in sustaining MoEF's long term commitment to biodiversity conservation and Tanguar Haor management due to the radical changes in political leadership. - Notwithstanding the commitment expressed in perspective plans (the Sixth Five Year Plan) regarding Tanguar Haor, there has been insufficient allocation of funds by the government for medium- to long-term management of Tanguar Haor, beyond the life of initial projects.

Source: Developed and elaborated by the authors based on Giesen *et al.* (2000)

3.3 Summary of the Clusters of the Current Challenges

In continuation of the above discussions, here we attempt to capture the more contemporary challenges through a series of stakeholder consultations complemented by two short field visits.

Cluster of Challenges 1: Incapacitated stakeholders and constrained livelihood and collective action

Key manifestations:

- Difficult terrain and communication conditions
- Diversity and conflicts in the socio-economic and cultural composition, background and behavioural patterns of the local community
- Very low capacity of the community in terms of basic education and organisational/institution building skills
- Diverse and often conflicting views and priorities of the key stakeholders on resource management
- Limited scope of interaction and exchange of knowledge among the key stakeholders.
- Generally restraining and unfavourable environment for collective action and entrepreneurship
- Limited number of functional community organisations to nurture collective action and associated organisational capacity restrictions

Cluster of Challenges 2: Inefficient resource management and unrecognised ecosystem services

Key manifestations:

- Competing and conflicting mode of resource usage
- Abject state of poverty – leading to desperate means of resource extraction
- Weak reinforcement of regulatory measures and laws regarding resource use and harvesting
- Reluctant and marginal presence of law enforcement institutions and activities on the ground
- Generally unfavourable context of policy and operational support for the local community to play a major role in resource management and protection
- Little or no social and cultural resistance against illicit and harmful resource extraction
- Patronization of poachers by socio-political elites
- Lack of agreement amongst the community about the priorities and goals of Tanguar Haor management; and the difficulty in developing a shared vision of the Tanguar Haor management and use amongst the key stakeholders
- Limited interest and understanding of conservation needs: Conflict in perception about development and conservation
- Lack or inadequate understanding of an ecosystem or landscape based long-term vision in resource use and conversation; pursuits of short run gains predominate
- Difficulty in ensuring equitable access and benefits to members of the community
- Sabotage and interferences by powerful local vested interest groups
- Inadequate scientific and research-based information and knowledge base on the use, modalities and outputs and the difficulty in generating these information
- Inequity in sharing of benefits and other resources
- Inadequate coordination and/or mutual trust amongst the relevant public agencies and between community organisations and the government

- Lack of an overall oversight entity responsible for the long-term coordination and management of Tanguar Haor – focussed on both livelihoods/ economic and ecological/conservation dimensions of resource management

Cluster of Challenges 3: Unsustainable institutions and inadequate community participation and long range vision

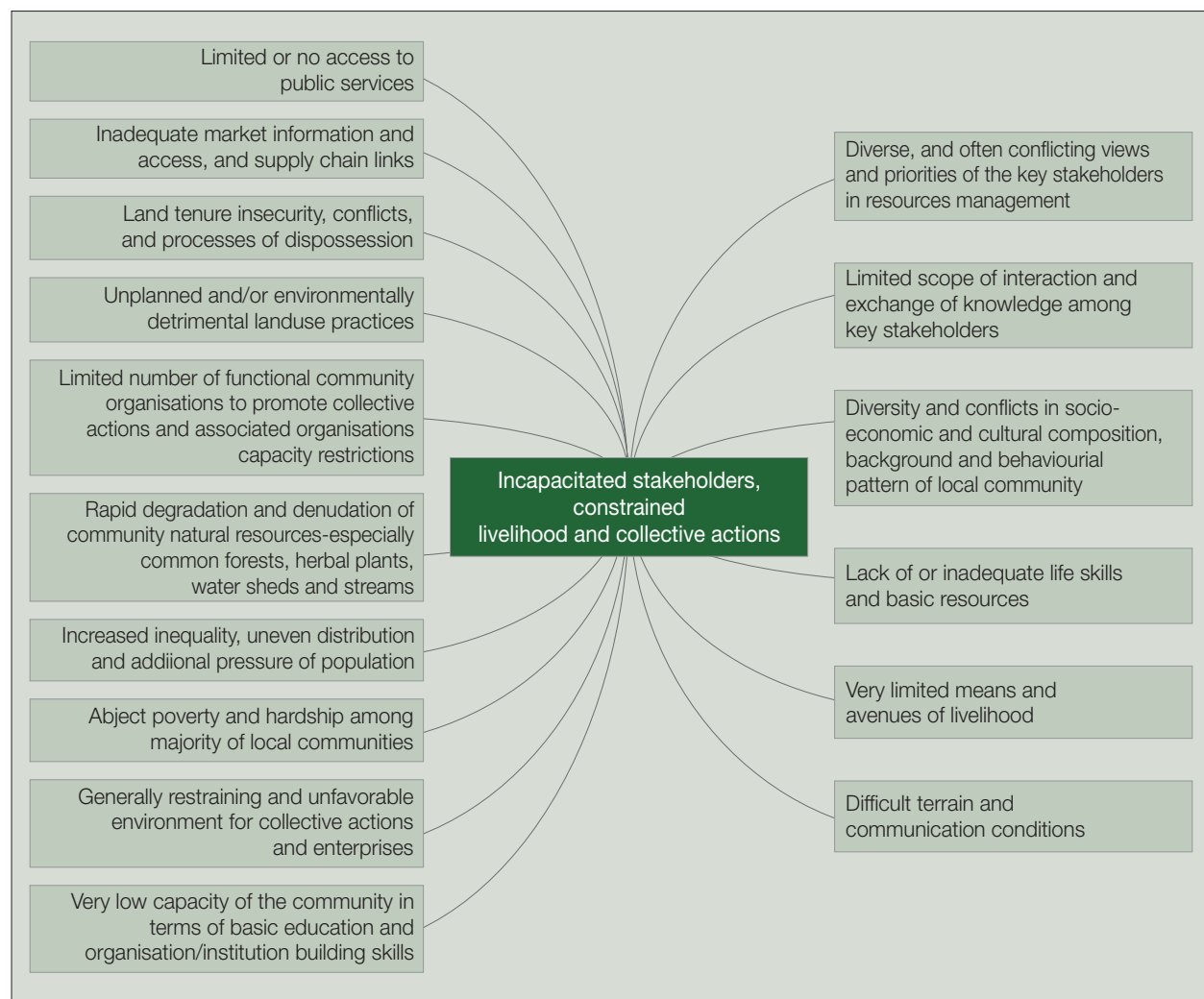
Key manifestations:

- Lack of or inadequate institutional structure and avenues for local resource mobilization
- Limited or no fund and/or office management skills at the community level
- Limited avenues and access to external source of finance and funding at the locality
- Limited participation of the community leaders in management and decision making
- Lack of a long term vision and perspective on resource management and institutional sustainability
- Inadequate understanding and conviction on the benefits of co-management amongst the community
- Lack of agreement amongst the community about the delegation of authority

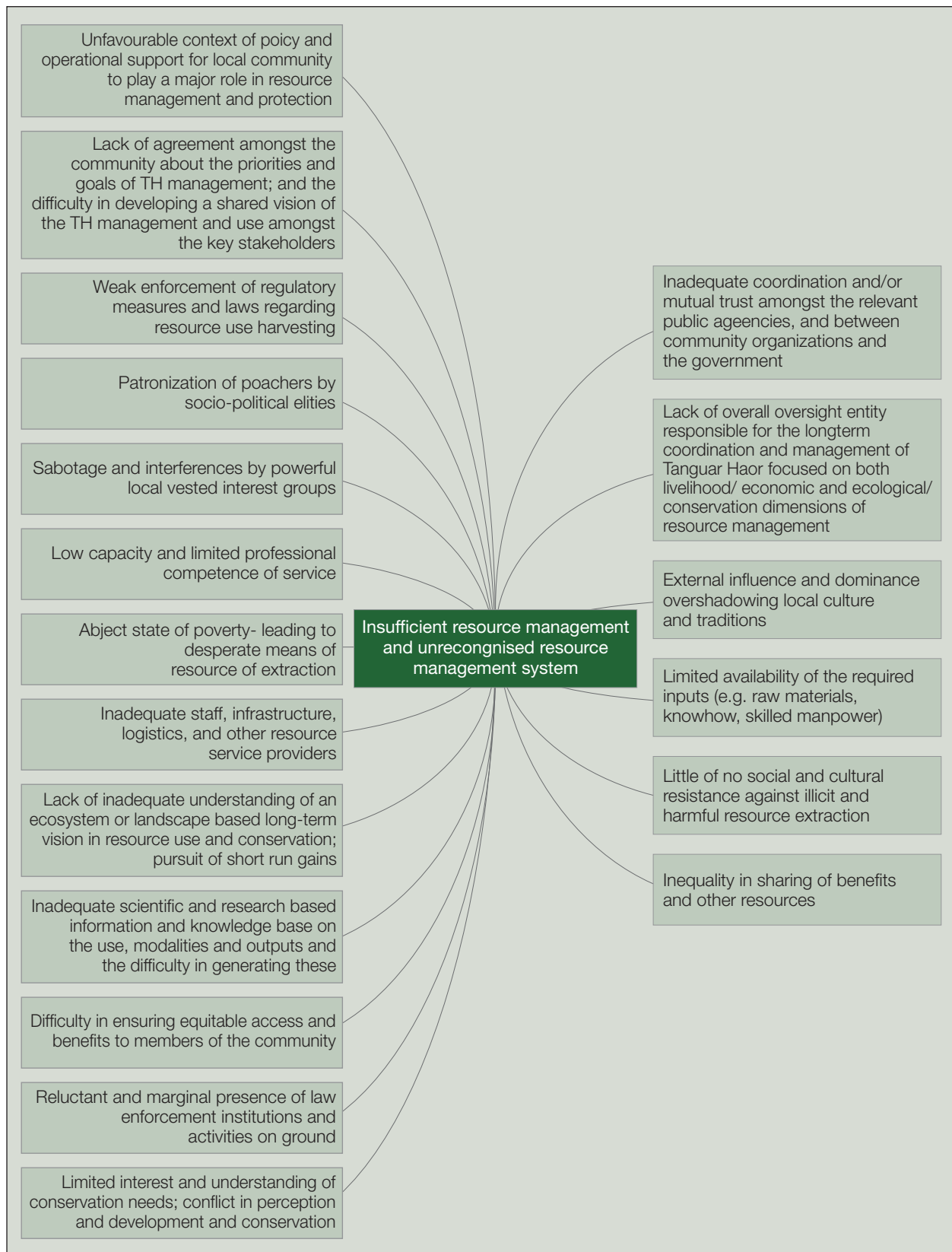
3.4 The Problem Trees

Based on the above key manifestations of the challenges the following 'problem trees' are developed which could be used as the basis of developing and recommending future programmatic interventions in Tanguar Haor (see Chapter 4).

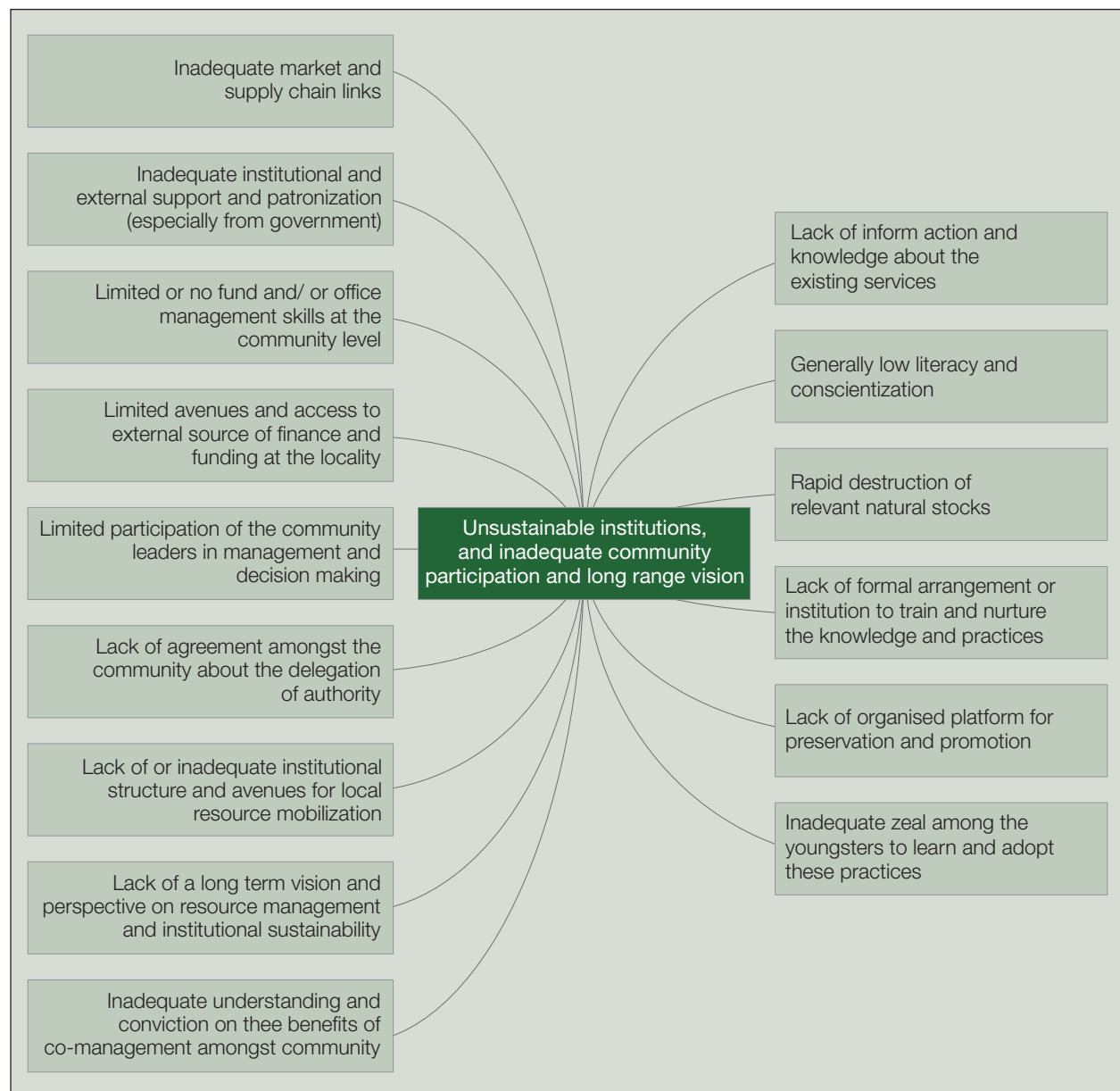
Problem Tree I



Problem Tree II



Problem Tree III



Above-mentioned challenges are complex and mostly cross-cutting in nature. A single prescription or isolated treatment cannot generate a long-lasting solution to the problems. Viewing the problems through a co-management lens, the present study broadly identifies three priority areas of interventions, which are as follows:

Poverty reduction and biodiversity conservation require more emphasis: As noted above, until recently, NRM policies and actions had a predominantly commercial and bureaucratic orientation and this approach, inter alia, provided for insufficient focus on the considerations of poverty reduction and biodiversity conservation. The interests in and experimentations with the more participatory and community focused interventions (e.g. social forestry, forest co-management, wetland and fisheries co-management) paved the way for focusing more intensively on poverty and biodiversity issues. This shift of focus needs continuation and further consolidation.

The value of empowerment through appropriate institution building, reforms and capacity enhancement: The above review of the NRM sectors points out in no ambiguous terms, the crucial need and significance of institution building, especially at the community levels and enhancing capacities nearly at all levels and across government, non-government and community organizations. The capacity gap and areas of possible interventions are now reasonably well identified and established. Besides systematic and well planned capacity enhancement measures, the other strands of interventions required for such empowerment include: provision of basic information and training, building of social capital and support for transparent institutions – irrespective of the size - that have the confidence of the local population.

Ambiguous property and tenurial rights and insufficient incentive: Insecure and ambiguous property and tenurial rights often lead to conflicts and inefficiencies in the utilization of NRs, and serve as a disincentive for the key stakeholders especially local communities and users to proactively participate in NRM. It is therefore imperative to (i) clarify property rights including, where applicable, resolving disputes, completing the process and making them exclusive; (ii) attune the distribution of such rights to interest of poverty reduction; and (iii) ensure policy and institutional support to enforce such rights especially in favour of the weaker sections of the communities.



Chapter 4

The Proposed Intervention: Basic Scruples, Structure, and Logic Model

This chapter presents an outline of the proposed programme in Tanguar Haor. Based on the preceding strategic review (Chapter 3) of the major challenges and risks of effective wetland co-management in general and Tanguar Haor in particular, in what follows we identify and recommend a set of scruples and principles that ought to underpin the relevant good practices and initiatives. Subsequently, the design and structure of the proposed programme is elaborated including the Action Logic and the relevant component descriptions. It is worth mentioning here that there is no standard or single best way to effective co-management. Alternative means need to be considered in light of the specific contextual situation. The following proposed approach to the Tanguar Haor co-management is therefore indicative and meant to be periodically revised and readjusted based on the changing contexts and circumstances.

4.1 The Principles and Scruples for Improved Community Focused Wetlands Governance

This section identifies several key principles and scruples that ought to underpin the relevant good practices and initiatives.

Table 4.1: Suggested guiding principles and scruples for improved community focused NR Governance in Bangladesh

Principles and Scruples	Manifestations, Connotations and Implications
Poverty, Gender Equity, and Rural Development Focus	• Exploration of the role of co-management in poverty reduction: Increase support for project and activities (including a focus on relevant research and extension of technology) that promote income generation and sustainable benefits to local communities especially the weaker sections; Strengthen the ability of poor farmers to obtain needed support such as credit and technology, access to markets and participation in training and extension services; Strengthen institutional, market and financial mechanism that expand opportunities for alternative income generation (e.g. off-farm employment) • Securing property and tenure rights is crucial • Equity in decision-making and gender is (a difficult but) worthy ideal • Emphasis on gender participation in co-management
Pluralistic Directions	• A decentralized, more open and equitable relationships between a range of groups and organizations (community, government, private sector NGO etc.) at the local level in the decision and implementation of forest management programs • There is no single, absolute universal solution to natural resource management problem; there are numerous 'scenarios' • Conflicts are inevitable and cannot be resolved but managed • Platforms, mediators and facilitators are needed to provide conditions for negotiation and cooperation needed for sustainable forest management • Communication is essential and helps participants understand the differences better • No group/organization can claim a superior or absolute scenario; sustainable development and rural development decision-making is no longer the sole mandate of expert authorities
Sustainability	• Developing an ecosystem and landscape based perspective; Building on local indigenous knowledge of resource use and conservation
Subsidiary and Decentralization	• Decisions should be made at the lowest possible level where competencies exist. The principle aims for effective implementation of tasks within a given policy and a hierarchical level, which minimizes costs and maximizes social well-being • Shifting responsibilities and separation of functions • Not imposing technical solutions, but promoting the emergence of possible solutions at the field level • Not assuming that the center has all the answers, technical or otherwise, but believing that solutions will emerge as challenges are encountered • Careful and realistic analysis of local capacities • A comparison of capacities and devolution of responsibility and authority to the most appropriate entity
Partnership, Participation, and Dialogue	• Improving cross-sectoral linkages with regard to co-management • Emphasis on the role of civil society (including NGOs and CBOs) and organized groups especially at the community level • Strengthen local participation in decision-making and sharing of the benefits of forest development and conservation • Special consideration to hearing the voices of and making room for the weaker sections including the poor, vulnerable (women, disabled, and otherwise excluded)

Principles and Scruples	Manifestations, Connotations and Implications
	Dialoguing towards setting priorities in terms of equity, efficiency and sustainability as well as timeliness, practical and public visibility of co-management programs; understanding multiple perspectives and need of stakeholders; and attempting to negotiate and cut deals between the need of wider society and local actors; and initiating partnerships
Social Capital, Collective Action, and Capacity Building	- Social capital essentially includes the norms of reciprocity, networks and trust among local people - Attempts at shifting more power and responsibilities and partnership with local people pose the questions of capacity building at the local level - Collective action can be very difficult where levels of social capital are low and capacity is weak or lacking - Social capital may be developed through a process of systematic dialogue between the local (rural/indigenous forms organizations) and central levels (government), decentralization of power and responsibilities and gradual building of networks and norms of trust - Besides legal and political reforms, several processes can contribute to capacity building and empowerment at the local level which include embeddedness of authorities in the local community; belief systems that orient authorities toward service and dedication; reputations that local organizations seek to maintain; journalists, NGOs, community organizations or individuals lobbying or acting as watchdogs; social resistance or threats of resistance; reporting requirements concerning local meetings and public service; information dissemination about obligations and powers of concerned institutions to local populations; open forums for public discussions; education and literacy campaigns
Communication and Democracy of Knowledge	- Communication is the means by which participants exchange information with each other about values, perceptions, interests, ecosystems, resources, the economy and society; participants reach agreement with each other on actions and strategies - Communication needs to be planned carefully as an integral part of co-management - Openness of information from all sources - Communication of both information used in policy making and information on policy impacts

Source: Developed by the author based on ideas expressed (and the literature cited) in Khan *et al.* (2004) (especially pages 171-173).

It is important to note here that the above framework of principles and scruples for improved NR governance in general and co-management in particular is suggested in light of and within the remit of IUCN and Ramsar visions, missions and programmatic priorities.

4.2 Programme Action Logic: The Logic Model

In light of the strategic review of the challenges- especially the Tanguar Haor 'problem clusters' (Chapter 3)- and the above listing of relevant scruples in what follows, we present the key elements of a proposed programme for Tanguar Haor co-management. We begin with outlining the programme's 'Action Logic', followed by elaboration of the corresponding 'Theory of Change' and programme 'Component Descriptions'.

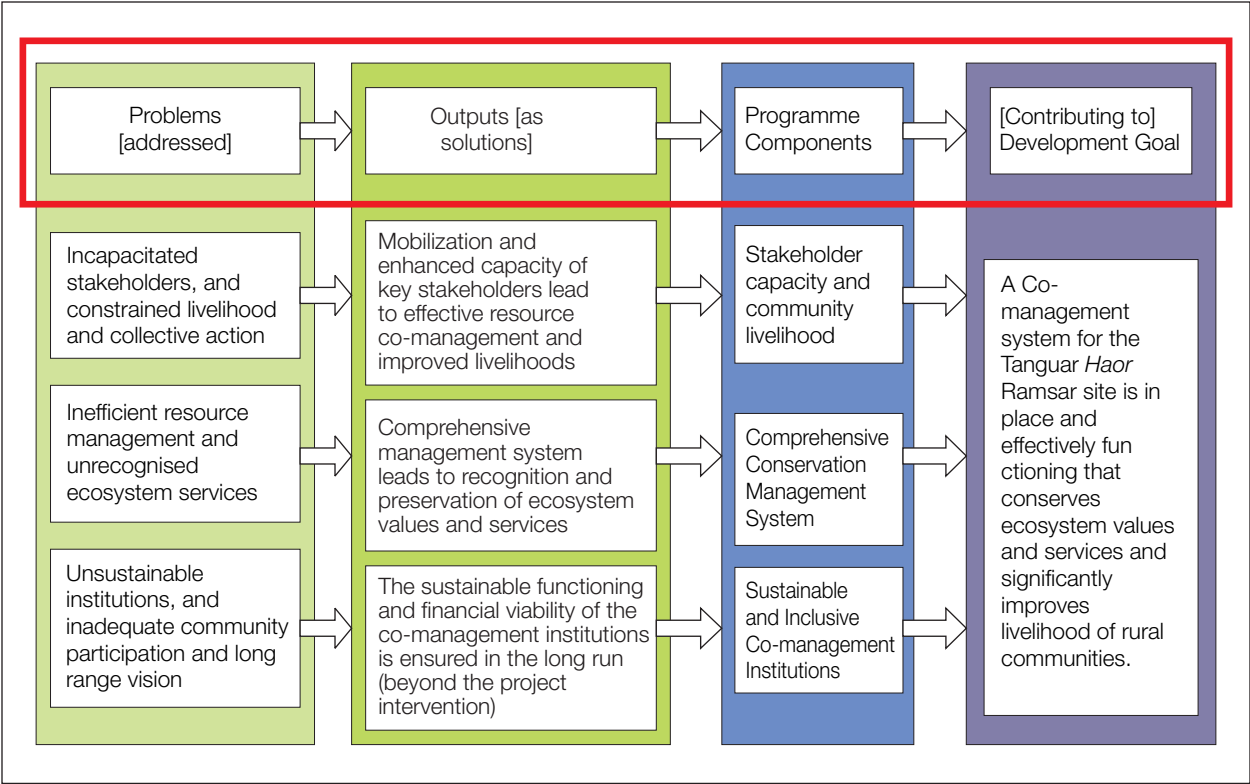


Figure 4.1: Summary Structure of the Logic Model



Natural view of Tanguar Haor during dry season

Table 4.2: The theory of change concerning component 1: Stakeholder Capacity and Community Livelihood

Inputs/Programme investments	Outputs		Outcome- Impacts		
	Activities	Participation	Short term	Medium	Long term
What we Invest?	What to do?	Who we reach?	What the Short term results are?	What the Medium term results are?	What the ultimate impact(s)?
- Trained Staff - Capacitated Organizations - Reasonable funds and logistics - Need-based work plan & time schedule - Working partnerships - Research and Learning - Technology & knowhow - Materials and Equipments - Knowledge & information	Stakeholder capacity and community livelihood - The community lives in 88 villages around Tanguar Haor (Tanguar Haor) which covers about 50 km along the periphery - Identification & conduct training at 88 villages - Formation, training & promotion of IGA-focused community & school-based groups in Tanguar Haor area - Establishment of market links and communication support in Tanguar Haor - Provision, training & facilitation of agriculture & other services - Enrichment & restoration of VCF & associated watershed resources through Tanguar Haor community management - Meetings, workshops, capacity development for relevant stakeholder engagement in Tanguar Haor - Capacity enhancement of relevant local institutions & community groups in Tanguar Haor - No single mode of transport is applicable for whole area except boat in the monsoon at Tanguar Haor - Socio-cultural and historical difference among the communities of different area. Some villages are dominated by original inhabitants, some by settlers from other districts and a few are governed by ethnic minorities - Interpersonal and social relationship vs. Organizational responsibility of the community - Conflicting and confusing role of the community prevails - Socio-economic diversity of the community. Rich-poor, influential-non-influential, varied social position (Teacher, Inam, businessman, local govt. representatives, politician)	Community groups; in Tanguar Haor area School-based committees/ groups; Concerned public line departments (Agriculture, Health, Forests, Livestock, Primary Education); Local government & traditional leaderships	Subject-specific IGA skills & knowledge increased; more positive attitude towards women participation in group decisions and project implementation; knowledge of basic project management (including elementary market and supply chain ideas) available at the community level; increased zeal and motivation for participating in the programme; Knowledge & skills on community-based NRM process & tools	Various community-level IGA enterprises launched & effectively operated; Additional income flowing into beneficiary households; Market better managed for selected enterprises; IGA best practices demonstrated; Selected enterprises/practice s picked up by communities beyond the programme, and replicated in the region; Community management of selected VCFs & associated watersheds experimented for enrichment of livelihood & environment	The targeted communities attained decent standard of living; Functional partnerships and social capital towards community projects & actions; Targeted Tanguar Haor local & community organizations empowered; Selected VCFs & associated chora and watersheds of community livelihood and biodiversity significance brought under well functioning community based management that delivers restored habitats and biodiversity and improved livelihoods for a majority of poor in those communities

Table 4.3: The theory of change concerning component 2: Comprehensive Conservation Management System

Inputs/Programme investments	Outputs		Outcome- Impacts		
	Activities	Participation	Short term	Medium	Long term
What we Invest?	What to do?	Who we reach?	Learning	Action	Conditions
- Trained Staff - Capacitated Organizations - Reasonable funds and logistics - Need-based work plan & time schedule - Working partnerships - Research and Learning - Technology & knowhow - Materials and Equipments - Knowledge & information	Comprehensive Conservation Management System - Support to schools towards teachers' salary, infrastructure, teaching aids; study materials - Quality improvement measures - Behavioral Change Communication around Programme schools and community groups addressing primary, child & maternal health care - Experimental provision of mobile health clinics hovering over selected communities - Capacity enhancement of relevant local institutions & community groups - Geography of Tanguar Haor area divides the wetland in to more than hundred large/small depressions, huge ridges and banks (Kanda) of depressions. Man made homesteads, infrastructures, roads and embankments disrupted natural linkages among the depressions - Lack of common interest (access, benefit) in the conservation of resources. Agri. Vs Fisher for example - Sense of customary rights to the use of natural resources for social affairs (Religious mainly) and personal gain in disguise - Equitable distribution of resources among the community. Complex calculation of capacity, professional status and contribution to preservation of resources - Assessment of sustainable harvesting level. Huge data required for a long span of time - Maintenance of sustainable harvesting by the community. Monitoring mechanism, skill, sense of responsibility and integrity of community are factors - Existing procedure of resource management by the government represented by the district administration hinders the co-management approach - Access of community to the natural resources. Barred access vs indiscriminate exploitation - Development conservation nexus. Conflict in perception about development and conservation	Students; Parents (especially mothers); Teachers; School Management; Concerned public line departments; Local government & traditional leaderships	Better professional skills & knowledge of school teachers; Improved and more transparent school operations; more positive attitude towards female children's education, & mothers' participation in school management; development of leadership and management skills esp. among community women; increased zeal and motivation for resourcing & participating in the schooling programme; greater knowledge & awareness of existing public services and their accessibility; Health & hygienic awareness & learning amongst schools/communities increased	Overall performance of targeted teachers improved; Female students enrolment increased and drop out reduced; Women's voice reflected in school decisions and management; Increased community (cash/kind) contribution to resourcing the schools; School committees (SMC, PTA, MGs) made fully operational; Functional interactions between relevant line departments and community groups/organisations leading to availability of services as sought by the community; Mobile health clinics operationalised & targeted communities served; Relevant BCC campaigns fielded in targeted schools & communities	Targeted Tanguar Haor communities capacitated through increased literacy & basic life skills; Targeted schools take roots and become self-sustaining; Functional partnerships and social capital towards school-based projects & actions; Women's role & visibility in community affairs increased and recognized; Basic health & hygiene condition improved in participating schools & communities; Incidences & spread of common/contagious diseases reduced/contained

Table 4.4: The theory of change concerning component 3: Sustainable and Inclusive Co-management Institutions

Inputs/Programme investments	Outputs		Outcome- Impacts		
	Activities	Participation	Short term	Medium	Long term
What we Invest?	What to do?	Who we reach?	What the Short term results are?	What the Medium term results are?	What the ultimate impact(s)?
■ Trained Staff ■ Capacitated Organizations ■ Reasonable funds and logistics ■ Need-based work plan & time schedule ■ Working partnerships ■ Research and Learning ■ Technology & knowhow ■ Materials and Equipments ■ Knowledge & information	Sustainable and Inclusive Co-management Institutions ■ Policy advocacy on Tanguar Haor issues ■ Research & publications on indigenous culture and practices ■ promotion of traditional handicrafts, craftsmanship & events ■ preservation of traditional community practices ■ Capacity enhancement of relevant local institutions & community groups ■ New and unconventional approach of co-management of wetland resources needs huge promotion to make it comprehensible to office bearers ■ Understanding on the holistic co-management approach differs from person to person. Implementation procedure suffers from personal stance ■ Confusing state of mind of the management created by interested groups with fictitious information ■ Specific guidelines from the government are yet to be issued. Confusion in decision making specially to provide the community with access to resources ■ Effect of both external and internal influence regarding resource protection measures ■ Dearth of time need to be spent for Tanguar Haor management amidst huge everyday workload ■ Staff shortage and bureaucratic system delays disposal of critical issues. Revenue matters, delegation of authority for example	Practicing Tanguar Haor cultural groups (especially youths); Tanguar Haor traditional craftsmen; Tanguar Haor local communities (especially smaller ethnic groups); Regional & national policy/decision making quarters; Media; Concerned international community/organisations; Civil society	Greater community awareness of relevant rights and services; broader understanding among targeted regional and national audience on topical CHT issues; greater social awareness among targeted Tanguar Haor (especially young) communities re heritage restoration	Targeted cultural groups/craftsmen made fully operational; Functional interactions between relevant institutions (cultural institute, museum, display centres, cultural activists & organizations) and community groups leading to stronger preservation efforts; Selected tradition and cultural practices restored and demonstrated	Burning Tanguar Haor issues effectively projected at the regional and national level; Relevant national policies/decisions showing more responsiveness & sensitivity to Tanguar Haor; Selected near-extinct tradition and cultural practices revitalized and reasonably practiced by local communities; An accessible repository of knowledge & information on Tanguar Haor culture and heritage maintained

4.3 Brief Component Description

Component short title	Stakeholder Capacity and Community Livelihood
Output 1:	Improved Tanguar Haor community livelihood and associated environment through diversification of income generation avenues and sustainable natural resource use and management
Rationale:	Means of livelihood in the region is strikingly limited. The situation is further aggravated by such factors as inadequate literacy and other life skills amongst majority of the poorer members of the local communities; acute food and nutritional deficiency and insecurity; limited or no access to external markets, knowhow and relevant public services; rapid degradation and denudation of community natural resources – especially common forests, herbal plants, watersheds and streams.
Indicative functional activity-areas:	• Identification, training, development and implementation of various IGA projects in Tanguar Haor area • Formation, capacity enhancement & promotion of IGA-focused community and school-based groups in Tanguar Haor area • Exploration, facilitation and establishment of market links, communication and other supply-chain related support to the communities • Provision, training & facilitation of agriculture, livestock, poultry & other services in Tanguar Haor area • Enrichment & restoration of Village Common Forests (VCF) and associated watershed resources in Tanguar Haor area through community management • Prioritise in Tanguar Haor area VCFs and watershed systems of high environmental and livelihood support value • Tree plantations along streams with indigenous species and keeping the streams alive throughout the year to ensure water supply for households and irrigation for agriculture activities • Community based -preferably socio-religious institution-led herbal gardening, mixed fruit and other plantations in Tanguar Haor area • Involve traditional and local government leaders and provide support to VCF and associated watershed management with the participation of stream-dependent households; supply quality-planting materials to raise streamside plantation and support the communities to manage and protect streamside vegetation effectively in Tanguar Haor area • Meetings, workshops, capacity development for relevant stakeholder engagement in Tanguar Haor area • Various capacity enhancement measures targeting relevant local institutions and community groups in Tanguar Haor area

Component short title	Comprehensive Conservation Management System
Output 2:	Availability of Comprehensive Conservation Management System, skills & knowledge amongst targeted communities and enhanced capacity of local communities and institutions to tap the services
Rationale:	Opportunities of and accessibility to of Comprehensive Conservation Management System, skills and knowledge in Tanguar Haor area are strikingly limited. The region represents one of the most disadvantaged and vulnerable regions in the country in terms of almost all major development indicators including education and health. Education rate in the Tanguar Haor area is very low particularly among the remote rural communities. School infrastructure, furniture, teaching aids, extracurricular materials, safe drinking water and sanitation facilities are grossly inadequate. In the same vein, basic healthcare services are limited and often remain inaccessible especially to poorer and remote communities. In this context, raising awareness for identifying symptoms of common diseases, fundamental behavioural changes regarding health, hygiene and sanitation and basic provision of primary healthcare can be a life saving initiative. This component is conceived against the above context and addresses some of the existing gaps and paucities in basic wellbeing provisions and services through of Comprehensive Conservation Management System.

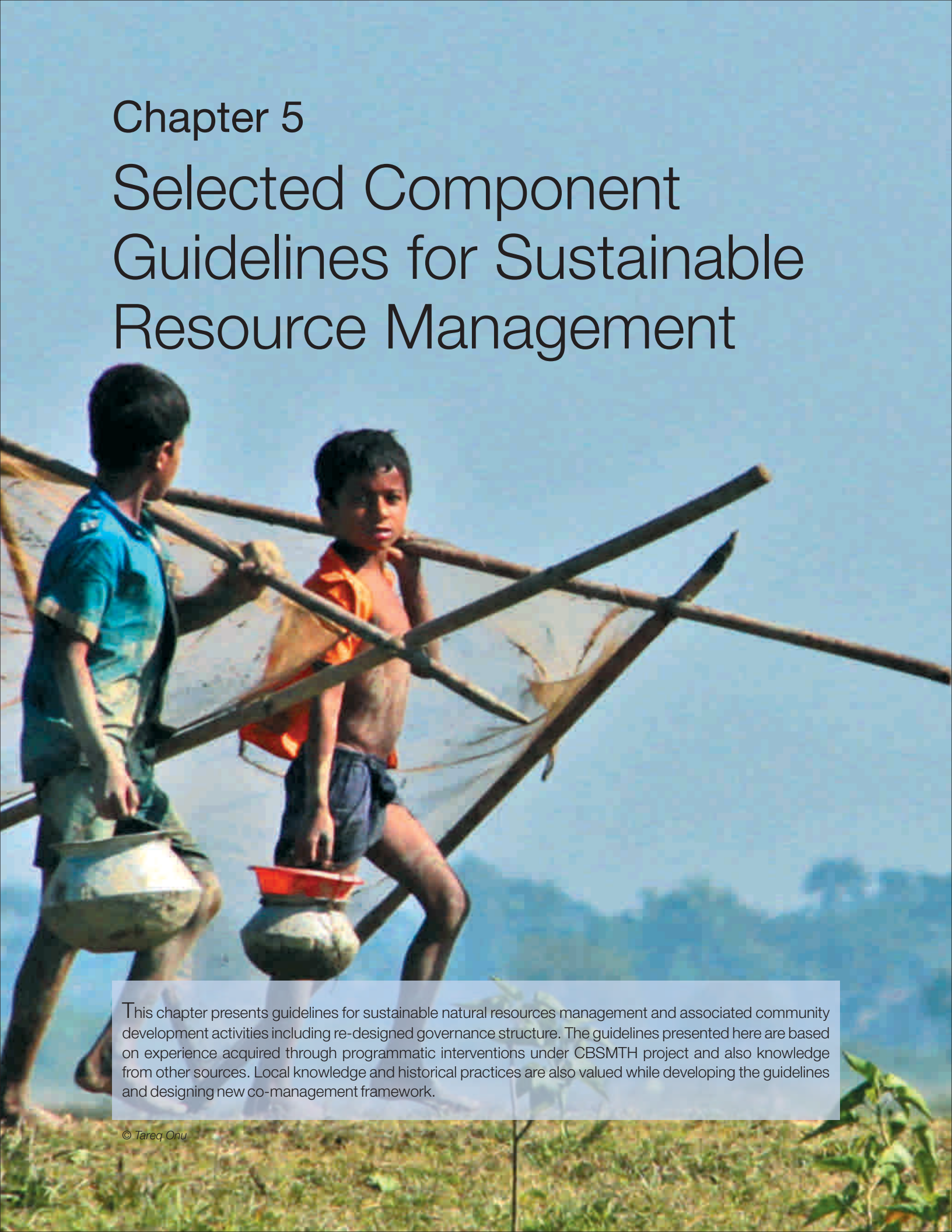
Component short title	Comprehensive Conservation Management System
Indicative functional activity-areas:	• Support to institutions, infrastructure, teaching aids; study materials within the Tanguar Haor area • Quality improvement measures in the Tanguar Haor area • Behavioral Change Communication around Programme in schools and community groups addressing primary, child & maternal health care in the Tanguar Haor area • Facilitation & linking of communities to local public health services in the Tanguar Haor area • Experimental provision of mobile health clinics hovering over selected communities within the Tanguar Haor area • Meetings, workshops, capacity development for relevant stakeholder of Tanguar Haor for community engagement • Capacity enhancement of relevant local institutions & community groups in the Tanguar Haor area • Promotion, capacity support and facilitation of various local organisations/groups in Tanguar Haor area (SMCs, PTAs, MGs etc.) • Particular/targeted support to disadvantaged women and children in the Tanguar Haor community • The Tanguar Haor community school support initiative can enjoy a great local support and goodwill

Component short title	Sustainable and Inclusive Co-management Institutions
Output 3:	Selected near-extinct knowledge, tradition and cultural practices restored within Tanguar Haor community and topical development issues advocated at the regional and national level through Sustainable and Inclusive Co-management Institutions
Rationale:	Although the heritage and cultural diversity of Tanguar Haor local communities enriches the national culture of Bangladesh, some of the traditional practices and customs have, of late become nearly extinct owing to a host of problems such as external influence and dominance overshadowing local traditions, limited availability of the required inputs (e.g. raw materials, knowhow, skilled hand); rapid destruction of relevant natural stocks; lack of formal arrangement or institution to train and nurture the local knowledge and practice; lack of organized platform for preservation and promotion; inadequate Institutional and external support and patronisation (especially from the government); inadequate market and supply chain links; inadequate zeal among the youngsters to learn and adopt these practices. Besides, reflections and understanding of crucial Tanguar Haor development issues and challenges in the national and policy levels are still superficial and limited. Despite the rather dismal present state of affairs, these age-old traditions and deeply rooted social practices, most of which have significant value as a community service, still hold great potential and remains too important to be ignored. This component therefore, focuses on such issues as restoring and projecting selected nearly extinct cultural traditions and practices, creating opportunity for local children's of Tanguar Haor area to study in schools; enhancing relevant groups' capacity through Sustainable and Inclusive Co-management Institutions.
Indicative functional activity-areas:	• Various conscientisation and dissemination work at community, regional and national levels focusing Tanguar Haor community based management practices and its relevance and benefits • Policy advocacy on Tanguar Haor Management issues • Research & publications on Tanguar Haor co management culture and practices • Promotion of traditional handicrafts, craftsmanship & events like boat racing (Nowka bich), water buffalo racing etc. • Preservation of traditional community practices within the Tanguar Haor area • Capacity enhancement of relevant local institutions & community groups within the Tanguar Haor area • Strengthening links to relevant public institutions within the Tanguar Haor area • Community based - preferably socio-religious institution-led conservation and revival projects on such subjects as herbal plants, fish sanctuary with in the Tanguar Haor area



Chapter 5

Selected Component Guidelines for Sustainable Resource Management

A photograph of two young boys in a rural setting. They are carrying a large, rectangular fishing net on their shoulders, supported by wooden poles. The boy on the left is wearing a blue shirt and green shorts, and is holding a large metal pot. The boy on the right is wearing an orange shirt and blue shorts, and is holding a red bowl and a large metal pot. They are walking through a grassy field with hills in the background.

This chapter presents guidelines for sustainable natural resources management and associated community development activities including re-designed governance structure. The guidelines presented here are based on experience acquired through programmatic interventions under CBSMTH project and also knowledge from other sources. Local knowledge and historical practices are also valued while developing the guidelines and designing new co-management framework.

5.1 Guidelines on Components concerning Natural Resource Use and Management

5.1.1 Fisheries: Restoration and Sustainable Harvesting¹³

The Context

The baseline study of fisheries resources in Tanguar Haor is very important for conservation, harvesting, management and sustainability of the aquatic ecosystem. Only two estimation were conducted previously for assessing fisheries resources of Tanguar Haor- one assessment was conducted by NCS study in 1997 (5500 MT fish production) and another study was conducted by TARA (6500 MT production) in 2008. So, it has become an urgent need to estimate the fish stock in Tanguar Haor for assessing the Sustainable Yield Level (SYL) and sustainable use of fisheries resources thereby. The *haor* is considered as an important mother fishery of Bangladesh due to availability of a wide range of fresh water fish including non-commercial and ecologically important fish species. It is a unique wetland where a number of hill streams from the Meghalayan Hills regularly replenish its waters. Moreover, the wetland supports a distinctive habitat for biological species because the adjoining Jadukata River acts as strategically important feeder, and creates connection with the Surma River and the Dhanu-Baulai River system in the south. The wetland is linked with a number of surrounding *haors* such as Matian, Baldar, Khana Muia, Thapner beel and Shanir Haor. These features enrich the fisheries diversity and stock of this *haor* and make it the most productive wetland in the north-east region of Bangladesh.

In this *haor*, habitat diversity varies on the range of its *beel*, *beel* depth and inter-connectivity between beels and canals and rivers. Such habitat conditions support the optimum living place for the wide range of fish species and for their life spans at required levels. Disturbances in the right bank of the Patlai River at Nazarkhali are posing significant threat for entry and exit of fish from the beel to river and vice-versa. At the same time, sluice gate construction at Boalmari, Samsar beel and other places hinders free movement of this wetland fish, and leads to future risks. Furthermore, fish production in this haor is influenced due to continuous fishing pressures, fish habitat deterioration, creation of barricades and structural interventions, ascending water pollution, and other anthropogenic pressures. On this backdrop, the Ministry of Environment and Forests initiated the 'Community Based Sustainable Management of Tanguar Haor Project' in December 2006 with financial assistance of SDC and technical facilities of IUCN Bangladesh. The aim of the project is to establish a co-management system for Tanguar Haor through mobilizing the government administration local level and community organization in pursuit of good governance establishment in natural resource management, conservation and protection of all resources in Tanguar Haor including fish and aquatic life.

Understanding on the wise use principle of Ramsar Convention helps to ensure the sustainable harvesting of fish through conservation of the natural resources. To determine the SYL, it may consider the level and extent of harvesting of fisheries resources along with other organisms and wildlife species. It is expected that the joint initiatives of project management both at local and national level, will be able to raise awareness within community people about biodiversity conservation and long-term fish harvesting practice under the principle of resource harvesting modality. As Tanguar Haor is considered as mother fishery of Bangladesh it needs to update the fisheries baseline for every 5 years.

Physical Set-Up

Tanguar Haor is featured by major five depressions, a number of canals, nearby rivers and a number of hill streams. The most important *beels* of this *haor* are Rowa, Rupabhui, Berberia, Baluar Doba, Tekuinya, Hatirgata and Lechamara. Available hill streams contribute to maintaining year-round water flow and water quality. The depressions are interlinked with adjoining *haors*. The Jadukata River plays vital role for fish recruitment in Tanguar Haor and also for fish breeding place for many species. The Surma and Jadukata rivers contribute in fish migration. During monsoon, most of the *kandas* goes under water and then the *haor* turns into a single gigantic water body.

¹³ This section mainly draws on the following document and the literature cited therein: M. Ahmed (2015), Estimation and sustainable yield level of fishery resources in Tanguar Haor. TARA, Dhaka.

Biological Set-Up

Tanguar Haor is rich with fisheries resources, swamp forests and reeds. It is linked with the Dhanu-Baulai mother Fishery. *Ujja* or pre-monsoon fish migration is important when fish moves and migrate to the Jadukata and other rivers. Moreover, fish move to other nearby *haors* during that period.

Ecological Set-Up

The existing demarcated boundary of this *haor* is not properly reflected in the ecological boundary as the total area of this *haor* is always changing during the dry and wet seasons. Water flow during monsoon periods covers large areas of Tanguar Haor and its surroundings. Ecologically, the swamp forests and reeds are important for maintaining ecological cycle of this *haor* mainly for fishes, birds and wildlife.

Social Set-Up

Considering livelihoods and income sources - fishing, cattle grazing, reeds and twig collection and duck rearing are commonly practiced by most of the community people around Tanguar Haor. About 60,000 people from 88 villages directly/indirectly depend on resources of this wetland. Most of the people of this wetland are Muslim and Hindu by faith, whereas few are Garo including limited number of Hajong communities. Under various professional categories, most of the villagers are farmer, fisherman and day labourers. Few are small traders. About 70% people are directly involved in fishing. Fishing business spread over Solaimanpur, Lamargaon, Golgaon, Nutanbazar, Bangshikunda and in other small markets.

Habitat and Hydrology

The *beel* and *kanda* along with canals and *chara* (stream) are the major habitat type and pattern of Tanguar Haor. From pre-monsoon water level starts increasing and gets inundated. From October, water recedes from most of the *beels* of this wetland. However, in most of the *beels*, water remains in the dry season with adequate water depth. The shallow inundated *kanda* serves as grazing and nursery ground for floodplain and riverine fishes. Moreover, habitat is considered an important criterion based on the water depth and extension of most of the *beels* in Tanguar Haor in dry season, breeding ground for adjoining waterbodies, grazing and breeding areas for small fishes, harbour of threatened fishes, and residing place for many migratory birds.

Tanguar Haor is rich in biodiversity, and supports many plants, reeds and wildlife those are unique to this area. At present, some problems are becoming acute in this *haor* area such as illegal tree felling and reeds collection, poaching, water pollution through oil leakage from engine boat and wastage thrown from nearby villages.

Out of 54 *beels* that covers an area of about 3,650 ha (with *kanda* and floodplain 10,000 ha), 16 *beels* are perennial. Important *beels* are Berberia, Rowa, Lechamara, Baluar Doba, Goinnakuri, Chatainna, Tekunia, Ainna, Hatirgata, Mohishergata, Rupabhui, Noyhal, Kolma, Araillakona etc. Number of *kanda* in Tanguar Haor is about 180. Water depth in wet season is 6-10 meter and in dry season is 2-6 meter.

Nationally declared many threatened species are available in Tanguar Haor, which is an indication of rich biodiversity of this Ramsar site. About 17 endangered fish species out of total 28 are found in Tanguar Haor. This *haor* serves as the main source of fishes for many other *haors*. Tanguar Haor is habitat for many fish and non fish organisms. Rare fish like Mohashoal also is found here. Migratory fishes refuge in Tanguar Haor too. Thus it is enriched in biodiversity. This wetland, especially reeds and swamps, supports birds and wildlife. Migratory birds also visit and use the *haor* resources every winter. Food chain and food web appear to be well functioning and diversified here. Thus, this wetland is considered as the best place for all types of biota. More than 140 fish species are available in Tanguar Haor. Rui is dominating in the species composition in most of the *beels* of Tanguar Haor. Other dominant species are Ghonia, Lachu, Boal, Shoal, Gazar and small fish species. Some exotic fishes such as Grass Carp and Carpio are also found here, but these species are not dominant in this openwater. Fishes of Tanguar Haor contributes to total fish production of Bangladesh by about 0.67 percent.

Nature of Breeding, Migration and *Ujja*¹⁴

Small fishes breed in Tanguar Haor in pre-monsoon using khals, connecting channels, hill streams and inlet channels. Medium sized fish and big fish of sedentary in nature breed in the *haor*. However, big fishes use the

¹⁴ *Ujja*, the upward fish movement or migration in the pursuit of dispersion and breeding occurs from Haor to another water body during pre-monsoon.

Jadukata River for breeding and Rui, Catla go long distance for breeding. Tanguar Haor is a unique place from where migratory fishes go for long distance movement. It is believed that the Jadukata River is used for breeding purpose and Alamaer duar is important for breeding of Chitol Fish. Fish movement from *beel* to *beel* also occurs. Three types of fish migration such as *ujja* or pre-monsoon migration, breeding migration of fishes within Tanguar Haor and returning migration in September and October are available in this wetland.

In the pre-monsoon, major carps like Rui, Catla and Mrigel go long distance to find suitable place and environment for breeding. It is believed that fertilized eggs roll down with river current and within 4 days they enter into the floodplain and beel adjacent to the river. Small fishes breed in the hill stream and also within the *beels* in the Tanguar Haor. Medium sized fishes breed in the connecting channel or near to that in the Tanguar Haor.

Maturity of fish and gonad development of fish depends on quality of habitat, temperature, food availability, water flow and many other environmental factors. Maturity of small fishes takes place in late winter and gonadal development of large carps and catfish takes place in early summer. Breeding places and behavior is different for different fishes. For example, Chital fish prefer the submerged vegetation and structures. Ayre fish breeds in small pits/small depressions.

Small fishes of Tanguar Haor breed in early March-April. Big fishes breed in late May to early June, though carp breeds outside Tanguar Haor. Mrigel breeds in May whereas Calibaush, boal, ghonia breeds in April and May. Carnivorous fishes have their breeding in May-June for the abundance of huge foods in *beel* fisheries. Chital breeds in early April and May but Shoal and Gazar breed in June.

The Jadukata River is a special breeding ground for many fishes related to Tanguar Haor. Alamer Duar is also a breeding place for many fishes. Fishes that breed in the river are Baila, Baghaayre, Ayre, Pangas, Kajuli, Baim, Rani and Major Carps. Some species such as Gonia breed in the inundated *kanda* of *beel* and floodplain during monsoon.

Contribution of Breeding-Migration-Recruitment to Stocking

Recruitment of fish takes place both within and outside of Tanguar Haor. Mostly small fishes and some minor carps breed in Tanguar Haor. The yearly offspring added to the existing fish population which is termed as recruitment. Big fishes breed in bigger river outside of Tanguar Haor and their Juvenile or fish fry migrate and enter to Tanguar Haor and contribute in the recruitment process. Stock is related to many factors and also a balance between out going and in migration. Based on the previous study the estimated total fish stock of Tanguar Haor is around 7,000 tons.

Different types of fish migration and movement occur in Tanguar Haor. Fish movement occurs from *beel* to *beel* and migration occurs from *beel* to river or vice versa. In Tanguar Haor, migration takes place from *beel* to the Patlai river, Patlai river to the Dhanu-Baulai to Surma River, Tanguar Haor to the Jadukata River or vice versa. The migration is related to propagation as migration support fish breeding. For example, about 75 percent fishes return to Tanguar Haor that migrate to river and other haors for breeding or grazing during monsoon but contribution of this return in building total stock is estimated about 20%.

Selected Issues and Concerns

Some special issues such as over fishing, obstructing of fish movement/migration through earthen dam construction at Nazarkhali and other points, and sluice gate construction at some place along the Patlai river and un-authorized fishing need to consider with the utmost priority for maintaining the ecosystem and fishes resource conservation in Tanguar Haor.

Major issues of Tanguar Haor in the context of fish conservation are as follows:

- Over fishing
- Earthen dam construction at Nazarkhali and other places
- Sluice gate construction
- Un-authorized fishing

Fish Sanctuary Management

Considering conservation issues, fish sanctuary establishment is an integral part of resource management. In 2011, a total of five fish sanctuaries were established in Tanguar Haor. Among these, four sanctuaries were in four *beels* and another one at Alamer Duar of the Patlai River. These fish sanctuaries play an important role for maintaining the fish stock and fish diversity in this wetland. For increasing fish stock size, an advanced fish sanctuary has been proposed for some of the beels in Tanguar Haor. If implemented successfully it is believed that the fish sanctuaries of Tanguar Haor can contribute to increase the stock size and fish diversity.

Development of an Advanced Fish Sanctuary

Advanced fish sanctuary may be established from the middle of the buffer zone to shore of the *beel* area. The tree branches, *katha*, with dense to light and vice-versa may set horizontally and vertically at the sanctuary.

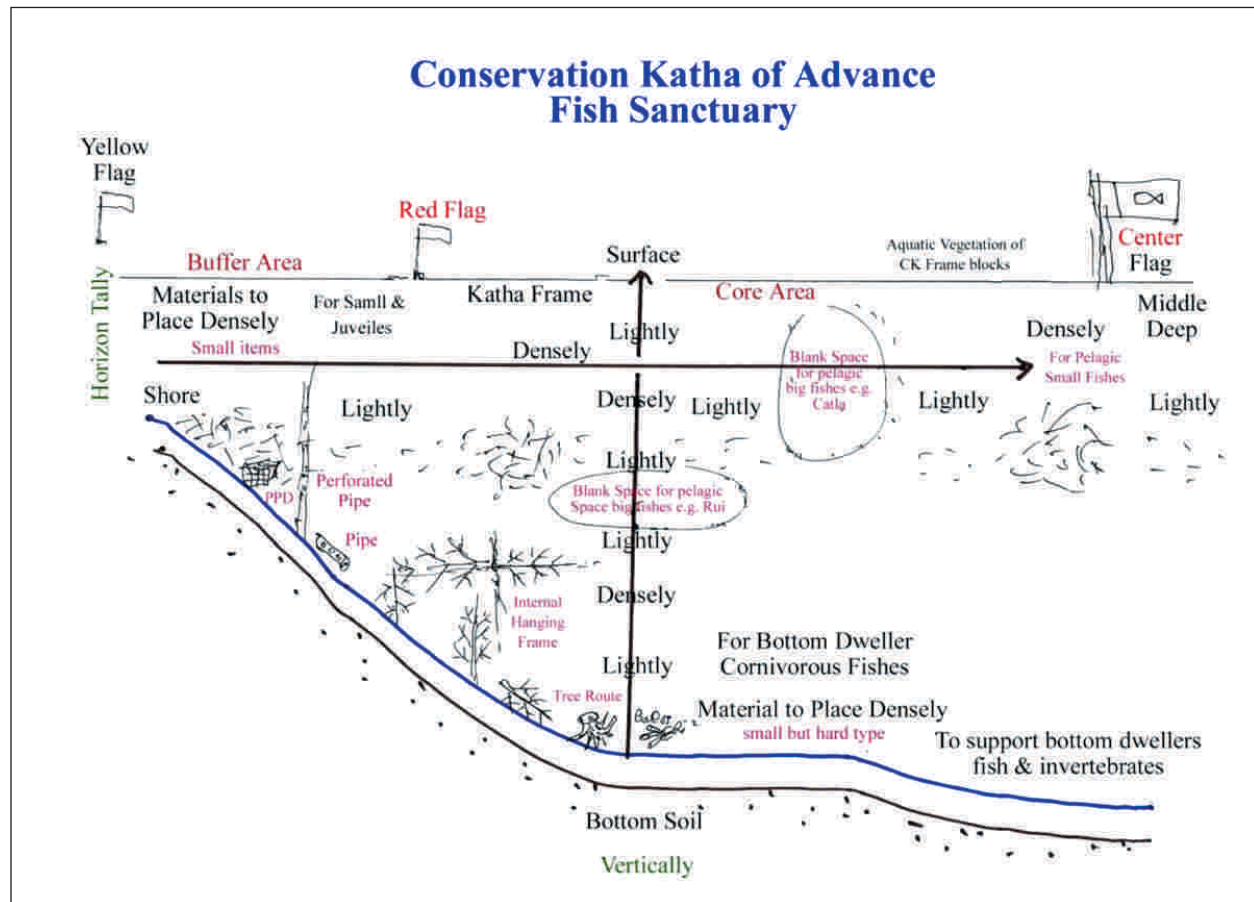


Figure 5.1: A schematic view of an advanced fish sanctuary proposed for Rowa Beel (Ahmed, 2015)

Plan for Swamp Forest Demo Block Area

A demo block of swamp forest was established at the levee (*kanda*) between Lechamara and Rowa beels in 2014. It was planned to establish a small block of multi species swamp tree and reed plants that may serve as useful habitat for birds, amphibians and fishes in Tanguar Haor. A thematic diagram of advanced type of swamp forest and fish sanctuary is before showed in Figure 5.2

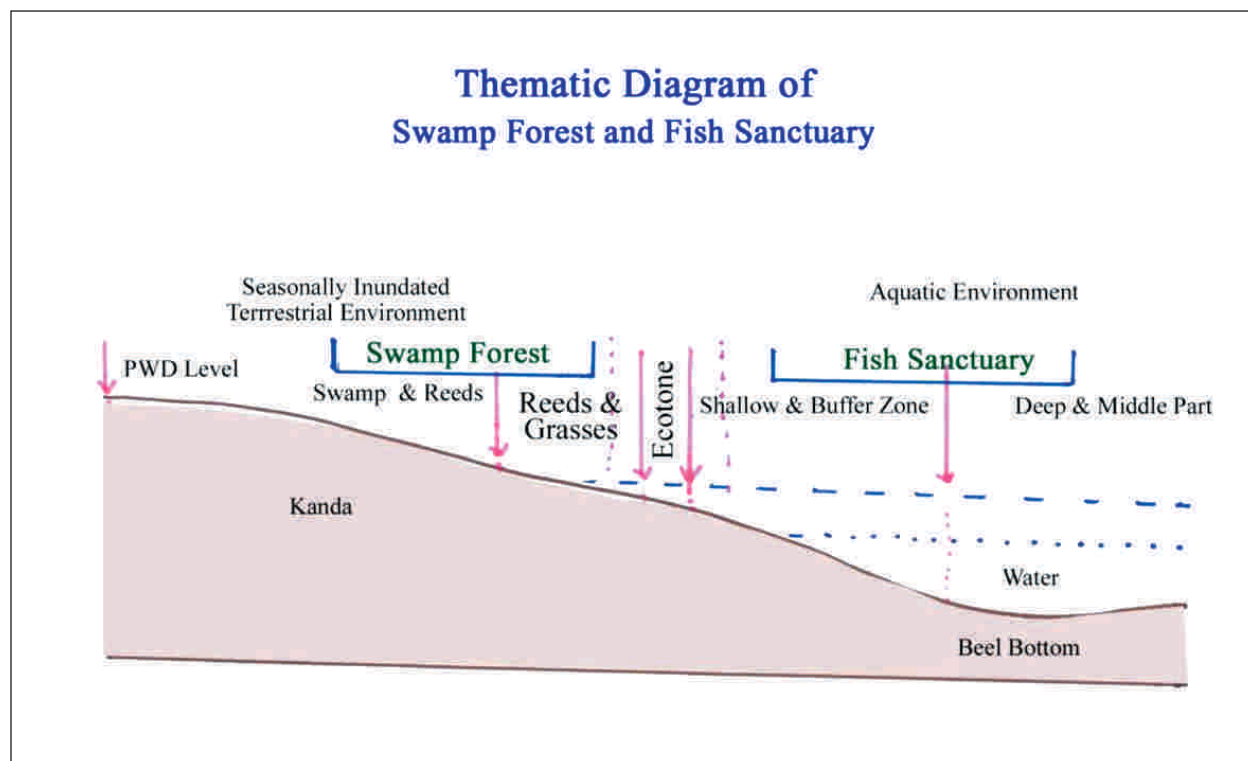


Figure 5.2: Swamp Forest Demo Block situated at the shore of the advanced fish sanctuary (Ahmed, 2015)

Understanding of SYL in General

Sustainable Yield Level (SYL) is also called as MSY (Maximum Sustainable Yield). Conceptually or more accurately both have nearly same application. Difference is that the SYL is at more safe side compared to MSY. For community based resource management it is very crucial that how much fish should be harvested from a water body. SYL is also related to Stock. It is also known as Potential Yield. In other words, it is of how much is to harvest so that fish population is not collapsed or a level without exhausting the fishes can be harvested at a recommended level. It is important or mandatory if the water body is managed focusing on conservation and the recommended harvesting level has to maintain. Additional information is also available in Fish and Reeds report (Ahmed, 2012) on MSY, understanding, Sustainable Yield Level (SYL) and its importance.

Method of Estimation of SYL

Simply, stock means the quantity of available fish species. Fish stock means how much fish is available usually per year in a water body. So, it is the simply aggregation of how much fish is harvested plus how much fish is used by other organisms plus how much fish go for un-authorised fishing and how much fish remain in the *beel* after catching.

Considering breeding and recruitment patterns the use for the groups of fishes (it works at species level) depends on its rate of recruitment. In broad range, SYL for a particular species vary with its contemporary another species (may be one is local breeder and another is river breeder). Thus, fish harvest level may be as high as 70 percent for local breeder and maximum 30 percent for non-local breeder fish.

Stock may be assessed properly through scientific study by a three year data set of fishes. Simple understanding of this stock is made by Graham in 1935. In such case, a fishery is sustainable if the removal is replaced by recurrent stock every year.

If the stock size is maintained at half of its carrying capacity, the population growth rate is fastest, and sustainable yield is greatest then (Maximum Sustainable Yield).

K = unfished stock biomass at carrying capacity r = intrinsic rate of stock growth.

Simple way of MSY calculations/understanding:

If “ X ” is the total population and “ Y ” is a part of X that will support the population then

$$MSY = X - Y$$

The stock assessment of tropical fishes needs to consider few points such as high diversity in biodiversity context, high diversity in socio-economic context (multi-gear, numerous landing points, poaching), complex and continuously changing hydrology and morphology of ecosystem, high sensitiveness to external disturbances, open access and unpredictability.

Fish stock and sustainable yield level aspects are referred to FAO (2009); Khan (2007); Mustafa (2003) as cited in Ahmed (2012).

Applicability and Easy Understanding on SYL in Fisheries Resources Management for the Community

For easy comprehensiveness of the community it is need to make the simple assessment approach. When local knowledge is used, this simple approach becomes more realistic. In this document this was done in that way where different recruitment rate of different species was considered.

Thus, without doing a sound stock assessment, resource managers at community level can monitor stock in terms of indicator species and can set the harvest limit through an observation that stock before harvest is nearly equal to next year reserve, where harvest quantity is replaced/replenished by natural recruitment. More information on this topic is available in fish and reeds report (Ahmed, 2012). Required trainings are important for community capacity building for developing their understanding on SYL.

Quantification of Authorised and Un-authorized Fishing to Estimate Stock

The project management facilitates commercial and noncommercial fish harvesting system for the fishermen in core and buffer zone during wet and dry seasons. Fish harvesting data was collected from the project management and used for estimating the fish stock. However, further information was also gathered from community.

Un-authorized fishing (Poaching, subsistence fishing, fishing for one meal, outsiders poaching) occurs round the year but vary with season and fishing intensity also vary from place to place.

For the study purpose, data were collected in dry and wet seasons for covering the entire year on the basis of day and night. From the entire after Tanguar Haor, 5 major areas were identified in where people are mostly engaged in poaching of fish. The areas were treated as clusters.

If the village of a cluster is situated at the periphery of a *beel* it is assumed that 100 percent of un-authorized fishers harvest fish from Tanguar Haor. If the village is in a side of the *haor* and other side is in another *haor* then estimation was done in a way that what percentage people of this category catch fish from Tanguar Haor. In some cases, extrapolation of results made after such proportion estimation or after total quantity estimated.

During estimation and survey, detailed village/cluster maps were prepared and used to show all the *paras* (small area of a village) of the village and from which community people go for more or less poaching. In the map, *paras* were marked separately based on high, medium and low involvement with unauthorized fishing.

For each of the cluster/village, the gears used for fishing are listed and grouped into wet and dry seasons and also day and night basis. Gear-wise fishing rate was estimated for each gear, depending on season. Variation of Catch per Unit Area and Effort (CPUAE) of the same gear used for poaching and permitted fishing were also assessed.

Recommended Points for Consideration in Fisheries Management

Allow Pre-Monsoon Upward Migration

It needs to allow *ujja* or pre-monsoon upward fish migration including fish dispersion for facilitating breeding in and outside Tanguar Haor. Access of people to fishing during *ujja* and fish migration should be controlled. The gears to be banned which are used for fishing during *ujja* and fish migration. Species that takes *ujja* for breeding and rare and threatened species should be banned from fishing.

Allow Post-Monsoon Downward Migration

Allow return migration and to keep adequate opening in the roads/embankments and obstructions so that fish movement is not interfered significantly and returning of relatively mature fishes from adjoining and nearby *haors* to Tanguar Haor does not get disturbed.

Ensure Seasonal Connectivity between the Jadukata River and Tanguar Haor

The seasonal connectivity between the Jadukata River and Tanguar Haor is to be kept open by dint of maintaining the fish pass crossing Baldar and Matian *haors*. Much opening has to be kept under the road between Tahirpur and Tekerghat. The perennial connectivity is to be free and open too.

Facilitate Propagation and Dispersion of Non-Fish Organisms

It needs to ensure proper protection measures and adequate enhancement for propagation and dispersion of non-fish organisms.

Habitat Restoration

In the *beel* and canal and at their sides there should be taken adequate habitat restoration activities. Forest development should be continued and strengthened for the existing swamp forests and reed beds. It needs to take steps for increasing the coverage of reeds beds and swamps forested areas with multi species.

Fish Conservation-Fish Sanctuaries

Advanced fish sanctuaries may be established for protecting the spawning ground and grazing areas and migration purposes. Introduction of exotic species in Tanguar Haor wetland should be discouraged. Catla fish may be introduced only from the Brahmaputra-Jamuna sources. Implementation of Fish Acts should be established for conservation and sustainable management of fisheries resources.

Understanding on the Recruitment Pattern through conducting Hatchling Movement Studies

Study of hatchling movement in and outside of Tanguar Haor needs to conduct for better understanding on the extension of recruitment pattern and fisheries management thereby. In that case, a complete inventory of all natural resources and biology/life cycle of fish and non-fish organisms may be conducted simultaneously.

Proper Monitoring of Fish and Aquatic Resources

A clear cut monitoring system of biological resources needs to design and do practice. The monitoring components, place of monitoring, when and how to monitor should be embedded in the system for proper monitoring of fish habitat, swamp forest, reed bed and other aquatic organisms. Capacity building of different stakeholders needs to be facilitated and documented to make this in practice properly. The fisheries baseline data (2008) should be updated for every year.

Policy Issues

Government policy and guidelines related to fisheries and fish habitats need to be reviewed and updated time to time. Relevant policies and acts need to be enforced as an added layer with community by-laws.

Training on Natural Fisheries Management and Capacity Building

For natural fisheries management, some training need to be arranged for capacity building of the communities. The mass awareness campaign should be arranged at the ground level to mobilise the local communities for discouraging them in catching brood fishes during the pre-monsoon migration or *ujja* fishing period. Besides this

practice, existing Fish Acts and its execution should be ensured through mass awareness campaign. SYL harvesting practices for fish conservation and overall impact of sustainable *haor* management should be applied properly and promoted to other wetlands management in Bangladesh.

To introduce the Fish Landing Centres, it needs to establish the preliminary process centres with improved transportation and storage facilities. Fish cultivation activities (aquaculture) should be discouraged in and around Tanguar Haor and not even in its ecological boundary.

Some 'Dos and Don'ts'

For sustainable fisheries resource management, some of the activities need to discourage or disallow for Tanguar Haor. Establishment of any embankment for crop protection close to the Nazarkhali khal and other openings of the Patlai River should be discouraged. Withdrawal of upstream water must be restricted; if it is essential for irrigation then it should allow minimum 30% water flow of a stream for the downstream. Not to allow any construction of sluice gate near this *haor* rather existing sluice gate at Boalmari khal should be removed for permitting fish movement and migration. The co-management committees and local level government authorities ought to be responsible for monitoring and taking strong actions against any construction of sluice gate near Tanguar Haor in a coordinated way.

The Tanguar Haor co-management committees and government line departments should be involved intensively for ensuring the resource protection measures and long term *haor* management and development in the sustainable way. Aquaculture practice should be discouraged in and at the periphery of this *haor*. Duck rearing at commercial scale should be avoided in this unique wetland. For sustainable fisheries management, income generation activities for the poor fishers to be promoted at sufficient level, adequate fish landing centres with processing plants should be established and fish transportation system should be improved.



Birds resting at a fish sanctuary in Tanguar Haor

5.1.2 Forests and Reedlands: Restoration, Management and Training¹⁵

This section presents indicative guidelines for forest resources in Tanguar Haor.

Assessment and Yield Prescription of Reeds

The Tanguar Haor has two major forestry natural resources, namely reeds and trees. Their assessment and management will be naturally different. In this chapter we will try to describe the assessment and management aspects of reeds.

Assessment of reeds

To assess the quantity of reeds in Tanguar Haor, we will look for the followings:

- The area under the reed vegetation (in acres), and
- The quantity (amount) of growing-stock (in tons) per acre.

Area under reed

To find out the area under reeds, the first thing that we will need is a map of Tanguar Haor illustrating the reed covered area. Thus, generation or collection of maps showing the reed areas of Tanguar Haor has to be done first. Various types of maps may be used of which the followings are common.

- Mauza maps (or sheet maps).
- Topographic sheets (or topo sheets).
- Maps generated from satellite imageries.

The reed areas are required to be identified and delineated not only on the ground but also on the maps.

Generate maps using mauza maps: All the mauza sheets that fall within Tanguar Haor area are to be collected from the office of survey of Bangladesh. By physically visiting the plots that have reeds, the boundary lines may be drawn on the sheet maps either through chain survey (to be preferred) or plain table survey or through ocular estimations, which is not expected to be very correct. On completion of this task, every sheet will have its reed area delineated on these sheet maps, plot by plot. Using these maps the area may be correctly assessed and located on the maps as well as on the ground.

These mauza maps will not only let us assess the areas under reed, but shall be of great assistance to ventilate the tenural or proprietary rights, since all the record of rights (ROR), kept by the Government are primarily based on these 'mauza maps' (plot number, sheet number, mauza name and J.L. number.) information. This process however, will need more time and money. Though this would have been the best method for estimating the reed area, this method has not been used in this assignment.

Generate maps using topographic sheets: The topographic sheets are available with the 'Survey of Bangladesh' Dhaka office. The relevant top-sheets of Tanguar Haor may be procured from the office of Survey of Bangladesh. The boundaries of the reed patches shall have to be physically identified using the GPS. These GPS readings may be transferred on the topographic sheets and the area under reeds may be calculated. Though this is an option for the given purpose, this has not been used in this assignment.

Generate maps using satellite imageries: IUCN Bangladesh has procured the latest imageries of Tanguar Haor area. Using these satellite images IUCN Bangladesh has generated maps showing the reed land (reed covered) area. The estimated reed area, site wise (FID) has been calculated. Maps generated using satellite imageries, indicate that the total reed land in Tanguar Haor is about 1081.5 acres in 508 patches. The area of each of these patches (FID) in acres is given in Annexure 01. In this assignment, we have used the recent satellite imageries that were already procured by the IUCN.

The following are the step by step process that has been used under this given assignment, to estimate the reeds.

Maps were generated using the recently procured satellite images.

¹⁵ This section mainly draws on the following document and the literature cited therein: J.K. Choudhury (2014), Tanguar Haor Forest Resources: Assessment, Plantation Establishment, Management and Community Training, IUCN-B, Dhaka.

Each and every reed patch was delineated very carefully on the (satellite imageries) maps and the required maps were generated.

The total area of Tanguar Haor from the GIS map (satellite imageries) was found to be 39,277 acres. The total reed area in Tanguar Haor was found to be 1081.5 acres in 508 patches (FIDs).

Stratification of the reed area into high, medium and low density (of reed), using these maps were attempted but did not succeeded. Finally we stratified the reed area into two, namely 'Dark' and 'Light' depending on the tone of the area as appeared in the imageries. The total areas under Dark stratum and Light stratum were found to be 373 and 708.5 acres respectively.

We identified 9 sampling locations at random using the GIS maps. The physical sampling of reeds (field data collection) was done in these 9 sampling locations.

In each of these 9 sampling locations, three sampling points were selected, using the maps at random. The Lat Long of these 27 sampling points was read from the map. The co-ordinates of these 27 sampling points, given below, were used to reach the location roughly for field data collection.

On reaching the sampling points the exact GPS of the sampling point was recorded which is shown in table 5.1.

Table 5.1 : GPS Sampling point

Sampling Point	Category	Latitude	Longitude
1	Light	25.17630236760	91.07743844200
2	Light	25.17505682080	91.07752025440
3	Light	25.17447573090	91.07640855910
4	Dark	25.13925467430	91.08587877720
5	Dark	25.13874807300	91.08566146630
6	Dark	25.13839519670	91.08620124910
7	Dark	25.13172864290	91.08743234250
8	Dark	25.13219370500	91.08775528730
9	Dark	25.13272035490	91.08752695600
10	Dark	25.13835061880	91.08049583680
11	Dark	25.13815813690	91.08103951920
12	Dark	25.13762969920	91.08080667210
13	Dark	25.13466074470	91.07987585000
14	Dark	25.13515816160	91.08018080990
15	Dark	25.13536939140	91.08085858750
16	Light	25.17747698250	91.12576949090
17	Light	25.17583195930	91.12786107150
18	Light	25.17986526560	91.12816025050
19	Light	25.17305929350	91.11401287410
20	Light	25.17215996760	91.11487949250
21	Light	25.17210791110	91.11665144570
22	Light	25.17015038850	91.09018368520
23	Light	25.16962259680	91.09076676880
24	Light	25.16893317140	91.09045220310
25	Light	25.12110532160	91.06090971290
26	Light	25.11991627950	91.05948472080
27	Light	25.11820385160	91.06071818880

In each of these 27 sampling points a plot of 3'x3' was laid, where from all the reed was harvested at ground level, weighed and recorded as field data. Though we had the original thinking to reweigh these samples, after about a week from the date of harvest to obtain the air-dry weight, this step could not be undertaken due to various constraints.

Form 01 given in Annexure was used for recording the field data.¹⁶ The data collected is given in Annexure. It can be seen from these data set that only 3 sample plots, namely 1, 2 and 3 out of the 15 sample plots that were (randomly) selected from the 'light' area had reed. Other 12 sample plots that were taken from 'light' area had no reed. The 12 sample plots that were taken (randomly selected) from the 'dark' area had reeds.

Table 5.2 : Selected field observations on vegetation

(a)

Density/ Tone	Sample Plot #	Average height in feet	Average weight of green reed in pounds per 3x3 ft plot	Average green weight of reed in Long Ton per Acre
Dark	4,5 & 6	6.42	7	15.12
Dark	7,8 & 9	5.47	6	12.96
Dark	10,11 & 12	5.67	6	12.96
Dark	13,14 & 15	5.92	7.33	15.84
Light	16,17 & 18	0	0	0
Light	19,20 & 21	0	0	0
Light	1,2 & 3	4.9	3	6.48
Light	22,23 & 24	0	0	0
Light	25,26 & 27	0	0	0

(b)

Category	Weight of green reed in Ton/Acre
Dark	14.22
Light	1.29

(c)

Category	Total area in acres	Annual yield in acres	Estimated annual yield of reed in tons (green weight) per acre	Estimated total annual yield of reed in tons (green weight) from area of given category.	Total yield prescribed (rounded to a conservative figure) category wise in long tons.
Dark	372.97	124	14.22	1768.48	1725
Light	708.50	236	1.29	306.17	275
Total	1081.47	360			2000

¹⁶ The field data were collected during the dry period (April 2014)

Silvicultural System Suggested

The reeds will be harvested in strips i.e. Clear Felling in strips, at 4 year cycle, as indicated below.

In every FID or patch, strips will be laid in such a fashion so that their number is multiple of 3. Thus number of strips will be 3, 6, 9, 12, & so on. The width of the strip cannot be more than 15 feet. Thus depending on the size and shape of the patch the width and length of the strips will vary. In any way however, 1/3rd of the area will be harvested every year. Two consecutive strips cannot be harvested in any given year.

Assessment and Yield Prescription of Tree Growth

Assessment of trees

To estimate the growing stock, especially of the trees, it will be necessary to assess the followings.

- Area under tree cover
- Species composition

Growing stock, especially the quantity of branches species wise. Since the main purpose of harvest is to produce *katha* that are largely used for fishing.

Area

Area has to be physically identified on the ground and on the maps as well. Thus, generation of the maps is the primary task required for this purpose. The tree covered areas are required to be identified and delineated not only on the ground but also on the maps. These maps may be generated using

- Mauza sheet maps
- Topographic sheets and/or
- Satellite imageries

Since the tree covered areas are not properly demarcated in the field, the first thing required to be done, is to identify the boundaries of the tree patches (areas) using GPS. These GPS readings may be transferred on the maps generated (using satellite imageries, top-sheets or mauza maps) to make an estimate of the area under tree cover. This has been deferred for the time being.



Guards walking through a plantation site in Tanguar Haor

Generate maps using sheet maps: All the mauza sheets that fall within the Tanguar Haor area are to be collected from the office of Survey of Bangladesh. By physically visiting the plots that have trees, the boundary lines may be drawn on the sheet maps either through chain survey or plain table survey or through ocular estimations (the least preferred process). On completion of this task, every sheet will have its tree areas delineated on it, plot by plot. Using these sheet maps the area may be correctly assessed and located on the maps as well as on the ground. These mauza (sheet) maps will not only let us assess the areas under trees, but shall be of great assistance to ventilate the tenural or proprietary rights, since all the record of rights kept by the Government are primarily based on these mauza maps' (plot number, sheet number, mauza name and J.L. number.) information. For this given assessment, this work has been deferred for the time being.

Generate maps using topographic sheets: The topographic sheets are available with the 'Survey of Bangladesh' Dhaka office. The relevant top-sheets of Tanguar Haor may be procured from the office of Survey of Bangladesh. The boundaries of the forest patches shall have to physically identify using the GPS. These GPS readings may be transferred on the topographic sheets and the area under tree cover may be calculated. For this given assignment, top sheets will not be used.

Generate maps using satellite imageries: IUCN has generated the maps of Tanguar Haor area using the latest available satellite images showing the tree covered areas. IUCN has already procured a set of latest satellite data of the area covered by Tanguar Haor. Maps generated using these satellite imageries, indicate that the total tree covered area in Tanguar Haor is about 170 acres in 77 patches. These are to be refined through ground truthing. However, the ground truthing could not be done for various reasons. The maps prepared after the ground truthing, may be used to calculate the actual tree covered area. In absence of ground truthing, the tree covered area may be taken as 170 acres in 77 patches as obtained from the satellite imageries.

Species composition

There are two distinct habitat types in Tanguar Haor area, namely homesteads and open *haor* area. The homestead habitats will not come under our purview. Our interest is in the open area of *haor* habitat. Tree species that are commonly available in the open *haor* areas are

- Hijal (*Barringtonia acutangula*)
- Koroch (*Pongamia pinnata*)
- Barun (*Crataeva magna*)
- Shewri (*Cynometra remiflora*)

Growing stock & yield calculations

The followings may be enumerated as the step by step process to estimate the trees and the product or yield which is "Katha" and/or "Fuel-wood".

1. Maps are generated using the recently procured satellite images.
2. Each and every tree patch has been delineated very carefully and maps generated exhibit all the tree covered areas in Tanguar Haor. These are used to find out the area of each patch.
3. The total tree covered (forest) area in Tanguar Haor is calculated using these results. It is found that in 77 patches, the total tree covered area is 170 acres.
4. Stratification into thick (29% of the total tree covered area), light (46% of the total tree covered area) and very light (25% of the total tree covered area) is done using these maps.
5. Identification of these 9 sample sites or patches, as a weighted proportion, is ($9 \times 0.29 = 2.61$) say 3, ($9 \times 0.46 = 4.14$) say 4 and ($9 \times 0.25 = 2.25$) say 2 samples on thick, light and very light (stratum) area respectively, was done on the GIS maps for field sampling.
6. The GPS of each of these 9 sampling patches from the GIS maps has been recorded to locate them in the field. These GPS locations are given below.

GPS Locations for 9 Tree Sample Points

Sample No.	Category	ORIG_FID	Longitude	Latitude
1	Thick	1	91.09391115830	25.16047802840
2	Very Light	14	91.07516170440	25.16569900390
3	Thick	21	91.08406705260	25.12120911930
4	Light	28	91.09125004690	25.12315670750
5	Light	45	91.10313698020	25.13391464500
6	Thick	46	91.10440038870	25.13570684420
7	Light	61	91.10554049640	25.13522074180
8	Light	69	91.12444067350	25.11947152630
9	Very Light	78	91.11394344440	25.11576750830

At each of these 9 sampling sites (patches) the following field activities were done.

- a. The lat-log given was used to reach the sample site.
- b. At each site one 66ft by 66ft sample plot was laid.
- c. All trees in the plot were measured to obtain the required information.
- d. Ratio of Hijal: Karoch may be worked out.
- e. For each of the trees in this 66 x 66 ft plot, the following data was recorded in Form 02.
 - i. Species
 - ii. Form Factor (estimated)
 - iii. Height of the tree
 - iv. DBH of the tree
 - v. Number of branches in the bottom 1/3rd of the bole and approximate volume of wood (ocular estimate) in each (of the branches)
 - vi. Number of branches in the mid 1/3rd of the bole and approximate volume of wood (ocular estimate) in each (of the branches)
 - vii. Number of branches in the top 1/3rd of the bole and approximate volume of wood (ocular estimate) in each (of the branches)

The data recorded in Form 02 given in Annexure 04 were analyzed.

The total tree area is 170 acres in Tanguar Haor; while the total area of Tanguar Haor forms the GIS map is 39,277 acres.

The silvicultural system suggested

Ploarding at 5 year cycle.

- All the branches on the lower 1/3rd of the bole will be harvested.
- 50% (by volume) of the branches on the middle 1/3rd of the bole will be harvested, preferably the bigger ones. It is estimated that about 1/3rd of the number of branches will be harvested to harvest 50% of the volume.
- None of the branches on the top 1/3rd of the bole will be cut or harvested.
- While harvesting these 'Kathas' as branches, the top of every 5th or 6th Hijal tree, especially in areas that are not closely stocked, will also be cut at a point where the dia is about 2.5 to 3 inches to induce the production of more branches in future.

Yield in area

The total tree covered area in Tanguar Haor is 170 acres. Thus the area that will be worked every year is $(170/5 =)$ 34 acres. This will be distributed as under:

- In thick area $(34.0 * 0.290 = 9.86)$ say 10 acres. Since 29% of the total 170 acre is thick area.
- In light area $(34 * 0.458 = 15.57)$ say 16 acres. Since 46% of the total 170 acre is light area.
- In very light area $(34 * 0.251 = 8.53)$ say 8 acres. Since 25% of the total 170 acre is light area.

Thus the total annual yield in acres will be $(10+16+8=)$ 34 acres.

Yield in quantity

The quantity of annual harvest, category wise will be as under.

Category of the tree cover	Total area in acres against the category (in TH)	Total area in acres (against the category) to be harvested annually	Number of Branches to be harvested per acre from the bottom 1/3rd of the bole	Number of Branches to be harvested per acre from the mid 1/3rd of the bole	Approximate volume in cft, to be harvested per acre from the bottom 1/3rd of the bole	Approximate volume in cft, to be harvested per acre from the mid 1/3rd of the bole
Thick	49.47	10	390	200	311.3	148.7
Light	77.86	16	285	182	207.3	129
Very light	42.67	8	105	26	32.5	10.4
Total	170	34	780	408	551.1	288.1

Thus the total annual yield will be as under.¹⁷

Total Annual Yield	
Total Number of Katha.	Total volume of Katha in Cft
14433 Say 14400	10323 say 10000

Since 49% is Hijol and 51% is Koroj, the proportionate yield will be:

Spp		Percent	# of Katha	Vol in cft/
Koroch	51.48515	51%	7344	5100
Hijal	48.51485	49%	7056	4900
		Total	14400	10000

Plantation Establishment

Through field visits the probable potential sites wherein, establishment of reed and/or tree plantations are possible, may be identified and located on the maps for future plantation programs.

Raising of reed plantation

The areas that have been identified in the field for raising reed plantation may be planted with the reed depending on the availability of funds.

Planting techniques

The rhizomes of the reeds are to be collected from the natural reed area. These rhizomes are to be collected in such a manner so that they are scattered all over the area and should not be contiguous. No area wider than 1 to 2 feet width is subjected to such collection of rhizomes. The rhizomes are to be collected during second fortnight

¹⁷ Reference: J.K. Choudhury (2014).

of April and should be planted immediately. If the planting site is away from the rhizome collection site, the rhizomes may be stored for a period of maximum 1 day. While storing the rhizomes, these are to be kept wrapped with wet gunny bags so that they do not get dried. The rhizomes must be uprooted from the natural reed site using a shovel so that the roots of the rhizome are not seriously damaged.

While planting 6 inch wide strips, at a distance of 2 feet apart may be hoed (soil worked) with a small spade and one rhizome may be planted at distance of 2 feet on the hoed strip. Thus every acre 10,890 rhizome will be necessary. With the wastage margin for every acre about 12 thousand rhizomes will be required. Planting has to be done during the second fortnight of April.

After care

It does not need any intensive after care but in its second and third year a quick weeding especially the removal of the climbers (which very often infest in these sort of reed plantation) will be necessary. Generally on its fifth year of planting the area may be brought under management and reed may be harvested using the management techniques suggested in the later chapters of this report.

Raising of tree plantation

The most important tree species in Tanguar Haor area are

- Hijal (*Barringtonia acutangula*) and
- Koroch (*Pongamia pinnata*).

We will focus on these two species for establishing plantations.

Plantation raising techniques

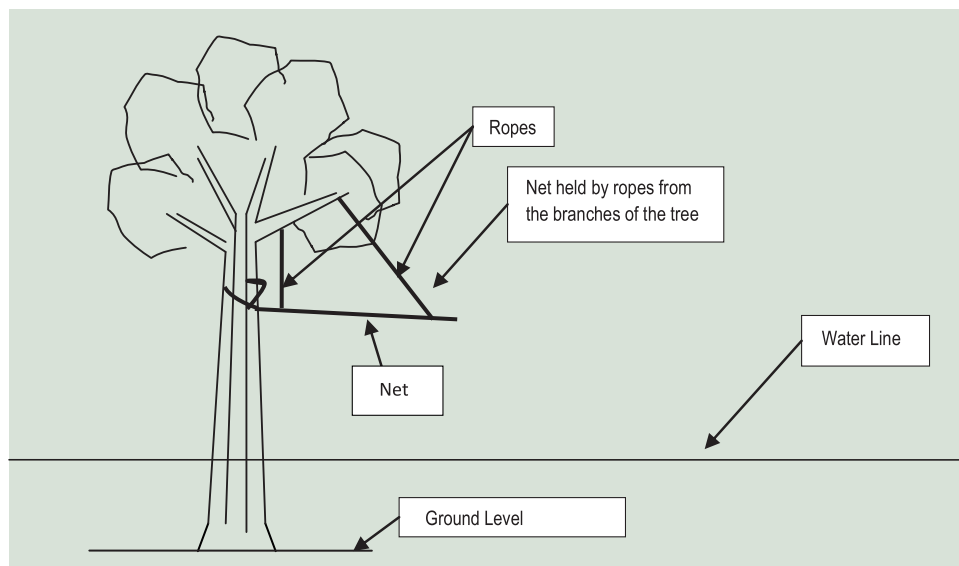


Figure 5.3: Seed collection techniques from Hijal tree

Hijal (*Barringtonia acutangula*): Ripe seeds are to be collected from the trees. The seeds generally mature in the months of June/July. Sometimes seeds that dropped on the water or the ground are collected. However, seedlings raised from such seeds have been found to be more affected by pathogens and become weak. It has been found that the seedlings that are raised by seeds that are collected by putting a net underneath the crown (as shown in the figure 5.3) or those plucked directly from the trees, exhibit better performance.

The seedlings are to be raised in polybags, preferably of 9 x 16 inch size. Generally two year old seedlings should be used. No seedling less than 4 feet tall is used for plantation establishment. Seedlings should never be transported by tractor trailer or bullock carts. Such transportation will damage the fine roots of the seedlings while within the bag and the seedling will die in about 2 to 3 months after planting.

The Koroch having little faster growth rate may be raised in 10 x 6 inch bags and one year old seedlings may be used for planting. In the plantation sites we will be planting Hijal and Koroch at the proportion of 4:1 i.e. 20% Koroch and 80% Hijal. The seedlings are to be planted at 11 by 11 feet and the planting plan shown below may be followed. The details of nursery establishment and planting methods are appended.

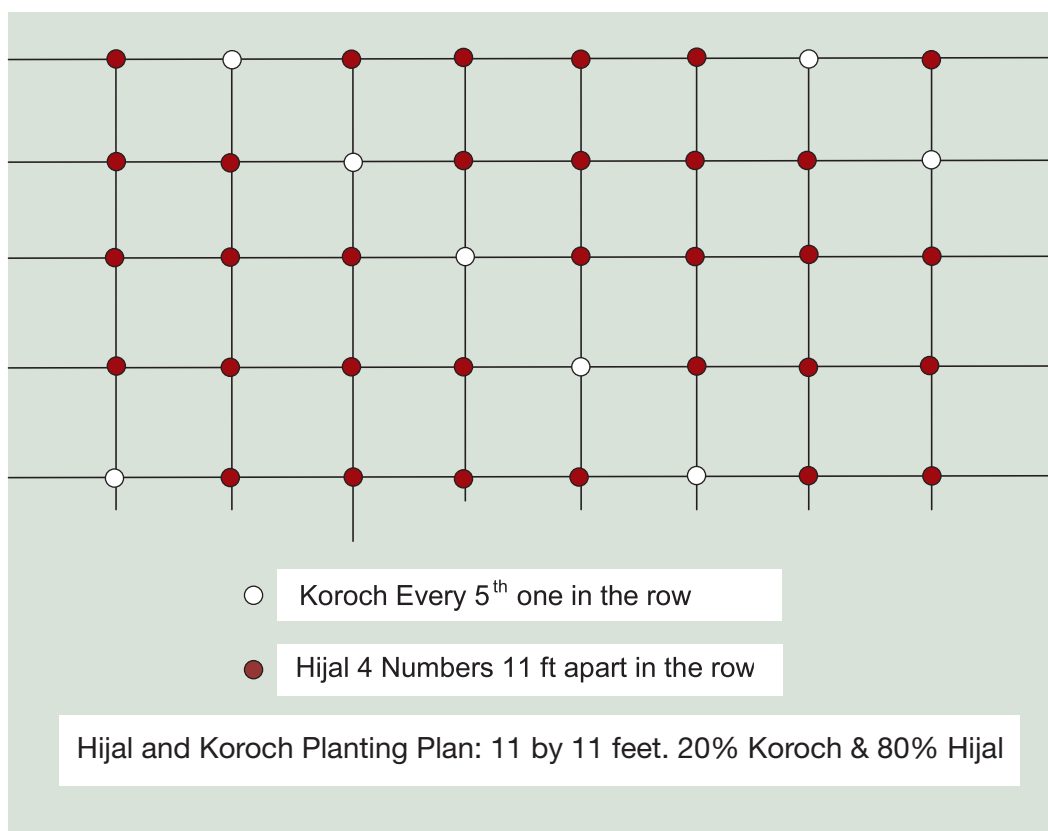


Figure 5.4: Suggested Plantation Design

After care

If there is no rain during the planting period, watering will be necessary, at least once in every third day till monsoon starts.

Barun, Shewri and Cane

It is suggested that some seedlings of Barun (*Crataeva magna*), Shewri (*Cynometra remiflora*) and cane should also be raised in the nursery. Along the water line some of the Barun (*Crataeva magna*) seedlings may be planted may be at a distance of about 30 to 40 feet. The Shewri (*Cynometra remiflora*) seedlings may be given to those community personnel, who are interested in rearing cattle heads or are rearing cattle at present, for planting in their homesteads. There some specific sites in the *Haor* Area where cane (*Jali Bet*) is only species that has to be planted. The cane seedlings raised in the nursery may be used planting out such specific sites.

Training of the Community on the Assessment and Monitoring of Reed and Tree Resources

It has been anticipated that community personnel will be given appropriate training so that they can assess and monitor the growing stock (both reeds & trees) and implement the management prescriptions. Such a suggested training approach together with operational details is appended.

5.1.3 Biodiversity: Monitoring Protocol¹⁸

Biodiversity monitoring systems help us contribute to the improved conservation and sustainable use of forests, freshwater and marine wetlands. Monitoring can show whether the biodiversity of an area is being maintained in accordance with the existing acts and provisions and if management interventions in the area are effective in addressing biodiversity conservation issues.

Community Based Biodiversity Monitoring

This monitoring format will be used by the groups consisting of experts, project staff and local volunteers such as committee members, school teachers or students from colleges and schools. As the monitoring format will be finalized by a comprehensive discussion with the community people there is a good possibility to incorporate them in future monitoring processes such as survey time or data analysis for example. Enthusiastic and potential people from local community having interest in biodiversity conservation will be selected as 'local volunteers'. Central Committee with help of management authority will select the local volunteers. A biodiversity monitoring team will be formed with above mentioned people. Four monitoring teams will be formed and they will work in four Unions.

At the initial stage, the monitoring procedure is being endorsed by the experts where the project staff and community people will be a part of the system. They would have learnt the full procedure practically from the experts. The project staff and the community people in this process can acquire the knowledge on survey procedure, data compilation, data analysis and status of the *haor* ecosystem. Indicator species have already been selected by the experts and community people become skilled at these species by knowing their identifying characteristics. This will assist them to learn the process to identify the indicator species, their habitats, impact on the wetland ecosystem and finally to make decisions about further intervention in respect of biodiversity conservation and its management.

Biodiversity Monitoring Indicators and Format for Tanguar Haor

Biodiversity monitoring articulates the status of species in and around Tanguar Haor which ultimately reflect the accomplishment of the ecosystem management. Sustainability of the monitoring mechanism after completion of the study largely depends on local volunteers. They will take over the whole biodiversity monitoring procedure and undertake it continuously throughout the year. Monitoring tools are generally used to evaluate the impact of current and past activities to a certain set of activities.

Indicator species for biodiversity monitoring

The most important event of community based biodiversity monitoring activities is setting up indicators. Indicators will be selected by consulting literature, talking to recognized experts on biodiversity conservation and management, local people and assessing relevance of the information gathered. The following biological indicators could be used in biodiversity monitoring:

- Dominant plant species (for Tanguar Haor i.e. Hijal, Singra, Nal etc.)
- Bird species (for Tanguar Haor Purple Swamphen, Pallas's Fish Eagle, Ferruginous Pochard, Oriental Darter etc.).
- Fish (Rohu fish)
- Freshwater mollusks (Apple Snail)
- Frogs (Marbled toad)
- Turtle (Indian peacock softshell turtle)

These species are being selected as indicators for variety of reasons. Indicator species are taken from different ecological strata which will ultimately depict a picture of a whole ecosystem. As the ecosystem is an inter- and intra-relationship between the living and nonliving organisms, the indicators are carefully chosen to include all

¹⁸ This section mainly draws on IUCN (2012) Community Based Monitoring and Evaluation Protocol (IUCN-B, Dhaka). Additionally some information was drawn from IUCN's Publication (2012). Biodiversity of Tanguar Haor: A Ramsar Site of Bangladesh; Volume I: Wildlife (Amphibians, Reptiles, Birds and Mammals) and Volume II: Flora.

aspects of the *haor*. As an example, Purple Swampphen depends on reed land vegetation, so degradation of such vegetation would affect the population of this bird. Tall Hijal, Koroch, Barun trees are suitable for Pallas's Fish Eagle nesting. So decline of these plant species would be alarming for the existence of this globally vulnerable species. Fishes are integral part of the wetland, as are reptiles and amphibians. In considering all these issues, the species mentioned here are preferred as indicators for biodiversity monitoring of Tanguar Haor.

Floral Species Monitoring

Few species have been selected as indicator species for monitoring purpose. The following table 5.3 shows the community based floral species monitoring matrix.

Table 5.3: Community based floral species monitoring matrix

Species name	Monitoring aspects	Monitoring time	How to monitor	Distribution of Monitoring Responsibility (village-wise)	Remarks
<i>Barringtonia acutangula</i> [Indian Oak (English); Hijal (Local name)]	Number of trees and area of occupancy	February	Following the monitoring information collection form	Foliar beel adjacent forest: Mandiata (East side) and Binodpur (West side) Lechuamara beel adjacent forest: Paniakhali Noal beel adjacent forest: Ramshingapur (Northwest side) and Jaypur (East side) Kajjori beel adjacent forest: Silan Tahirpur Rongchi forest: Rongchi	Different species of birds depends on this tree for nesting and roosting, branches of this tree have been used as food staff for the fishes. Increase of both the number of trees and the area of occupancy will have positive impacts on haor biodiversity.
<i>Pongamia pinnata</i> [Indian Beach (English); Koroch Local name]]	Number of trees and area of occupancy	February	Following the monitoring information collection form	Noal beel adjacent forest: Amtorpur Naindar garden: Indrapur Purangaon forest: Sriargaon (North side) and Golabari (South side) Kaillartok forest: Lamagaon Annar beel adjacent forest: Lamagaon (East side) and Makordi (West side) Berberia beel adjacent forest: Isamari Bank forest of Patlai river (east of Alamdor): Chriargaon (North side) and Tahirpur (South side) Hatirgata beel adjacent forest: Indrapur (North side) and Lamagaon (South side)	Different species of birds depends on this tree for nesting and roosting. Increase of both the number of trees and the area of occupancy will have positive impacts on haor biodiversity.
<i>Trapa bispinosa</i> [Water Chestnut (English); Shingara (Local name)]	Area of occupancy by this species in different beels	February/ March	Following the monitoring information collection form	Lechuamara beel, Rupaboi, Rowa beel, Tekunna beel, Hatirgata beel and Berberia beel	Small fishes and fries get nutrition from submerged portion of this species. Pheasant tailed Jacana lays their eggs on leaves of this species. Local people collect its fruit as food staff.

Species name	Monitoring aspects	Monitoring time	How to monitor	Distribution of Monitoring Responsibility (village-wise)	Remarks
<i>Phragmites karka</i> [Tropical Reed (English); Nal (Local name)]	Number of Nalbans and area of occupancy by this species	February/ March	Following the monitoring information collection form	Kandas of Lechuamara beel, Rupaboi, Rowa beel, Tekunna beel, Hatirgata beel and Berberia beel	Reeds directly support fishes for breeding, grazing, protection etc. They also support birds for protection, food and breeding of local wetland birds. So increasing reeds both in terms of coverage, height and density would be beneficial for fish production, birds and other wildlife
<i>Rosa clinophylla</i> [The Bengal Rose (English); Gujjakata (Local name)]	Number of individuals	February/ March	Following the monitoring information collection form	Kanda of north side of Rowa beel Purangaon adjacent Kanda (West side of Patlai river): Sriargaon Kanda of west side of Eraillkona beel: Binodpur Kanda of north side of Lechuamara beel: Binodpur Kanda of Naindar beel: Indrapur	Villagers used to take these as fuel. This species is occurred only in Tanguar Haor and in a part of Mymensingh district.
<i>Hydrilla verticillata</i> [Whorled-leaved Hydrilla (English); Jhangi (Local name)]	Area of occupancy by this species in different beels	February/ March	Following the monitoring information collection form	Lechuamara beel, Rupaboi, Rowa beel, Tekunna beel, Hatirgata beel and Berberia beel South side of Hatirgata beel and East side of Ballarduba beel: Lamagaon	Fishes get nutrition and shelter from this submerged species. However, vigorous growth of the plant may cause adverse effects on aquatic fauna.
<i>Vallisneria spiralis</i> [Eel Grass (English); Patseola (Local name)]	Area of occupancy by this species in different beels	February/ March	Following the monitoring information collection form	Lechuamara beel, Rupaboi, Rowa beel, Tekunna beel, Hatirgata beel and Berberia beel	Fishes get nutrition and shelter from this submerged species. However, vigorous growth of the plant may cause adverse effects on aquatic fauna.

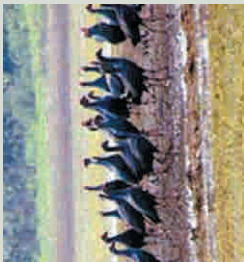
Faunal Species Monitoring

A few species have been selected as indicator species for monitoring purpose. The following table 5.4 shows the community based faunal species monitoring matrix

Code: E- English name; S- Scientific name; L-Local name

Table 5.4: Bird species monitoring matrix

Name of the Indicator bird species	Food and habitat	Status	Bird's Calling	Census time	Status without this species (red line)	Photo
E- Pallas's Fish Eagle S- <i>Haliaeetus leucoryphus</i> L- Kura/Kuro/Bo-wol	-Mainly come in winter for food and breeding in Tanguar Haor -Normally live on catching large fish from the water surface - Need tall trees to build their nests	Threatened all over the world, mostly seen in Tanguar Haor in Bangladesh	Can be easily identified by its frequent very loud specific calling	Winter season	-Decreasing of this species indicates reducing the number of large fish in the <i>haor</i> -Decreasing the number of large trees inside and surrounding the <i>haor</i>	
E- Ferruginous Pochard S- <i>Aythya nyroca</i> L- Bhuti Hans	-Come in winter for food in the haor -Lives on aquatic tender leaves of the plants -It is the representative of the migratory duck	-Threatened all over the world, -Mostly found in Tanguar Haor from all over the world	Difficult to identify by its calling	Winter season	Decreasing of this species indicates reducing the aquatic herbs and shrubs which are essential not only for birds but also for the survival of the fish	
E- Oriental Darter S- <i>Anhinga melanogaster</i> L- Goyar/Shapapakhi	-Resident bird of Bangladesh -Feed on hunting small fish by diving under water like a cormorant -They need large trees to build their nests	Threatened all over the world, mostly found in Tanguar Haor in Bangladesh	Difficult to identify by its calling. As it is virtually silent	All around the year	-Decreasing of this species indicates reducing the small fish of the <i>haor</i> which are essential for the wolfish such as Striped Snakehead, Freshwater Shark, Giant Snakehead, etc. - The number of large trees inside and surrounding the <i>haor</i> is decreasing -Water pollution is increasing	

Name of the Indicator bird species	Food and habitat	Status	Bird's Calling	Census time	Status without this species (red line)	Photo
E-Purple Swampphen S-Porphyrio porphyrio L- Kalim/Kayem	-Resident bird of Bangladesh -Largely feed on aquatic vegetation insects, small fishes and larvae -Builds nests inside the reed of elevated land of the <i>haor</i>	-Once it was widely found in most of the wetlands of Bangladesh -Hard to be seen anywhere except in the <i>haor</i>	Can be easily identified by its calling	All around the year	-Decreasing of this species indicates reducing the reeds of the <i>haor</i> -Not only Purple swampphen but also other birds, small mammals, frog, turtle/tortoise and fish will be reduced in numbers as it is suitable for their breeding	
E-Peacock Soft-shelled Turtle S-Nilssonina hurum L-Dhum Kasim	-Both water and upland area are important for their survival -Feed on aquatic plants and small fish -Keep the water clean by eating aquatic waste materials	Threatened in Bangladesh but can be easily seen in Tanguar Haor		Winter and rainy season	-Decreasing of this species indicates reducing the aquatic plants and small fish -Increase of water pollution -Hunting increasing	
E-Marbled Toad S-Bufo stomaticus L- Khoshkhoshey Bang	-Important food item for birds and snakes		Can be easily identified by its calling	Rainy season	-Decrease the number of birds and snakes -Acts as an important indicator of climate change	

Fish Species Monitoring

Few species have been selected as indicator species for monitoring purpose. The following table 5.5 shows the community based fish species monitoring matrix

Table 5.5: Fish species monitoring matrix

Fish		
E- Rohi or Rohu S-Labeo rohita L-Rou	-Natural breeding center. -Rapidly growing -Survival of this fish is interlinked with the depth of water -Thousands of fishermen sustain their livelihoods by Rohu fishing.	-If this fish decreases in Tanguar Haor area, Bangladesh's most prosperous breeding centre, the whole biodiversity of this area would be affected. - Living standards of the fishermen will decline - Protein crisis might occur
E-Freshwater Shark L-Boal S –Wallago attu	-It's a predatory fish - Maintains an equilibrium among the fish species by eating some fishes - Survivability of this fish is interlinked with the depth of water -Thousands of fishermen live on fishing	- If this fish decreases in Tanguar Haor area, Bangladesh's most prosperous breeding centre, the whole biodiversity of this area would be affected. - Living standards of the fishermen will decline - Protein crisis might be noticed
E- Reba carp S-Cirrhinus reba L-Laacho	- This fish of the haor is unique. - In fact thousands of fishermen live on catching this fish.	- If this fish decreases in Tanguar Haor area, Bangladesh's most prosperous breeding centre, the whole biodiversity of this area would be affected. - Living standards of the fishermen will decline - Protein crisis might be felt

Biodiversity Monitoring Format

A species monitoring format (Tables 5.6 and 5.7) after being designed by the researchers will be sent to the field level for analyzing. At this stage, a species monitoring format will be finalized by discussing with the local people and then field work will be started following that format.

Who will monitor?

Several teams (each comprising of three educated local people interested in birds/nature conservation from villages/union) will be formed for the monitoring task. Local school teachers or even the students of schools and colleges could be considered for the team.

Who will scrutinize the monitoring format?

After receiving field information, researchers will examine the data of the baseline survey and will submit a comparative report to the authority and accordingly they will take the necessary steps.

Monitoring Format for Indicator Species: Plant, Bird, Turtle Species, Hunting, Hunter and Other Indicators

Table 5.6: Plant Monitoring Information

1. Hijal (*Barringtonia acutangula*)

Sl. No.	Present status of old/mature forest			Sl. No.	Count of newly cultivated gardens and plants		
	Name/location	Area coverage	Tree number		Name/location	Area coverage	Tree number
Total				Total			

2. Koroch Plant (*Pongamia pinnata*)

Sl. No.	Present status of old/mature forest			Sl. No.	Count of newly cultivated gardens/plants		
	Name/location	Area coverage	Tree number		Name/location	Area coverage	Tree number
Total				Total			

3. Singara (*Trapa bispinosa*)

Sl. No.	Present status of old/mature singara vegetation		Sl. No.	Count of newly regenerated singara vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

4. Nalbon (*Phragmites karka*)

Sl. No.	Present status of old/mature nalbon		Sl. No.	Count of newly regenerated nalbon	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

5. Gujjakata (*Rosa clinophylla*)

Sl. No.	Present status of old/mature Gujjakata		Sl. No.	Count of newly regenerated Gujjakata	
	Name/location	Individual Number		Name/location	Individual Number
Total			Total		

6. Jhangi (*Hydrilla verticillata*)

Sl. No.	Present status of old/mature Jhangi vegetation		Sl. No.	Count of newly regenerated Jhangi vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

7. Patseola (*Vallisneria spiralis*)

Sl. No.	Present status of old/mature Patseola vegetation		Sl. No.	Count of newly regenerated Patseola vegetation	
	Name/location	Area coverage		Name/location	Area coverage
Total			Total		

Table 5.7: Wildlife monitoring information

Bird's name	Number	Obtained marks
Pallas's Fish Eagle	Census data:	Marks:.....
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: $20 \times 100 / 40 = 50\%$ = if 10 birds seen in one census, Marks=3		
Pallas's Fish Eagle=40 seen=100%=No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Bird's name	Number	Obtained marks
Nest of Pallas's Fish Eagle	Census data:	Marks:.....
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: $10 \times 100 / 20 = 50\%$ = if 5 nests seen in one census, Marks=3		
Pallas's Fish Eagle Nesting =20 =100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Bird's name	Number	Obtained marks
Ferruginous Pochard	Census data:	Marks:.....
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: $7500 \times 100 / 15000 = 50\%$ = if 7500 birds seen in one census, Marks=3		
Ferruginous Pochard= if 30,000 individuals are seen=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Bird's name	Number	Obtained marks
Oriental Darter	Census data:	Marks:.....
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: $40 \times 100 / 60 = 66.66\%$ = if 40 birds seen in one census, Marks=4		
Oriental Darter=60 seen=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Bird's name	Number	Obtained marks
Purple Swampphen	Census data:	Marks:.....
Marking guidelines: 0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation: $7000 \times 100 / 10,000 = 70\%$ = if 7,000 birds seen in one census, Marks=3		
Purple Swampphen= If 10,000 individuals are seen=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		

Bird's name	Number	Obtained marks
Purple Swampphen (Nesting)	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:60*100/100=60%=if 60 birds seen in one census, Marks=3		
Purple Swampphen (Nesting)=100=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Hunting	Number	Obtained marks
Bird's Hunted	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:40*100/100=40%=if 40 birds seen in one census, Marks=2		
If Hunting 100 individuals =100% =Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		
Hunter	Number	Obtained marks
Bird hunter	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:20*100/50=40%=if 20 birds seen in one season, Marks 2		
Bird Hunter=If 50 Bird hunters are seen=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicates that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		
Turtle	Number	Obtained marks
Peacock Soft-shelled Turtle	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:30*100/50=60%=if 40 Turtles seen in one season, Marks=3		
Turtle=50=100%= No management is required in case of scored more than 80% (5) marks If scored 4 management is going well If scored 3 management is required If scored 2 management is going down In case of not seen Red Line's causes are clear		
Hunting	Number	Obtained marks
Turtles hunted	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:10*100/20=50%=if 10 Turtles seen in one season, Marks=3		
Turtle hunting=If 20 individuals are hunted=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		

Hunter	Number	Obtained marks
Turtle hunter	Census data:	Marks:.....
Marking guidelines:0%=1, 1-40%=2, 41-60%=3, 61-79%=4, 80>=5		
Formula of result calculation:5*100/10=50%=if 5 Turtle hunters found in one season, Marks=3		
Turtle hunting=10 turtle hunters found=100%= Management is required if the number is over 20% (2) Score 3 indicates to regular hunting Score 4 indicate that hunters are desperate or there is no monitoring from the authority Score 5 indicates very poor management		
Census	Number	Obtained marks
Scientific Bird Census	Census data:	Marks:.....
Marking guidelines:0%=1, 1-50%=3, 100 >=5		
Formula of result calculation: 50%=1 time census, Marks=3		
Scientifically bird census=2 times every year=100%=If score 5, research works are going on regularly Score 3 indicates that research is going on but not regular Score 1 indicates no research is going on		
Festival	Number	Obtained marks
Bird Festival	Census data:	Marks:.....
Marks guidelines:0%=1, 99%=5		
Formula of result calculation: If biodiversity conservation festival organize once in a =100%= Marks 5		
Festival on bird conservation=once in every year=5 marks, Awareness works is going on Score 1 indicates that there is no mass awareness on biodiversity conservation		
Committee	Number	Obtained marks
Biodiversity conservation committee	Census data:	Marks:.....
Marks guidelines:0%=1, 1-50%=2, 51>=5		
Formula of result calculation: committee in 4 villages=100%=Marks=5, committee in two villages=50%= 3 marks		
Biodiversity conservation Committee= committee in four villages every year=100%= Marks 5, Biodiversity conservation committee is working well Biodiversity conservation committee=2 committees in 2 villages per year=50%=Marks 2, biodiversity conservation committee is working slowly		

Community Benefit from Sustainable Biodiversity Conservation and Resource Management

The natural resources of Tanguar Haor are immensely important to the local community as the people are extremely dependent on *haor* resources. The sustainable management of the wetlands flora and fauna needs detailed understanding of species composition, distribution patterns, estimates of productivity and direct and indirect values.

Sustainable forest (swamp forest and reed beds) management will help local people to continue collecting their variety of products and services and also assist in fish breeding. These are both of considerable benefit to the community.

Conservation of fish in the *haor* would increase fish production in the floodplains of Bangladesh and subsequently directly affect the economy of *haor* community as a vast proportion of the population in Tanguar Haor is connected to fishery.

In Tanguar Haor, local people are mainly engaged in agriculture. Conservation of fauna will help increase fertility of agricultural land, e.g., wetland waterfowls, turtle and tortoises and indirectly help increase the fertility of agricultural land through their fecal deposition.

A thorough combination of biodiversity and sustainable management will represent a healthy ecosystem in Tanguar Haor and therefore will help to protect the biodiversity of this *haor* for future benefits. Accordingly, it will directly or indirectly help the economy and livelihood of the Tanguar Haor community.

5.1.4 Water Regime Management¹⁹

Hydrological Regimes

River System

Three major river systems govern the *haor* area inside Bangladesh: the Surma-Baulai, the Kalni-Kushiyara and the Kansha-Dhanu. The Barak River (Indian River) feeds the Surma and the Kushiyara. Consequently, it plays an important role in the two major systems, the Surma-Baulai and the Kalni-Kushiyara. In Tanguar Haor, the rivers contributing to the Surma-Baulai systems are described below:

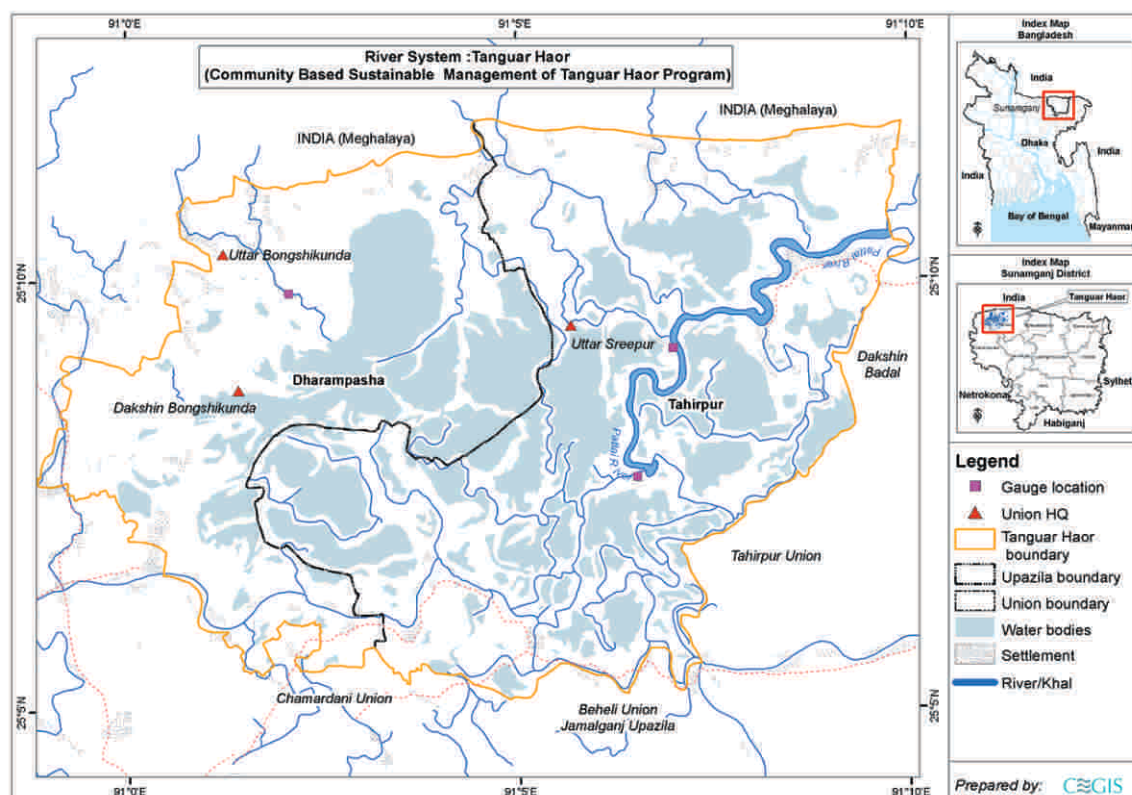


Figure 5.5: River System of Tanguar Haor

This system carries the flow of the Surma and the large number of trans-boundary rivers flowing from the north to south. The Surma, the Baulai, the Old Surma, the Sari-Gowain, the Piyan, the Dhala, the Nowagang, the Jhalukhali/Dhomali, the Chalti, the Jadukata, the Rakti etc. are the major in the system among which the Sari-Gowain, the Piyan, the Dhala, the Nowagang, the Jhalukhali/Dhomali, the Jadukata and the Rakti are trans-boundary. This river system meets the Kalni-Kushiyara system at Bajitpur Upazila of Kishoreganj district. (Master Plan of Haor Area, Main Report, V-II, Page-79) (Figure 5.5)

¹⁹ This section mainly draws on the following document and the literature cited therein: CEGIS (2015), Hydrological regime report. IUCN-B, Dhaka.

Rainfall

Rainfall is the most distinctive component in the *haor* region and function as an important regulating variability in *haor* hydrology. Tanguar Haor is located entirely to the north of the tropic of cancer; hence its monsoon climate is known as sub-tropical. The climatic data on temperature has been taken from BMD (Bangladesh Meteorological Department) Station ID at Sylhet to observe the variability of rainfall. Rainfall distribution of the study area has been analyzed using long time series data and it shows the annual and monthly total rainfall that has been presented in Figure 5.6. The trend reflects that each year, the rainfall in the area has been decreasing by approximately 21 mm per year during the period of 1980 to 2008. The annual average, maximum and minimum rainfall were recorded in the area as 4,107 mm, 5,620 mm and 3,280 mm respectively. Monthly average, maximum and minimum rainfall was recorded in the area as 342 mm, 798 mm and 7 mm respectively. From the seasonal distribution of rainfall, it has been found that the amount of rainfall is very low during the period of November to February. Rainfall starts increasing during March and reaches its maximum value (800 mm/month) during July.

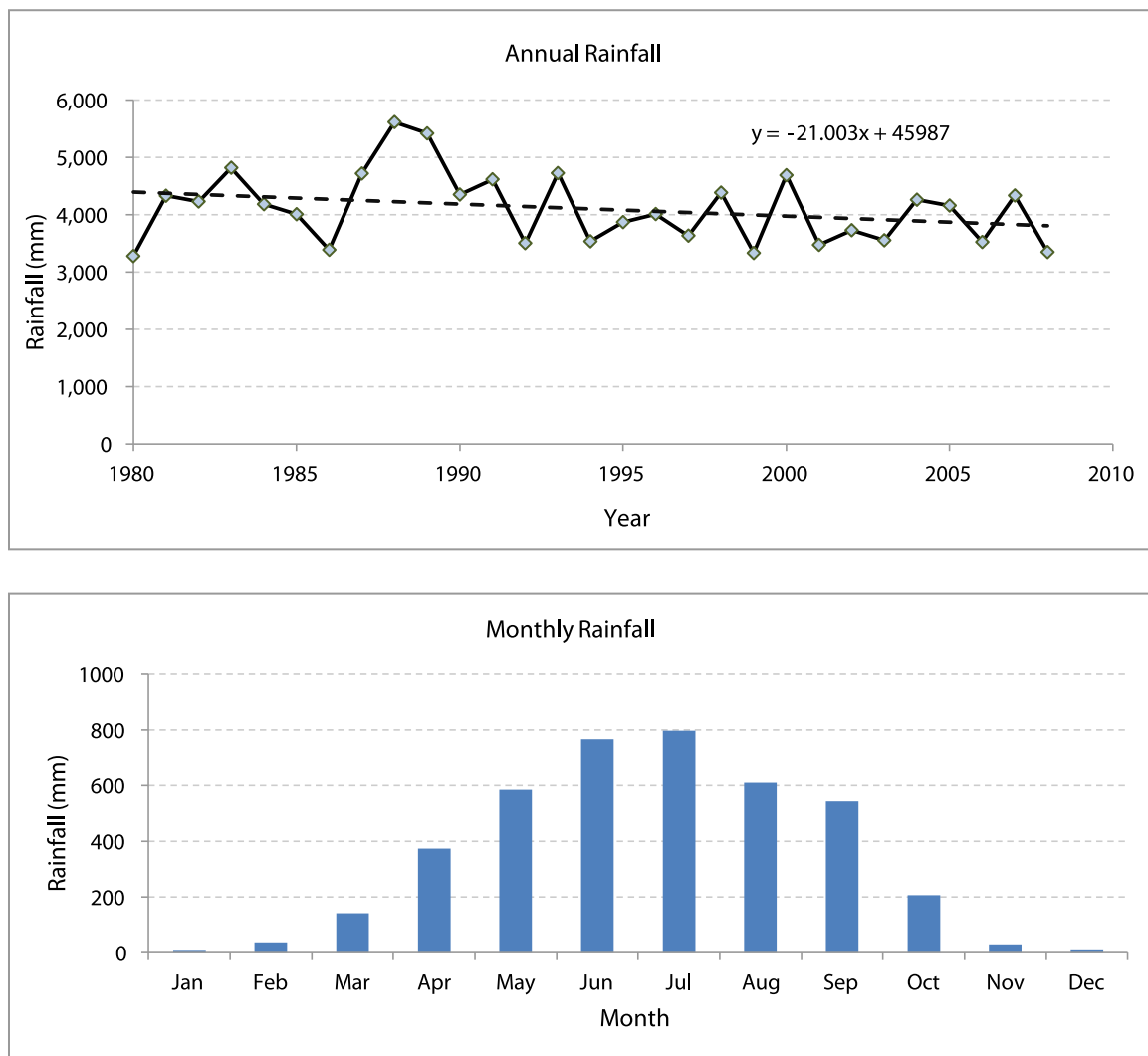


Figure 5.6: Rainfall hydrograph (CEGIS, 2015)

Temperature

The meteorological data of the area measured at Sylhet that reflects the trend of each year, the maximum and minimum temperature in the area has been increasing by approximately 0.042 and 0.03 °C per year during the period of 1980 to 2008. The monthly average temperature during monsoon is about 28 °C.

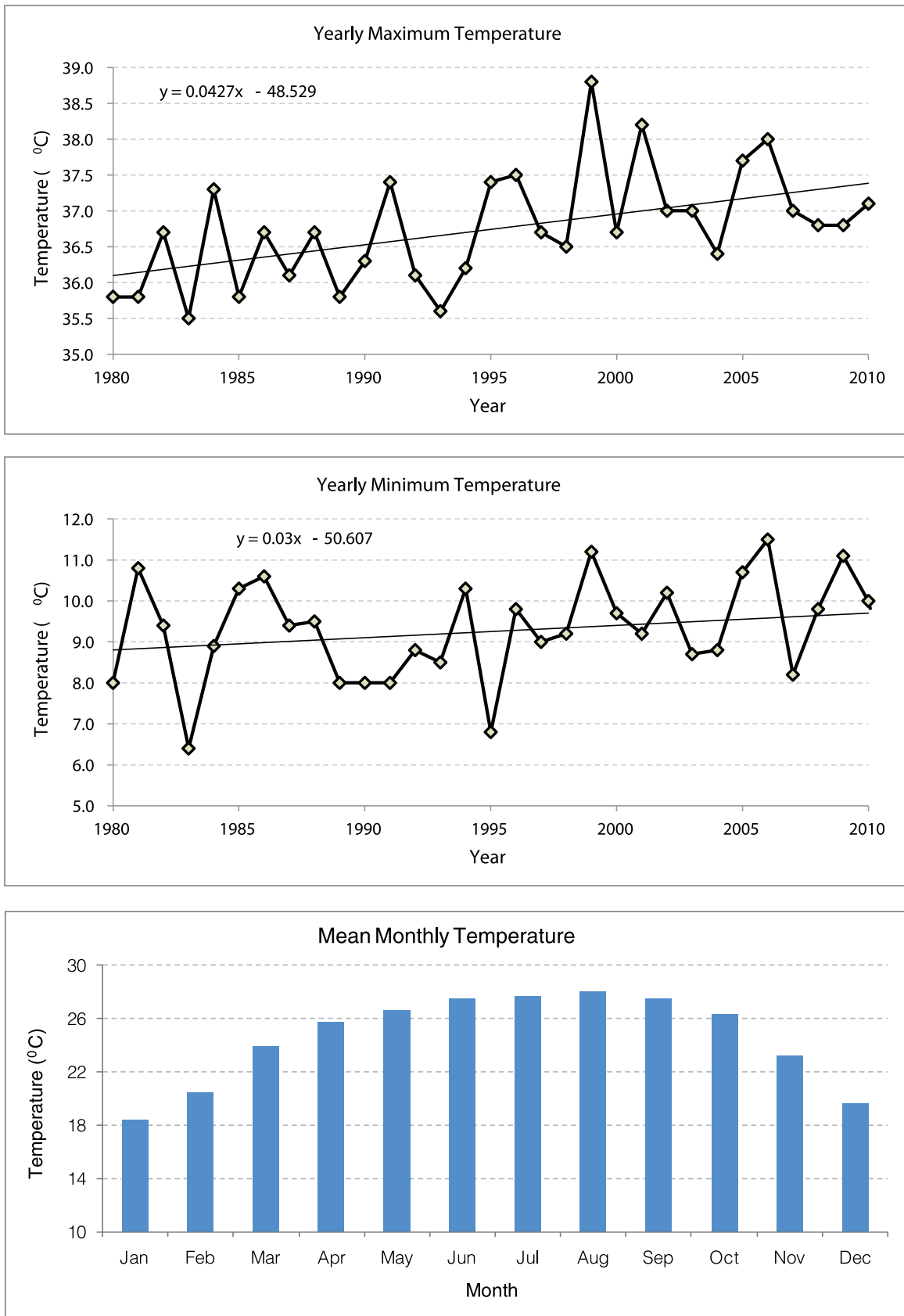


Figure 5.7: Temperature analysis (CEGIS, 2015)

Fluctuation of Water Level

The water level data from the three gauge location have been collected from 7th May 2013 to present date which is shown in figure 5.8. After the installation of gauges, the water level starts increasing, reaches its peak level during July. The water level is high during the period of July to September and then starts decreasing. The fluctuation of water level is higher (2.75m) for gauge 1 and 2 while gauge 3, the fluctuation is around three meters. The water level of gauge location 3 is more rapid fluctuating with rapid increase of water level.

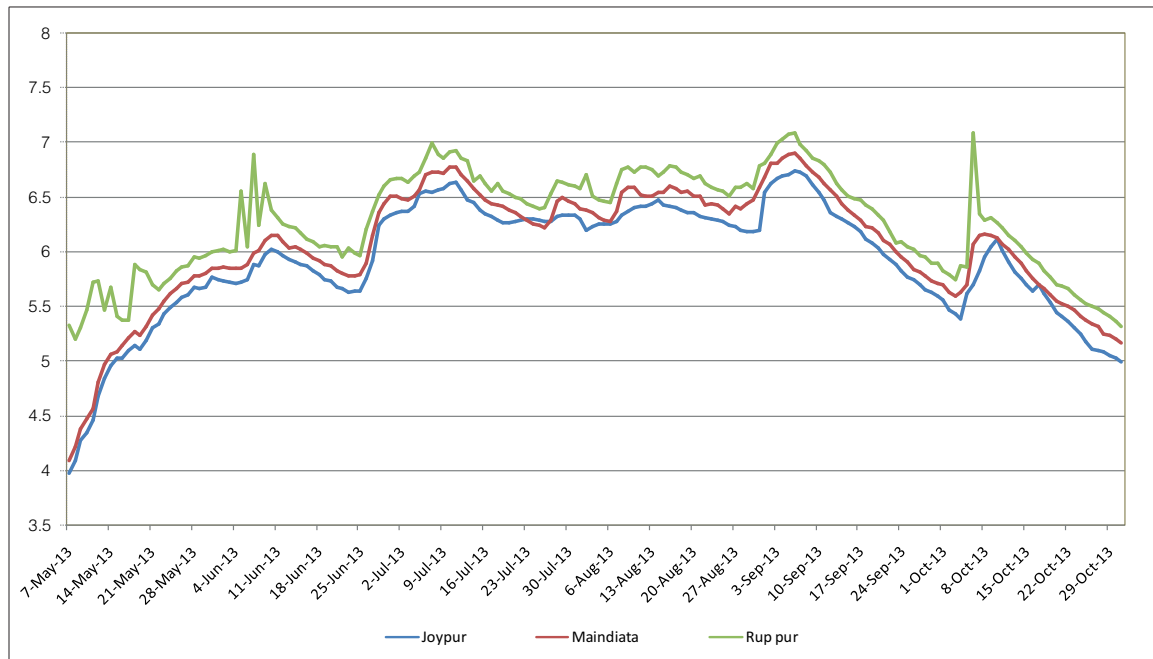


Figure 5.8: Observed Water Level for Three Gauge Locations (CEGIS, 2015)

Water Quality

Four major water quality parameters were measured in April, 2015 from four different locations of the study area (Table 5.8). The pH values in these locations are higher than neutral scale (pH=7) which means the water in these locations was alkaline in nature during April; this may be because typical pre-monsoon rainfall did not yet start by then (as opined by local people during field visits). Values of TDS (Total Dissolve Solid) were found low (below 350 ppm) for locations inside the haor area. Values of DO (Dissolve Oxygen) were mostly found close to the standards set by the DoE for both irrigation (5 to 6 mg/l) and fishing (5 mg/l). No salinity has been found in the haor area during the field test.

Table 5.8: Water quality parameters

Location	GPS coordinates	pH	TDS (ppm)	Temp. (°C)	DO (mg/l)
Nazarkhali	25°07'39.9"N	7.8	190	25	5.2
	91°06'00.3"E				
Joypur	25°07'44.5"N	7.6	222	25	5.6
	91°06'21.4"E				
Maindiata	25°09'13.2"N	7.6	325	27	5.1
	91°06'50.2"E				
Rupnagar	25°09'52.3"N	7.8	115	26	5.0
	91°01'54.5"E				

Source: CEGIS (2015)

Water Depth

The water depth in Tanguar Haor has been estimated based on the highest water level during 2013 as shown in Figure 5.9. The maximum water depth during that period varies from 0 to above 6 m. About 3.5% of the *haor* area was flood free which is mainly located in the northern part. About 12% area is inundated with a depth of 1 to 2 m. A major portion (20%) of the area which is mainly permanent water bodies had a depth of above 5 m. During dry season, the water depth reduced to 1 - 4 m.

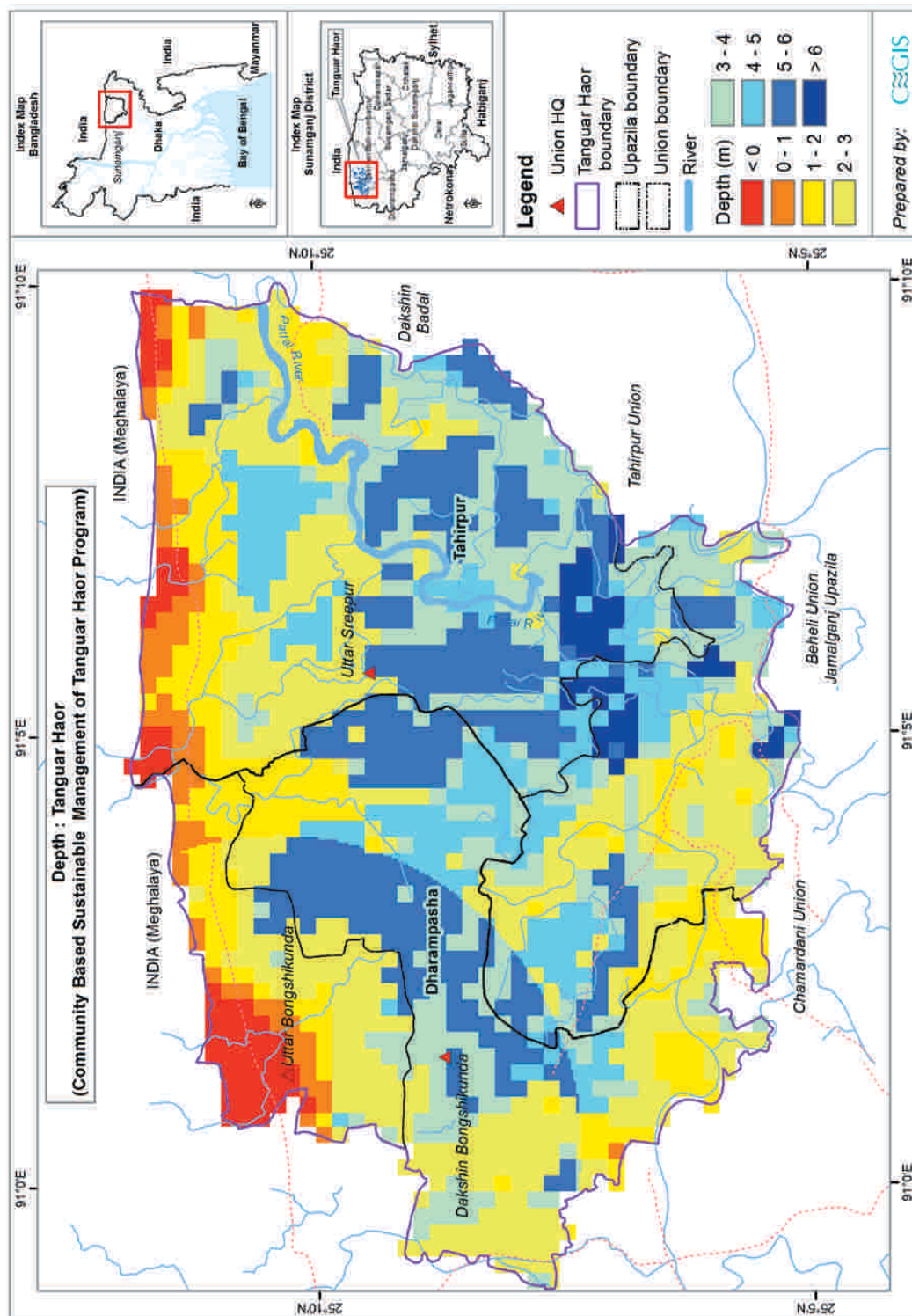


Figure 5.9: Highest water depth of Tanguar Haor for year 2013

Water Permanence

There is a large variation of water level in Tanguar Haor. Seasonal variation in rainfall, temperature, evaporation, upstream water flow, groundwater table reflect in water fluctuation into the *haor* area. During monsoon, almost all of the area go under water. During dry season, about 5089 ha (44%) area remains inundated which is considered as permanent water body. The location of permanent water bodies is shown in Figure 5.10.

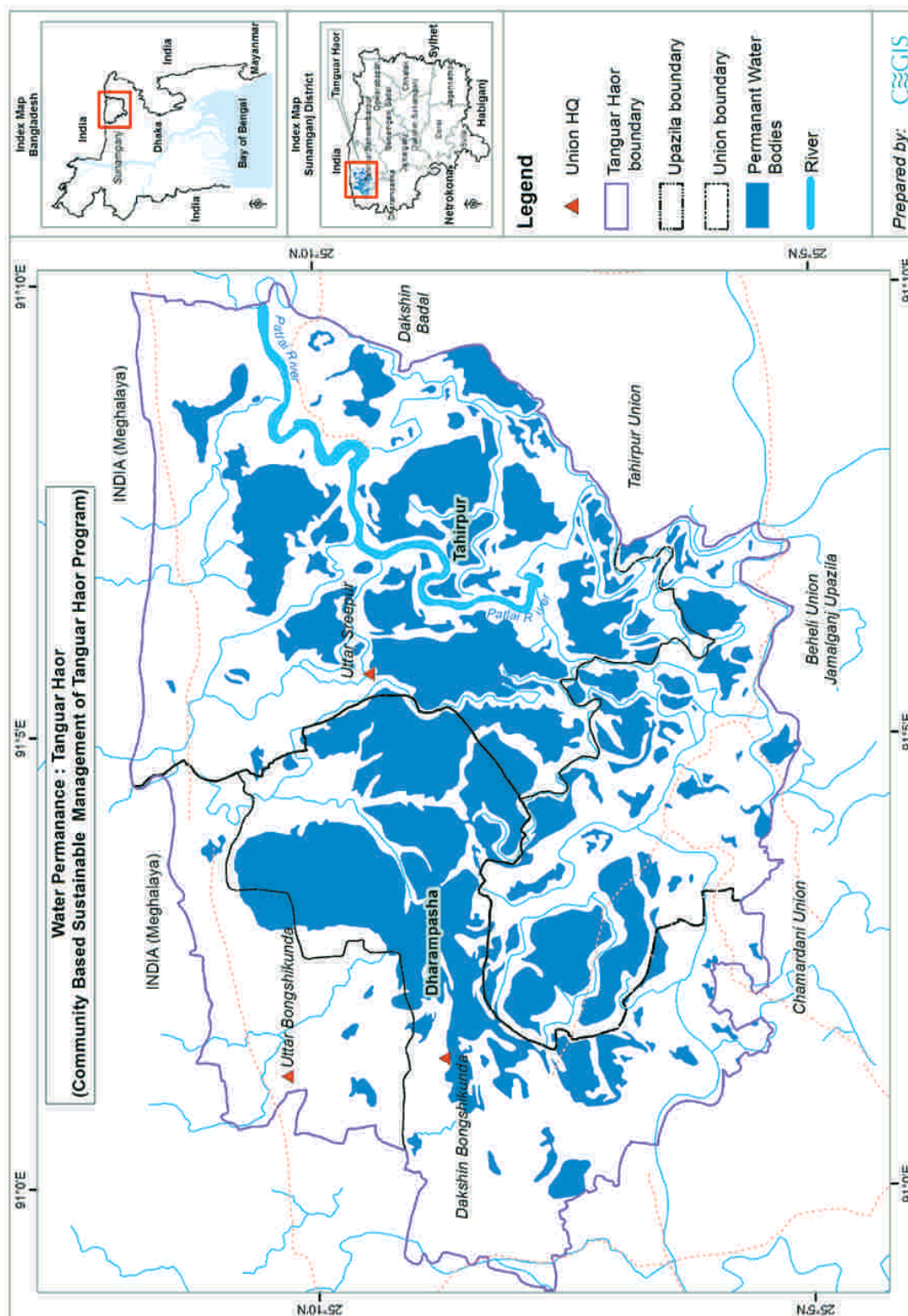


Figure 5.10: Locations of the permanent water bodies in Tanguar Haor

Flooding

There are two types of flood in this area: flash flood and monsoon flood. Among these, flash flood or pre-monsoon flood is of major concern since this flood damages Boro crop in the *haor* area. This is one of the major disasters in the *haor* area which engulfs the primary production and thus threatens the life and livelihood of the inhabitants of the *haor* areas. Due to flash floods induced damage to Boro crop, the dependent inhabitants remain in a distressed condition until the next year's harvest. This is a major concern for the area as well as for the whole nation.

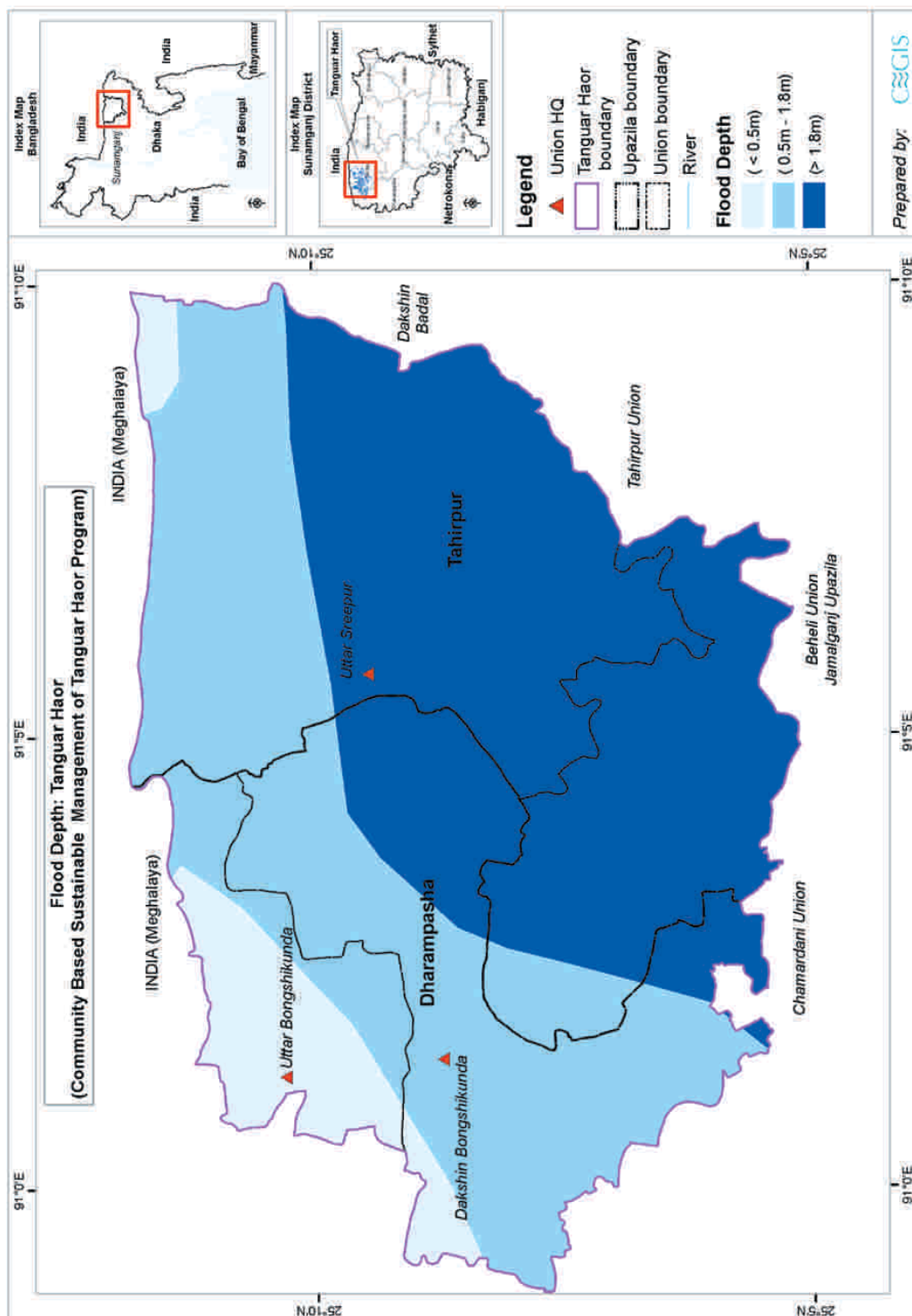


Figure 5.1.1: Flood depth map of Tanguar Haor

Flash Flood

This is the most common water resources phenomenon in the area and is of major concern. Such floods are caused by land runoff due to heavy or torrential rainfall of a short duration over a relatively small area having steep slopes. Flash floods are caused mainly due to huge volume of flow through trans-boundary rivers within a very short period. During flash floods, the water level rises and falls quite rapidly with little or limited advance warning. Typically, flash floods occur in the North East Region where the upstream basin topography is relatively steep and the concentration time of floods on the basin is relatively short. In terms of devastation, flash floods during late April to early May are common water related disaster in the *haor* region. The extent of flooding in the region is even more aggravated mainly by the confinement effect which occurs due to a number of natural or topographic and anthropogenic factors. Repeated floods over the last few years have weakened the existing flood protection structures.

Monsoon Flood

Monsoon flood is not considerably important since there is no damage to crop due to absence of crop in the fields during this season.

Ecosystem Services and Functions

Tanguar Haor is a large water logged area between banks of large rivers at the foothill of the Meghalayan-Joyanti Hill Cherapunji rainforest. Water is available here throughout the year and water supply varies 220 to 7000 m³/sec in February and July, respectively (Alam *et al.*, 2012).

According to the Ramsar Convention on Wetlands (2011), the 'ecosystem services' means the benefits of people obtain from ecosystems provided by wetlands. The great diversity of ecosystem services delivered by wetlands and their values cover flood control, groundwater replenishment, shoreline stabilization and storm protection, nutrient retention and export, water purification, reservoirs of biodiversity, cultural values, recreation and tourism.

The siltation process creates new landform in the *beels* and ultimately provides fertile lands for harvesting best crops. In addition to agricultural practices, the 'Tanguar Haor' is used as grazing land for cows, buffalos and birds. This land is also known as fish breeding ground which provides suitable habitats when become submerged. Of the freshwater fishes, 141 species out of 268 graze in this wetland. Tanguar Haor is a prominent breeding ground for fish especially major carps. It contributes in national fish production and protein demands to the locals and their livelihoods through fishing. In addition to these, the livelihood options of the locals provided by the activities of commercial fishing, fuelwood trade, and hunting and trapping of waterfowls. Moreover, harvesting of grasses and reeds also provide earning to the locals. In the case of cultural values, the villagers arrange wedding program during the monsoon in order to get access everywhere for smooth moving which has a great contribution of hydrological resources. It has a cultural value throughout the *Haor* Basin (HB). On the other way, the natural beauty of Tanguar Haor makes this area very lucrative to nature lovers and researchers for their bird watching and research works, respectively.

The Tanguar Haor plays an important role to maintain natural balance. The major functions of Tanguar Haor are flood control, groundwater recharge, sediment trapping, supporting habitat and biodiversity. The following sections are briefly discussed below.

Flood Control

Flash flood is a common phenomenon in Tanguar Haor region as mentioned earlier. The low elevation of Tanguar Haor acts as a flood control reservoir to reduce the magnitude as well as the impact of flood wave. When the flood flow from the upstream catchemnts reaches to the *haor* area, it spreads over the low areas and reduces flood depth to the downstream locations. In 2013, the maximum water level of Tanguar Haor was around 6 m PWD. At this level, it stores 540 Mm³ of water and contributes to flood control.

Groundwater Recharge

Tanguar Haor contributes to recharge the groundwater which is used for irrigation and other uses during dry period. Besides the monsoon recharge, it contributes to groundwater recharge during dry season through its

permanent water bodies. Considering the percolation rate of one millimeter per day (1 mm/day), total contribution to the groundwater is 50890 m³ per day during dry period and 116500 m³ per day during monsoon.

Sediment Trapping

Tanguar Haor lies in the Sylhet basin which is different from other parts of the country. This basin has a shape of bathtub and low lying areas where all the rivers are merging as well as the subsidence rate is high due to the tectonic activities. Sediment transport is a big issue in Tanguar Haor. Because many rivers enter to this *haor* and during the movement of rivers, it deposits sediment to the *haor* area where flow velocity is less. This creates problem in sedimentation of the *haor* and rising of the bed level of the *haor*. So, Tanguar Haor is behaving as a sediment trap which is threat to wetlands species and also biodiversity.

Supporting Habitat and Biodiversity

The hydrological regime of Tanguar Haor creates important habitats especially for fishes. Tanguar Haor is the habitats for 141 indigenous freshwater fishes while entire inland fish species are counted for 268. A greater number of fish species supported by this important wetland. It is also one of the country's most productive inland fisheries source along with swamp forests for its unique wetland characteristics.

Tanguar Haor consists of about 50 *beels* along with perennial floodplains those are rich in fishes and retain water during the dry season. It acts as shelters for mother fishes.

Different plant communities occupy different habitats providing them a peculiar characteristics either they are tolerant to aquatic and terrestrial condition or both for their survival and propagation. Its aquatic environment is very unique. It has traditional interaction with much dynamic way with land and water, biotic to abiotic and fish to vegetation, fish to fish. It claims eutrication resulting from submerged plant hampers fish habitat but continuous wave and steady water supply do not support this condition to become acute.

In the monsoon, hill streams cause some sedimentation in the upper edge of the *haor* and the adjacent cluster villages. Siltation does not hamper the habitat of fishes instead provide some nutrients to soil which has good impact for agricultural activity. This also creates a unique character to the *beels* which provides good breeding ground and habitat for the shallow water living fishes. There is a great importance of Tanguar Haor in fish production and in maintaining biodiversity. Tanguar Haor as the wetland of low sediment with clear water and it is good ground for breeding fishes.

Submerged and amphibian vegetations are the good habitat for small and medium-sized fishes, mother fishes where reeds and other vegetations provide a natural ecological balance for shelter of mother fishes. Moreover, there is an abundance of food and biological situation to boost up the maturity of fishes along with the support of hill streams which keeps the reservoir in the dry season.

Pallas's Fish Eagle (*Haliaeetus leucoryphus*), a vulnerable bird species builds nests in trees at the periphery of Tanguar Haor in the winter. Tanguar Haor is the home to 268 fish, 11 amphibian, 34 reptile, 206 bird and 31 mammalian species. In the winter, Tanguar Haor supports more than half a million of migratory waders.

Hydrological Settings/ Installation of Gauge

There are six gauges which have already been installed in three places namely Joypur, Maindiata and Ruppur villages. Of the villages, Joypur and Maindiata are situated on the bank of the the Patlai River at Uttar Sreepur union of Tahirpur Upazila and Ruppur is situated on the bank of Rupnagar Chhara (Hill stream) at Uttar Bonshikunda union of Dharmapasha Upazila. Gauges were installed one in river and other in fringe of homestead at each site. Data obtained from all of these gauges will be used in the initial assessment of hydrological situation of Tanguar Haor.



Gauge Installation at different points of Tanguar Haor in 2013

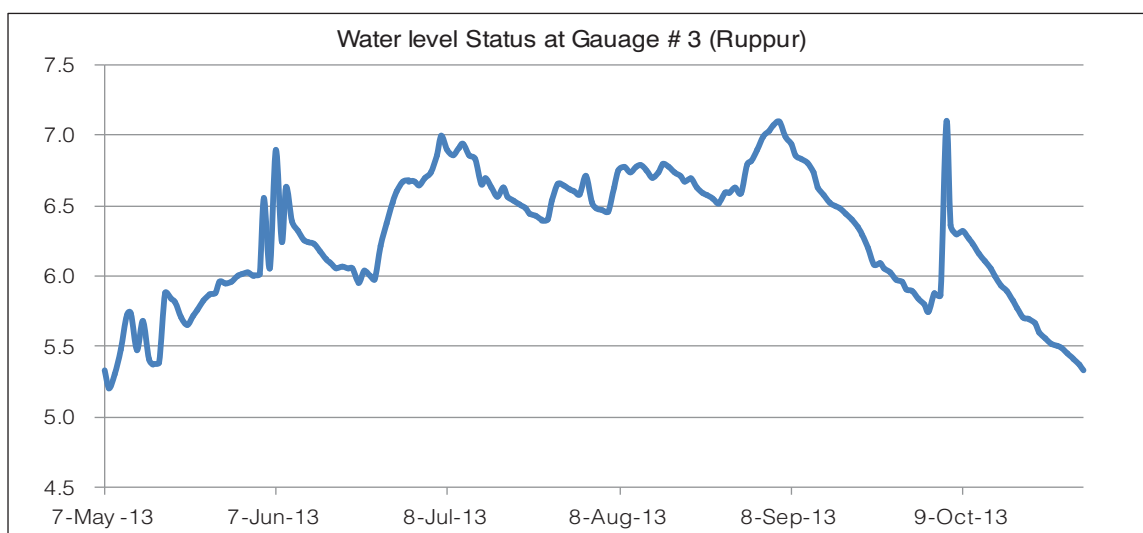
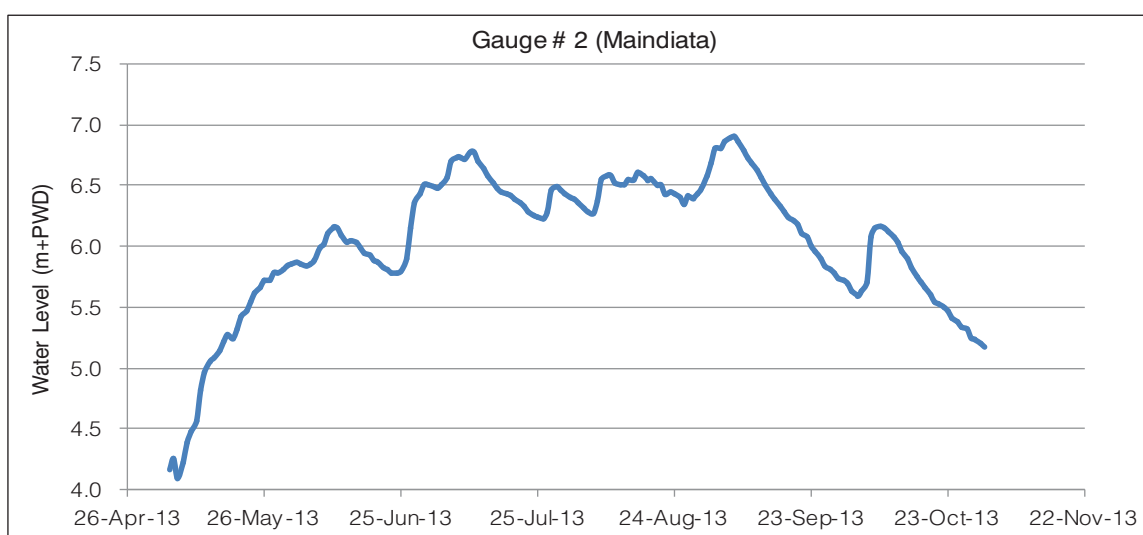
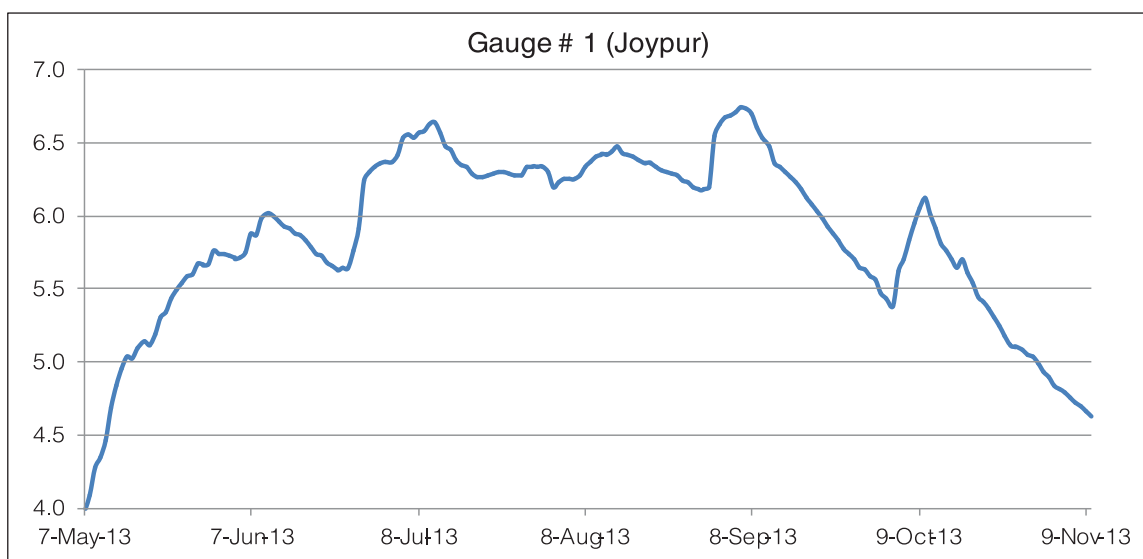


Figure 5.12: Observed water level for the three gauge locations in Tanguar Haor

Training

Gauge readers, three persons for each site, have been selected for each gauge site from the Tanguar Haor Management Committee. Selected Gauge reader was trained to properly read and maintain the gauges. During the flood season, gauge readers collected data five times daily with the interval of three hours from 6:00 am to 6:00 pm for each of the six gauges. They recorded the data in a logbook, which was collected every 15 days by a field supervisor working for CEGIS. CEGIS field supervisors checked the logbooks regularly. Once every month, CEGIS field engineers checked the level of all the gauges, assuring accurate and consistent data.

They were responsible for taking gauge reading from the installed gauges and sending reading to the central hub for transforming data to develop hydrological forecast with 48-hour lead times for selected locations.

Finally, field data was entered into a spreadsheet and monitored to ensure that the flood forecasts were reasonable. If there were any significant inaccuracies with the forecast, as compared with the monitoring station data, then the forecast would be corrected or suspended until the error was identified.



Gauge reader on field training by CEGIS in Tanguar Haor, 2013



© CEGIS

Hydrograph of Installed Gauge

The water level data from the three gauge locations have been collected from 7th May 2013 to present date which is shown in figure 5.12. After the installation of gauges, the water level starts increasing, reaches its peak level during July. The water level is high during the period of July to September and then starts decreasing. The fluctuation of water level is higher (2.75m) for gauge 1 and 2 while gauge 3, the fluctuation is around three meters. The water level of gauge location 3 is more fluctuating with rapid increase of water level.

Recommended Actions for Improvement

- For hydrological monitoring, it needs information on flood dynamics between the rivers and floodplain, including the delineation of land and water interface for flood depth mapping methodology. To understand the process of flood dynamics and interaction with the floodplain, it is necessary to establish a hydrological monitoring information network in the floodplains. Water-level monitoring sites will be selected in the floodplain areas to monitor the water levels and the temporal and spatial variability of the flood dynamics and its responses. The main floodplain of the area is created by the feed water of the Jadukata and the Patlai River through different channels and creeks originating from those rivers. Flash flood occurs during late April to early May in the area. Water enters the study area from the northeast through the Jadukata River, east and south through the Patlai River and west through Rupppur Chhara. At the time of flash flood, water levels in the Jadukata-Patlai system along with other Chharas rise above danger level and thus most of the parts of the study area become inundated and damage the standing crops (Boro crops). Approximately 75% of the study area gets inundated under flash flood conditions.
- The installed gauges should be properly maintained and monitored by field supervisor for accurate measurement of water level.
- Installation of permanent gauge (RCC) to prevent it from damage due to high flow velocity during the high flow period.
- Installation of automatic gauge for more accurate and consistent data collection.

5.2 Guidelines on Components concerning Community Development²⁰

5.2.1 Governance

In simple terms, governance means the process of decision-making and the process by which decisions are implemented (or not implemented). In recent years, requirements to the political and administrative system of being democratic, responsive, effective etc. have increasingly been conceptualized as important elements of good governance.

Decentralization is often seen as an important means to foster and nurture the important elements of good governance in developing countries. Policy-makers and researchers recommend decentralized natural resource management for many reasons. Some of them are that:

- Local people are likely to identify and priorities their environmental problems more accurately than centralized organizations.
- Resource allocation is more efficient and transaction costs lower when decisions are taken locally, so that state expenditure on management can be reduced, while resource conservation is improved.
- Local groups are more likely to respect decisions that they have participated in taking.
- Monitoring of resources use is improved, and
- Marginalized groups gain greater influence on local policy.

The most delicate and important issue for Tanguar Haor is surely governance. Over the years Tanguar Haor has experienced many challenges in getting to the current state which is being practiced under Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP). However, the governance is yet to be institutionalized that could contribute to sustainable management of Tanguar Haor. Despite a few shortcoming, the unique feature of CBSMTHP is embodied in its essential nature, which manifests itself not only in advocating the grassroots cause, but by ensuring the closest participation of the concerned communities all through the project process. The community people and other stakeholders actively participated and regularly suggested ways of rendering the CBSMTHP successful, functional and sustainable. The basic objectives of the Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP) are as follow:

- Prevention and reversing the trends of wetland degradation
- Sustainable use of wetland resources.
- Promoting sustainable development
- Ensuring people's participation in formulation and implementation of sustainable management plans.
- Improving the quality of life with special focus on women

Co-management has been advocated in Tanguar Haor as sustainable solution to existing resource exploitation which could be viewed as trade-off between government based management and community based management, to be initiated by NGOs or third party where the main two parties will intend to maintain a win-win situation of the both (Berkes, 1994).

Jurisdiction of co-management governance depends mainly on the level of resource production of the property. If the production can meet the need of the community, it may remain confined only with allocation and management of the resources for example, legal access to resource, protection, restoration, regeneration, biodiversity, conservation and harvest of the resource. But if it fails, if need to address some additional interventions to protect resources from exploitation and over use.

- Co-management issues in Bangladesh have emerged in development sector in the Eighties. However, co-management in wetlands started from the mid-nineties. It has evolved mainly from the experience of

²⁰ This section mainly draws on the following document and the literature cited therein:

1. Hussain, A. (2014). Assessment of wetland governance system in Tanguar Haor Ramsar site. Winrock international;
2. Miah, F. (2015). Tanguar Haor Management Rules 2014. IUCN-B, Dhaka.

fisheries management in common property resources through different programs and projects initiated by the government, NGOs and community. The CBSMTHP is a project that aimed at establishing a co-management regime in Tanguar Haor.

- In spite of progress made with putting in place elements of a co-management system involving Government and local Communities from Tanguar Haor, there remain considerable uncertainties about what co-management entails, how it functions, what is the scope of its purview and what specifically would be the respective prerogatives of government and communities under a co-management scheme. The co-management project has to deal with a number of challenges such as providing legal access to wetlands while maintaining nature conservation. Establishment of the first requires willingness of GoB and the second, a sincere commitment from GoB and community and also from the project implementing organisations. Another important thing particularly in wetlands conservation is up and down stream management. In other words, controlling issues evolving from outside but affecting the resources. Both up and downstream issues need to be addressed under the co-management governance despite its origin from the outside of the territory.
- Community organization plays an important role in operationalisation of co-management regimes, particularly contributing to nature conservation. Research recommends that community organizations form the basis of co-management in Tanguar Haor (CBSMTHP, 2010). Community organization follows a multilevel structure that includes a very small community based organisation to a village wide or union wide organization. In Tanguar Haor, the Village Co-management Committee (VCC) promotes leadership that capacitated local people to negotiate with other actors in managing resources upon which they depend on. Guided by a co-management principle, this section focuses on scope of community mobilization and presents guidelines for community based organization that will strive for sustainable management of Tanguar Haor.

Co-management Governance

What are the issues to be considered under co-management governance? How these issues can be identified? Berkes (1994) argues that a co-management requires a long time and process to establish well functioning rules, regulations and values for the maintenance of minimum stock to maintain same biomass quantitatively and qualitatively. Issues may not be same in all places. All issues may also not appear at the same time. Different issues may be evolved in different courses of time. Issues are dependent on many things like, political stability, economic growth, natural disasters, social harmony and socio-economic conditions of the locality. However, in consideration to the experience of the other co-management models, we may identify some issues even in the beginning.

Experience shows that selection of issues also depend on the nature of resources. There should be a limit for maximum resource harvest for a specific period of time. If the harvestable stock can meet the need of the community, then management and administrative issues may remain confined only with the allocation and management of the property. These are legal access to resource, protection, restoration, regeneration, conservation and harvest. However, if the need of the community becomes higher than the harvestable one, then the management needs to adopt 'safety measures' for the protection of minimum stock. Safety measures mean safeguarding. Here, safeguard doesn't mean only to enforce law or restrict people from resource exploitation but it implies introduction of alternative options to enable people to reduce dependency on the resource.

Legal Access to Wetlands

If we analyse different issues related with the establishment of legal access, we need to consider at least three things. One is capacity of the community to bargain with GoB, capacity of the third party to convince GoB and willingness of the GoB to provide access to the community. However, after having legal access through an agreement, three activities need to be considered in establishing access rights of the community. One is demarcation of assets like beels, embankment and swamp forest. Second, is the management of access through introducing licence permits etc., and the third one is enforcement of law to protect properties from illegal access.

Current Situation of Community-Based Governance

Institutions and Structure

The Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP) Co-management governance apparently is well thought-out with a foundation at the grassroots resource user level and linking up to the GoB's highest, policymaking level. The Village Co-management Committee (VCC) is at the bottom of the governance structure. As its name suggests, VCCs were formed at the village level. The CBSMTHP has so far facilitated the formation of 73 VCCs covering 76 out of 88 villages around Tanguar Haor and brought 6,616 members from 4,774 out of 10,205 households into the co-management process. The VCCs are the bases for establishing four Union Co-management Committees (UCCs). The Central Co-management Committee (CCC) is the apex body at the ecosystem level that serves as the voice for Tanguar Haor community. The Tanguar Haor Management Committee (THMC) is located at the Sunamganj District Headquarters and chaired by the Deputy Commissioner (DC) of the district. While THMC is the authority to set the ToR for the implementation of all the operations of the project, the CCC plays a central role in managing the SCM. The Project Steering Committee (PSC) located at MoEF is chaired by the Secretary MoEF. One adult member of the household comes in as a member in a professional group of his or her choice, which is led and managed by a secretary. It is unusual that both the husband and wife join a group.

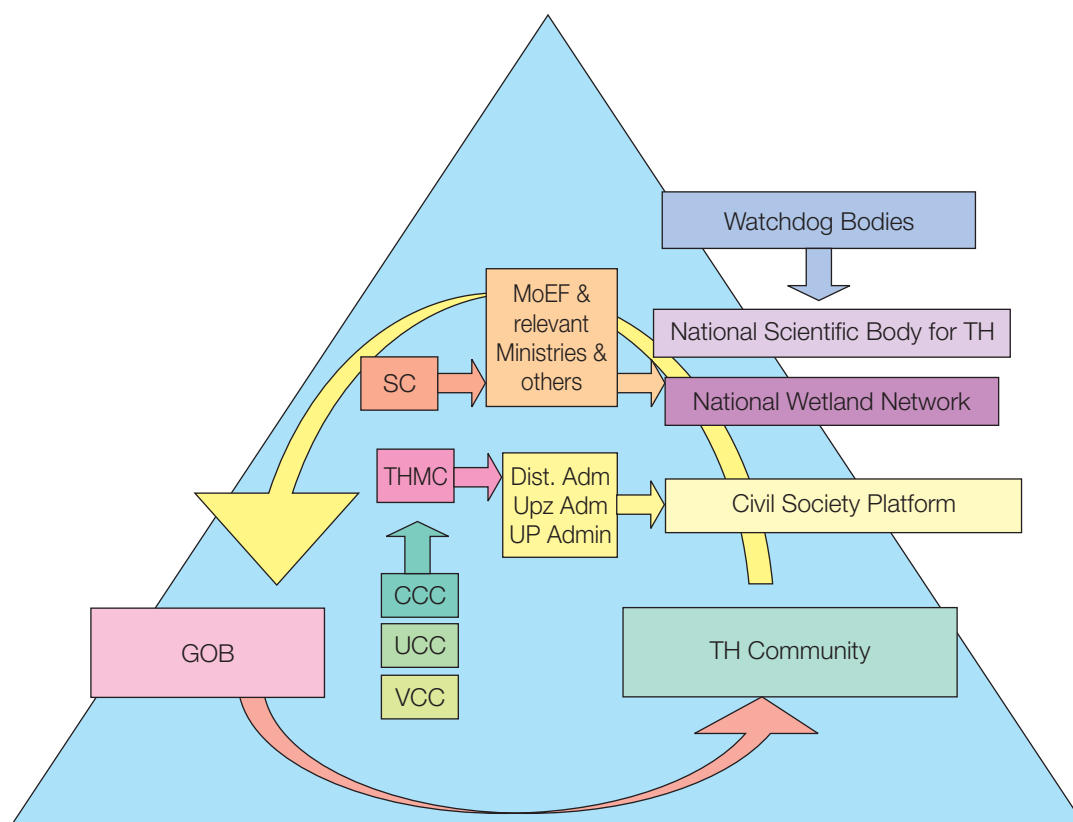


Figure 5.13: Institutional structure

Nine General Body members of the VCC, five professional secretaries and four other office bearers; President, General Secretary, Office Secretary and Treasurer, are elected to the VCC for two years and form the VCC Executive Committee (EC). The VCC-EC members are aggregated at the concerned UCC as UCC General Body (GB) members and they vote for the formation of UCC-EC members. The UCC-EC members are aggregated into the CCC as CCCGB members. At VCC level each voter of GB has the right to choose four office bearers and one professional secretary from his/her own professional group in the EC. At the UCC level, each voter of the GB has the right to choose only one member for the EC from his/her own group. On the other hand at the CCC level, each voter of the GB has the right to choose all members of the CCC-EC body. That means that the VCC is practicing five votes, UCC a single one and CCC nine. Three representatives from the CCC represent the community at the THMC (Mazumder, 2014).

Structure of three tier democratic leadership at community level



Figure 5.14: Structure of three tier democratic leadership at community level

Portfolio based election system is introduced under the project, i.e. an elected President of the VCC is only eligible to compete for the UCC presidential candidature and the same way an elected President of UCC is only eligible to compete for the CCC presidential candidature. Three representatives from the CCC represent the community at the THMC.

Legal Status

The CCC (and its Constitution) was registered as a 'Co-management Society' under the 1860 Societies' Registration Act. The VCCs and UCCs do not have any separate legal standing; they have been included in the CCC Constitution as supporting units (Mazumder, 2014).

Community Entitlements

A co-management system for Tanguar Haor is in place which conserves ecosystem values and services and provides a basis for an improvement of livelihoods for rural communities. The communities of the Tanguar Haor have improved livelihoods and increased incomes. The project has successfully engaged community in developing the co-management structure, advancing local leadership, organizing and supporting livelihood activities within the co-management structure and instilling self-help motivation among the community. On the policy ground, a milestone is achieved by obtaining government formal notification to allow fish harvest by the

community people and benefit sharing modalities among community people, community organization and government. The Ministry of Environment and Forest, Government of Bangladesh on 13 March, 2008 through a circular determined the ratio of share of fishery for the three stakeholders, namely fishermen (harvester) 40%; Community 36% and the Government 24%. The above ratio of share was determined through community level consultation discussion at the THMC, National Steering Committee and the Ministry.

The fish catch right is decided through a tendering process conducted by a Sub Committee headed by the Additional Deputy Commissioner (ADC) (Revenue) formed by the THMC. The contractor quoting the highest price is awarded the fish catch rights for the stipulated period.

Co-management approach and ecological status

The Management of Tanguar Haor ecosystem consists of the following, inter alia, (i) Regulated fishing: Commercial and non-Commercial; (ii) Controlling illegal fishing, and (iii) Ecosystem Restoration.

(i) Regulated Fishing

Benefit sharing formula has been notified in a central government gazette. Commercial fishing harvest (CFH) was taken up in 14 perennial beels by fishermen groups led by respective VCC leaders. There has been a good income for fishers as well as for the community organization. Similarly the license and permit fee or charges are established for a range of fishing gears for non-commercial fishing.

(ii) Controlling Illegal Fishing

Establishment of a magistrate and ansar system has gone through its ups and downs, but is becoming stronger slowly. There are several positive movements. Magistrate holds a weekly meeting with UCC and CCC leaders. Ansars jointly patrol with community guards, renting a boat given by UCC. Magistrate can get seized boats destroyed. However, the current arrangements are far from sufficient, given Tanguar Haor's open access and vast area and the hold of ex-leaseholders on the population and the latter's economic dependence on the former. There continues to be an issue of inadequate infrastructure with the magistrate demanding a speed boat for swift movement over the large area of Tanguar Haor.

(iii) Ecosystem Restoration

There are several activities undertaken for ecosystem restoration, including establishment of five fish and two bird sanctuaries; fish nurseries; plantation of large number of Hijal and Korocho saplings. However, the impact of these activities is not known nor detailed out in reports. In absence of a master plan of some sort, it is hard to estimate what more might have to be done.

An Assessment of Community-based Management and Governance in Tanguar Haor

Issues Related to Good Governance

The strategy to organize people around savings and credit, has largely been successful in as much as it mobilized a majority of poor population, including women; gave them voice; strengthened empowering processes through transparency of records; and built representational tiers above successively. One adult member of the household comes in as a member in a professional group of his or her choice, which is led and managed by a secretary. Rarely, both husband and wife join a group. Nine people, five professional secretaries and four other office bearers, President, Secretary, Office Secretary and Treasurer, are elected to VCC (Village Co-Management Committee), for a year. They are aggregated at union level (Union Co-Management Committee) and then into a single apex body for the entire wetland area covered by Tanguar Haor (Central Co-Management Committee).

Of these, UCC is the real decision making body, where all applications for loan as well as for fishing license and permit for example, are processed. It appears that the system at the VCC and UCC levels is well established. Organizationally, VCCs are active in managing saving and lending operations, but it is UCC that is the real decision making body, close enough to the people and large enough to give it economies of scale and high quality leadership. All applications for loan as well as for fishing license and permit for example, are processed at UCC.

Interaction with staff revealed that meetings are held regularly, records are maintained including the passbook and staff meetings are held weekly. During the village visits, one saw the chart clearly stating every individual's

saving, subscription and loan outstanding. This kind of transparent recording and sharing empowers. They get to regularly know about the decisions being made and what is at stake, which is a first step to learning about how to make decisions.

THMC is headed by Deputy Commissioner, the most crucial management structure that has been promoting co-management of Tanguar Haor resources. There are district level officers including that representing law enforcement machinery. Recently, Upazila officers too have been inducted. Local government (Upazila and Union Council) and community institutions are represented. Frequency of THMC meeting has been very high and a quick review of the decisions made (sample of the last four meeting) reveals great degree of work in the following areas: (i) law enforcement, issuing orders for functioning of magistrate-ansar system; (ii) establishing a license regime for regulated fishing and overseeing the process of bidding; (iii) allocating resources from existing schemes of various government departments for the purposes of poverty alleviation, ecosystem restoration and prevention of disaster etc. Some of the other notable features are: (i) Lower level machinery such as UNO's are involved in project activities such as issuing of licenses; (ii) magistrates hold meetings with UCC leaders within Tanguar Haor.

Among several strengths in the strategy of institution building, we note that - (i) there has been high inclusion; (ii) there has been a high degree of transparency and accountability vis-à-vis sharing of data; and (iii) a good leadership has come up at UCC and CCC levels.

Availability of small loan to almost everyone helps in two ways: (i) family can meet consumption needs; and (ii) repayment of smaller loan qualifies a borrower to apply for a larger one.

Several modalities of fish harvest have been designed for commercial and non-commercial harvesting, approved by the government. Acceptance is low, even though one can say there is much opposition from local elite. Making the VCC leaders participate in the bid process for commercial harvesting has created new stakeholders in the responsible use of the resource. It does in a way blunt the edge of those not interested in sustainable management. Yet, by not bringing in UC and UP representatives in any of the community forums, the project is losing a potential instrument to manage the opposing forces better.

The VCCs and UCCs are being promoted in isolation, without any apparent horizontal linkage with the local government structures such as Union Parishad (UP) and Upazila Parishad, even as chairmen of the four UPs are members of the THMC. Absence of a collaborative and negotiating process or a structural link between the two makes for an inherent weakness and un-sustainability that must be looked into.

Issues Related to Commercial and Non-Commercial Wetland Products

Lending from corpus (accumulated at CCC level) is a major strategy to promote income generation activities. Credit is helping them take up skill or asset based income generation in a whole host of micro-enterprises such as boat repair, petty shops, beef fattening and buying a boat to ply people or commodities. The resulting average daily income from micro-enterprises is far higher than what a person would make in fishing, making these an economically attractive proposition. Promoting micro-enterprises will instill a sense of confidence among the community that is used by the lower end of a value chain and lower margins. There are many other ways that project is adopting to enhance incomes such as training, agriculture extension (improved practices and better rice variety) and getting rice seed through a dealership (from agriculture department to CCC).

Currently the Tanguar Haor is managed under an innovative system called Co-management. This has replaced the age old leasing system in which someone was entrusted with the management function who would win the bid administered by the government. However, it needs to be mentioned here that the rights over the *haor* was not perpetual as was in the case of Permanent Settlement introduced in this country for the purpose of revenue collection in 1873 by the British colonialist. In this case the lease was granted for only a limited period of time.

As mentioned earlier, for better management, restoration, preservation, conservation and increasing the resource base, the co-management system has been introduced. The current system paved the way for the participation of many relevant stakeholders in the purposes mentioned above. However, it is imperative to mention here that the current co-management system functioning in Tanguar Haor is part of a project initiative. The project has already completed two tenures and the third one is continuing. The current tenure will be over in 2015.

Co-management System Analysis of Tanguar Haor

The present study tried to make a thorough analysis of the existing system of co-management. The purpose of this analysis was to identify its strengths, weaknesses, opportunities and threats. This has been done keeping in mind that current tenure project initiative under which the co-management system is operating will likely to be phased out in the next year. It is perceived that the present exercise will provide opportunities to upgrade and develop the present co-management system and continue with it under different scenario that may emerge once the project management is over.

Strengths of the Current Co-management System

The identified and analyzed perceived strengths of the current project sponsored co-management system are discussed and presented below.

The current co-management system of natural resources is quite unique in the sense that it tries to include the relevant stakeholders in the process of management and also tries to create a win-win situation for all ensuring restoration, preservation and conservation of natural resources of great importance both nationally and internationally.

As we know that the communities living in villages within the surroundings of the *haor* have been the beneficiaries of the natural resources of the *haor*. They are one of the most important stakeholders. Their participation in the co-management structure has been recognized and ensured. Here it should be mentioned that most of the activities under the present system of management revolves around the members of the communities living in the villages under the Unions in two Upazilas where the Tanguar Haor is located. The participation of the community people has been ensured at different levels starting from the village (VCC), Union (UCC) and federation level located also at the Union level (CCC).

Besides the communities, under the present arrangement of the co-management system participation of other institutions like the Government of Bangladesh, IUCN, CNRS, Helvetas and ERA have been included in the list of the concerned stakeholders on the basis of the roles and responsibilities, as prescribed in the co-management system under operation.

The other important strengths as identified have been the awareness and commitment developed over the years because of different interventions of various stakeholders among others. Especially, of the Government of Bangladesh about the importance of the habitat restoration, preservation, and conservation of Tanguar, includes the right of the local community to have access to the natural resources of the *haor*. During field investigation, it is revealed that especially the field level government officials are not in favour of reverting back to the old system. The old system of leasing out of the *haor* and its resources to any individual in exchange of certain amount of lease money, depriving the right of the local communities over the natural resources of the *haor*. They are in agreement that the right to the *haor* resources is an inalienable right of the communities living in and around Tanguar Haor from time immemorial.

Over and sole dependence on natural resources lead to its fast depletion finally causing destruction of the natural resources. Different studies also revealed a similar picture in the case of other areas endowed with natural resources. To reduce complete or absolute dependence, it is essential that alternative sources of income need to be identified and pursued upon to arrest the process of depletion of natural resources of great importance. Under the present co-management system as part of the project initiative, it has also taken initiative in the said direction of Alternative Income Generation (AIG) for the local communities. This initiative has opened a window of opportunity to reduce dependence on natural resources thus reducing pressure on them.

Access to financial resources is an important element for communities with meager or no resources other than access to surrounding natural resources. Fund created with the savings of the local community, who are members of the community co-management committees has been a noble venture to provide resources for poor Tanguar Haor communities, who with the access to financial resources in the form of credit facilities can take up various AIGs. This initiative also contributed in developing awareness and understanding among the local communities that besides solely depending on the *haor* resources, other income avenues could be explored and practiced.

Under the present co-management set up, community participation in the habitat restoration, preservation and conservation of the *haor's* natural resources has also been ensured with the facilitation of the partner organization. This practice is developing consciousness among the local communities that they need to take care and preserve their own natural resources. At the same time, this initiative of working in partnership is also developing communities' competencies in habitat restoration and also reservation and conservation of the natural resources.

Weaknesses of the Current Co-management System

No system is free from weaknesses or limitations. In depth analysis of the present system of co-management which is now in operation also revealed some weaknesses or limitations. These are discussed below.

There is non-inclusion of some of the key stakeholders in the current co-management scheme, whose roles are quite important for successful co-management. Local government institutions particularly the Union Parishad is the lowest tier of the local government system in Bangladesh. This an elected body with a fixed tenure and the UP Act empowers it with a number of functions and jurisdictions over a specified geographical territory. Relationship with it is crucial for any community based organizations and other organizations working within its territorial jurisdiction. The important fact is that the UP even if not directly involved in the co-management process, it can facilitate it. On the other hand, the negative side of it that the UP and its elected chairmen and members can also hinder the smooth functioning of the co-management system now in place at Tanguar Haor by turning them as rent seekers.

Again, when the co-management system was introduced in the case of Tanguar Haor, the current elected local body at the Upazila level was not in place. As such, no relationship with the co-management system particularly with community based organizations created under the current system were not envisaged. Now, the Upazila Parishad with its Chair and Vice Chairs is a glaring reality. Again, here it needs to be pointed out that at the Upazila level; the central government has its full presence with all its powers and authorities through its line departments under the de-concentrated system of administration. However, it is surprising to note that the current system of Upazila Parishad has been in place for about last six years and no noteworthy effort or changes in some form or other has been made in the co-management system to include at least the Upazila Chair, Vice Chairs and relevant line department officials of the government.

The other limitation with regard to participation/involvement is the non-inclusion of other stakeholders such as local elite, businesspersons and civil society organizations and its members in the presently practiced co-management system. The other aspect that should be noted; still about half of the concerned community has not joined the co-management system.

Besides, other weaknesses include limited options of AIG activities for the beneficiary members. The Haor areas are such that there are limited opportunities for economic activities because of poor communication network, absence of vibrant local market and limited options for alternative employment opportunities.

Field investigation including FGDs, Key Informants Interviews and Observations revealed that the community organization as the crucial building block of the co-management system, still lacks competency in organization management, fund management, networking with other institutions and organizations and ensuring compliance of the agreed rules and regulation especially about habitat restoration, harnessing, preservation and conservation of the natural resources of the *haor*.

It was reported by many of the respondents belonging to different segments of the stakeholders that the sense of ownership of the *haor* and its resources has still not developed among the members of the community based organizations, which are part of the co-management process. It could be well understood what could be the status in this regard of the community people, who has not yet joined the community based organization created to serve their interest.

Other noteworthy weakness of the current co-management scheme is that it is still very much a part of a project which is going to be phased out in 2016.

Need for New Governance Regime

The Government, as a signatory of Ramsar is committed to providing safety and security to different living creatures and save them from being abolished. Thousands of different species of fish were found in Tanguar Haor. In addition, birds from the cold Northern part used it as their safe home during winter. Fishermen caught fish and other people extracted natural resources, ensuring their living. Overtime, there arose a tendency to earn more and more, which endangered the existence of different species as well as threatened the livelihood of poor people having an earning source only at the *haor*.

The Government used to lease out the *haor* to influential persons/ bodies, who extracted natural resources as well as fish and other living creatures indiscriminately to maximize their profit. This has reduced the earning sources of the people living in the *haor* area and so the people have been looking for other sources of income in that area.

The impact of such endeavour has reduced production of fish and other water creatures and thus endangered bio-diversity. Moreover, more and more areas are brought under ownership and crop cultivation is started. Use of fertilizer and other chemicals has endangered the water species. So a need to rethink came up, which includes but is not limited to ensuring safety and security of water species and stopping extinction of such species.

Water bodies are endangered because of the lack of proper caring, indiscriminate extracting and ineffective planning. The main cause behind such is the leasing system. So there arose the need to stop leasing. The second urgency was to streamline existing extracting of natural resources, which requires legal basis and bodies having authority to exercise power. This requires involving people in the decision making process. Formation of co-management committee unites people together and helps ensure safety and security of water species.

Requirements

- (i) The whole area under Tanguar Haor must be earmarked first. There should have no private party inside the *haor*. If there is any, that should be brought under public control either through acquisition or exchange or in any other way.
- (ii) The whole *haor* should be brought under a unified program so that a planned development is ensured. This requires effective use, experienced man-power having clear knowledge about RAMSAR.
- (iii) People must be informed about what the government is going to do and how that will ensure safety of their present and continuous interest. In a word, they should have a participatory development system.
- (iv) There should have rules and regulations and any violation of such rules and regulation should be treated as offence should be tried. In a word, there should have rules of law that must be obeyed.
- (v) There should have Authority with legal basis so that it can frame rules and regulations required and make them effective. It should preferably a statutory body.
- (vi) The existing system of leasing should be stopped immediately to ensure that development of *haor* gets priority over profit of particular persons/ institutions.
- (vii) People must be made aware about the need for preservation of biodiversity. Moreover, there should have arrangement for alternate earning for poor people living in the *haor* area.
- (viii) People should have access to all information participation with clear learning about what is done for them.

Some Propositions towards Institutional Model of Governance

It may be noted here that the exact nature and structure of Tanguar Haor governance regime are currently under review by the concerned authorities. There are a number of ideas that are being discussed and explored. These include formation of a dedicated Management Authority for Tanguar Haor, a specialized institution within MoEF to look after Tanguar Haor, and formulation of dedicated act and rules for Tanguar Haor. Tentative drafts of the proposed act and rules that have highlighted most of the areas mentioned above as “requirements” is appended (Appendix 4).

After a thorough analysis of the existing governance system under the CBSMTH project IUCN-B in consultation with the key stakeholders, the following structure of governance has been proposed. District Administration including the Upazilla and Union Parishad have been actively involved in the programme through the Tanguar Haor Management Committee (THMC). However, a new structured has been proposed for THMC in the extension phase, as per recommendation by the MTR (Mid-term review) report, where Tanguar Haor Management Committee will be replaced by newly formed Tanguar Haor Management Council. The Council will operate under the auspices of District administration including representatives from local government institutions, civil society, NGOs, and community representatives.

The structure builds on the existing model and refines and expands it to include the following stakeholders: Union Parishad (local government), selected local and community elites, and members of civil society.

A summary of the proposed model is given below:

Currently, Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP) has community led Village Co-management Committees (VCC), Union Level Union Co-management Committees (UCC), a Central Co-management Committee (CCC), at the district level Deputy Commissioner headed Tanguar Haor Management Committee and at the apex Secretary chaired Project Steering Committee. The Sunamganj district administration and the Central Community-Based Committee (CCC) (made up of the representatives from the VCCs) are the prime two components of the current co-management system. However, considering the long attachment and sentiment of the community, aforementioned community led VCC, UCC and CCC kept unchanged and to avoid confusion with the new committees, they are renamed respectively as Village Community Based Committee (VCBC), Union Community Based Committee (UCBC) and Central Community Based Committee (CCBC) in the proposed new co-management structure. In addition to these committees, four Union Conservation Committees (UCC) and at Upazilla level, a totally new Tanguar Haor Co-management Committee (THCC) are incorporated, and present Tanguar Haor Management Committee (THMC) is less burdened and renamed as Tanguar Haor Co-management Council (THCC) and Project Steering Committee renamed as National Steering Committee (NSC) in the proposed new co-management structure. The central and decisive role on management aspects of this new co-management structure will be played by Upazilla level new Tanguar Haor Co-management Committee (THCC). The abovementioned committees other than community led committees are made inclusive with once left out important social actors with new responsibilities. This new co-management structure's inception day will ensure starting of paradigm shift from community led Co-management System to inclusive Co-management.

5.2.2 Community Based Organisation and Community Mobilisation

Co-management could be viewed as trade-off between government based management and community based management to be initiated by NGOs or third party where the main two parties will intend to maintain a win-win situation of the both (Berkes, 1994). Jurisdiction of co-management governance depends mainly on the level of resource production of the property. If the production can meet the need of the community, it may remain confined only with allocation and management of the resources for example, legal access to resource, protection, restoration, regeneration, biodiversity, conservation and harvest of the resource. But if it fails, a need to address some additional interventions to protect resources from exploitation and over use shall have to be made.

Co-management issues in Bangladesh have emerged in the development sector in the eighties. However, co-management in wetlands started from the mid-nineties. It has evolved mainly from the experience of fisheries management in common property resources, through different programs and projects initiated by the government, NGOs and community. The Community Based Sustainable Management of Tanguar Haor Project (CBSMTHP) is a project that aimed at establishing a co management regime in the Tanguar Haor.

In spite of progress made with putting in place elements of a co-management system involving Government and local Communities from Tanguar Haor, there remain considerable uncertainties about what co-management entails, how it functions, what is the scope of its purview and what specifically would be the respective prerogatives of government and communities under a co-management scheme. The co-management project

has to deal with a number of challenges such as providing legal access to wetlands while maintaining nature conservation. Establishment of the first requires willingness of Government of Bangladesh and the second require a sincere commitment from GoB and community, also from the project implementing organisations. Another important thing particularly in wetlands conservation is up and down stream management. In other words, controlling issues evolving from outside, but affecting the internal resources. Both up and downstream issues need to be addressed under the co-management governance, despite its origin from the outside of the territory.

Community organization plays an important role in operationalisation of co-management regime, particularly contributing to nature conservation. Research recommends that community organizations form the basis of co-management in Tanguar Haor (CBSMTHP, 2010). Community organization follows a multilevel structure that includes a very small community based organization, to a village wide or union wide organization. The Tanguar Haor Village Co management Committee (VCC) promotes leadership that capacitated local people to negotiate with other actors in managing resources upon which they depend on. Guided by a co-management principle, this section focuses on scope of community mobilization and presents guidelines for community based organization that will strive for sustainable management of Tanguar Haor.

Community Mobilisation

Collaboration among communities is the most important requisite for a co-management regime. However, collaboration is not always spontaneous or as easy as we perceived. Sometimes the question arises, why community will collaborate with other actors in a co management regime? The answer is not very simple. We may convince them by informing that they are not able to maximize benefit from the project area unless they are organized. Then what could be the main ingredient for their mobilisation?

In Tanguar Haor, community mobilisation actions (organising VCCs in all of the villages, organising and supporting the Village, Union and Central Coordination Committees) have been found successful in the first instance and the engagement of a significant portion of concerned households is noticed. However, at present the proportion of households participating ranges from 45% to 65% which needs to be increased through expanding the numbers of villages and households.

Community Based Organization

Formation and promotion of community based organizations is one of the commonly practiced tools of community mobilization. Likewise, the Tanguar Haor project identifies three ingredients to mobilize the community. One is election of village representative for Union Adhoc Committee (UAC). Second one is the formation of small groups at village level and the third one is to promote savings among the members. As a part of community mobilization, the Tanguar Haor project establishes village co-management committee in 73 villages out of 88 villages. The village co-management committees were formed following a manual which was developed in consultation with the community. However, to make the committees more effective and demand responsive towards community, a reform is suggested. IUCN has developed a guideline for VCC formation keeping provision of reform in Bengali for easy accessibility and use by the community.

Community based organizations are mobilized on achieving overall objectives or on specific issues. Weekly or monthly meetings are organized for VCC or UCC to discuss on challenges and promote strategies to strengthen community organizations, community actions for resources protection. While analyzing the meeting report it was found that the community leaders were aware about only fish and birds but lacked awareness about others resources of Tanguar Haor such as reeds, trees, aquatic plants, wild-life etc. As a whole; the leaders of community organizations were poor in knowledge regarding protection, conservation and extraction of all types of resources except fish and birds.

The participation of women in the Coordination Committees at the village, Union and Central level were noted. Although women tend to sit together, remain silent and unless prompted defer to the men. The participation of women in the Participatory Resource Management Plans seems positive and their participation in income generating activities and in benefiting from loans from the savings scheme (Social Capital) seems important. This should continue and more scope should be created for greater women participation with particular emphasis on the poorest households.

Institutional Mechanism

One of the biggest challenges might be to provide legal entity to such community based organisations having committees at union, upazila and district level, comprising of more than 10,000 members (if allowed, at least one member from each household). Existing policy will not support forming a co-operative at district level having branches at upazila, union and village. Moreover, resource based group formation may not be feasible for Tangura Haor as such arrangement in Tanguar Haor may divide the *beels* under the separate management of the groups that may lead to further exploitation. Moreover, such arrangement may ultimately lead to transfer the ownership of the resources to the elite groups.

Community based organisation can not be registered under The Societies Registration Act of 1860 under the Office of the Registrar, Joint Stock Company. This act will probably not allow the accommodation of more than 4,000 members as General Body and 15 - 20 elected members as Executive Committee. In addition, this act will not allow profit distribution among the members.

Company Act under the Office of the Registrar, Joint Stock Company could be one option to register Tanguar Haor community based organizations for legal entity. This act will allow community people to organise shares among themselves and receive profit by the end of the year. However, a strong mechanism should be developed in the memorandum of understanding so that the poor can protect their share and not sale to the riches.

Whatever the case, emphasis should be given to the flexibility of rules, regulations and responsibility to cope with different possible crisis in the future. Another issue which needs to be clarified with the existing rules and regulations of GoB is whether these groups are eligible to form self-help credit programme among them. One important argument for proposing such type of organisation is that the Tanguar Haor community and resources should remain under a single line management.

Progress with Community Capacity

Community structures at Village, Union and Central levels have been engaged in the first decisions and procedures concerning the licensing of commercial and non-commercial fishing as well as in the promotion of savings and lending operations. This period of committee building has also permitted a launching of discussions and awareness promotion with the communities of resource use and management aspects, notably through the elaboration of Participatory Resource Management Plans in 76 of the 88 villages. Groups have organised into five professions – fisheries, agriculture, livestock, small businesses and handicrafts. Technical and leadership training has been provided to the committees and to the profession groups.

Initial experiences in organising both commercial and non-commercial fishing have been positive in several ways. First and foremost in that they concretely demonstrate to communities that the prospect of access to and deriving benefits from the use of natural resources is real. They have also been the occasion for the communities to discuss and agree upon harvesting modalities, modalities for the monitoring of harvests and the sale (in the case of commercial fishing) of produce. Finally, the concept of payment of a fee (licence) for permission to fish is being accepted. This is particularly important in that it generates resources for the community fund (managed by the Central Coordination Committee) and also promotes the notion that the licence is related to the availability of sufficient fish stocks and that these need to be understood and taken account of in determining where, when and how much to harvest.

While these first steps at organising and building the capacity of communities previously isolated and disenfranchised are encouraging, this represents only a beginning. More time will be necessary to develop the capacity of these community structures and their leadership to a point where community initiatives are autonomous and where they are able on their own to interact with external partners and service providers and most importantly, to effectively articulate their aspirations in the context of the Tanguar Haor Management Committee.

In terms of capacities, the leadership training and the mentoring of community leaders is contributing to community mobilization towards a co-management regime. However, the capacity to negotiate remains limited and leadership training and mentoring needs to continue. The scope of issues discussed by community leaders expanded to include resource management and protection (law enforcement) issues, poverty and income generation schemes and market access questions.

5.2.3 Income Generation and Livelihood

Occupation of Tanguar Haor People

Livelihood and occupation at Tanguar Haor is mostly natural resource based. Major occupations of Tanguar Haor are (1) Agriculture; (2) Fishing; (3) Handicraft; (4) Small business and (5) Livestock husbandry; where fishing constitutes the major part with 41.7% household involvement, followed by agriculture (36.3%) (IUCN Household Survey, 2010). Despite huge potential, only 1.5% households were found to be involved in handicrafts making. Regarding small business, a multiple response was noticed as many people are engaged in small businesses along with fishing or agriculture. Diversity in small business is also noticeable. Varieties of small businesses were identified by IUCN survey: (i) small grocery shops, (ii) tea stall, where tea and dry food were sold in the village or local hat-bazar, (iii) ferry business in seasonal or year round which has become popular, (iv) Sweetmeat shop, (v) Vegetable shop and (vi) betel leaf and betel nut business, (vii) Small scale medicine shop, etc. Initial investments are comparatively low for all livelihood professions but generally profit from small businesses is higher than other professions. The livestock husbandry profession includes sheep rearing, goat rearing, chicken rearing, duck rearing, beef fattening, cow rearing, pig rearing, etc. Generally, the female members of households are mostly involved with animal husbandry and male members help them for food collection and ensure the medical treatment of livestock.

Livelihood Strategy in Lean Period

Livelihood and occupation at Tanguar Haor is greatly influenced and controlled by environmental sensitivity of the area. Environmentally challenged location of the Tanguar Haor restricts income sources of the people living there. Most of the occupations have scope to work for six months to maintain their cost of living and rest half of the year, have to depend on the alternative earning sources. People therefore change their occupation according to the feasibility and availability of income scope during the lean season of main occupation. IUCN survey (2010) finds that 34.5 percent population depends on agriculture as alternative income source during the lean period of their main occupation. It also shows that 25.2 percent, 14 percent and 3.5 percent population shift their occupation to day-labourer for non- agriculture, fishery and boatmen respectively as alternative income option during the lean period as their main occupation. It has been found in the study that the people involved in agriculture as main occupation depend on fish catch and day-labourer of non-agriculture as alternative earning sources during the lean period as main occupation. On the contrary, the people involved in fishery depend on agriculture and day-labourer of agriculture as alternative earning source to maintain their livelihoods.

Opportunities for Livelihood Enhancement

Fish Harvesting Modalities

Sustainable use of natural resources can be ensured when the users can own the resource base, take care of the resources spontaneously and harvest the resources following the rules and systems set for managing those resources in a good manner. It is essential to give space for the poor fishermen in access to the fisheries towards creating ownership on fisheries resources among them. Considering their livelihood and sustainability of Tanguar Haor fisheries resources, CBSMTH project management makes the room for sustainable harvesting practices for the fishermen and management of fisheries resources. The project management has designed different fish harvesting modalities following the Ramsar Wise Use Principle and community driven approach. The eligible fishermen can catch fisheries resources following the terms and conditions set in those modalities. The fish harvesting modalities in practice are outlined below:

1. Commercial Fish Harvesting

To conserve the biodiversity of Tanguar Haor, a number of perennial beels including the five fish sanctuaries, have been included in 'Core Zone'. Core zone fishing is alternatively named as 'Commercial fish harvesting.' To facilitate the commercial fish harvesting in Tanguar Haor a Benefit Sharing Mechanism was notified by the Ministry of Environment and Forests. Under the CBSMTH project this type of fishing is regularly conducted in every year since 2009. Before commencing the fish harvesting period the respective union co-management committees collect the intended fishermen names and send the list to the District Commissioner Office, Sunamganj. Only the illegible community fisherman either individually or in a group can participate in

commercial fish harvesting. Prior to commencing fish harvesting a vendor is selected through a tender process as conducted by the DC office of Sunamganj for selling the total catch during harvesting. To facilitate fish harvesting, a temporary camp is set usually from January to April of every year at the Hatirgatha *kanda*. The fishing operation is jointly managed by the local administration, community organization and project management. Having received the permit card from the District Commissioner of Sunamganj for the specific gears, i.e. *Chowhanda jal*, *Garojal/Chackjal* the selected fishermen can catch fish from the selected *beels*. On the selected day commercial fish harvesting is inaugurated by the government officials and the community leaders. Upon showing the permit card the selected fishers collect token from a group of community (Cat force) and set in with boat from Hatirgatha. The community fishermen start catching fish from 8:00 am to 2:00 pm and come back to Hatirgatha at around 3:00 pm. During this stipulated time they catch fishes in different beels under core zone except the 60% of the total area of any sanctuary. Usually the group of Chowhanda net (Seine net) consists of 8-12 fishermen while maximum two fishermen join in fishing with *Garojal*. At the time of fishing another community group; Tiger force, stay at the fixed *beel* on a roster basis to observe the fishing practice and guard the fishermen. After fish harvesting, community fishermen return to the camp and pile their catch to the landing centre. sell various fish species to the selected vendor. At the presence of community leaders, project personnel and the vendor different species of the harvested fishes are weighted separately (Grade-wise) by another community group (Lion force). Before handover the weighted fish to the vendor the Cat force calculates the prices of the sold fishes according to the settle rates. Prior to receiving the total catch the selected vendor pay the money to the assigned project staff. The sold value is distributed among the 3 bodies according to the notified gazette of benefit sharing mechanism. Share of the sold fishes is distributed among Community fishermen (40%), Tanguar Haor Somaj Bhittik Soho-beyabostapona Society/THSSBS (36%) and Government treasury (24%) accordingly. Three Conditions to Continue Fish Harvest (i) only the fishermen who are the members of THSSBS are illegible for catching fish. (ii) No rare species should be caught, (iii) No one can get access to Tanguar Haor at night, (iii) Fish poaching and bird hunting has to be stopped, (iv) Community leaders will intervene as a conflict mitigation measure/negotiator. If conflict further arises, then fish harvest will be stopped. Under this system about 400 fishermen can get scope of their income through harvesting fishes for three months in a year.

2. Non- Commercial Fish Harvesting

Out of the core zone the remaining part of Tanguar Haor is geographically defined as 'Buffer Zone'. About forty four *beels* of buffer zone are situated at the vicinity of villages of Tanguar Haor. During dry season a large number of *beels* become dried out and detached from the core zone due to some natural causes in every year. These *beels* of buffer zone are mainly used for non-commercial fish harvesting. Non commercial fish harvesting is categorized into 2 forms based on the season- (a) Non commercial fish harvesting in wet season and (b) Non commercial fish harvesting in dry season.

a) Non Commercial Fish Harvesting in Wet Season

Enlisted fishers of the THSSBS can harvest fish in the wet season except ban period (Boisak, Jaistha and Aashar). The fishermen have to apply to the DC, Sunamganj, for taking permit. Getting permit from DC Sunamganj the illegible fishermen can harvest fish from the buffer zone using the *Lar borsi* (hooks) and Burchunga chai (trap) in a limited scale. The fishermen usually catch small fishes under this harvesting system at subsistence level.

b) Buffer Zone Beel Fish Harvesting

In the dry season (November to March) about 2700 illegible fishermen can harvest fish from forty *beels* of buffer zone using different gears. The illegible fishermen can use the selective gears like *Chowhanda*, *Chai*, *Garojal* for specific beels considering geographical location & water depth of beels and diversity of fish species under Buffer Zone Fish Harvesting Modality. The number of fishermen varies with the sort of gears. Maximum 16 community fisherman can participate in fish harvesting with one Chowhanda. Maximum four community fishermen can take part in fishing with one *Garojal* and twenty *Chai*. The number of permit card and duration (4 months) of fishing is subject to nature of particular *beel*. The DC office, Sunamganj invites

applications from the interested fishermen member of Tanguar Haor Somaj Bhattik Soho-beyabostapona Society (Herein Tanguar Haor Society) on September of each year. Upon fulfilling all the conditions, i.e. fisherman group, SCM updated fishermen need to submit application with BD of taka 500/-. In case the no. of submitted applications exceed the no. of fixed permit of any *beel*, then the applicants must comply with any of the terms & conditions sequentially as follows: a) Consultation among interested fishermen/group, b) Preference to the fishermen of village adjacent to *beel*, c) Preference to comparatively poor fisherman of community and lastly d) the Lottery system. DC, the president of Tanguar Haor Management Committee (THMC) issues the permit for the selected community fishermen. Three different committees also work for the management and supervision of fish harvesting in buffer zone. These are a) One buffer zone fishing operational committee, b) Four buffer zone fishing monitoring committees at union level (For 4 unions) and c) Community watch group at *beel* base (as much as required). 76% of the earned money for issuing permit for buffer zone fishing goes to Tanguar Haor Society central committee fund while the rest 24% is deposited into the government treasury.

Following objectives are identified to develop an integrated regulation for fisheries harvest from *beels* in buffer zone:

- Conservation of biodiversity and maintain ecosystems in distant, remote *beels* in Tanguar Haor;
- Prevent illegal fishing through facilitation of access of local fishers in the *beels* of buffer zone;
- Livelihood improvement of local fishers through ensuring their rights to fishing in controlled and sustainable fishing practices;
- To reduce dependency of local fishers from Tanguar Haor core zone;
- Strengthen Tanguar Haor sustainable management programme through implementation of effective fish harvest modalities from buffer zone.

Tanguar Haor management committee, project management and fishers from adjoining villages decide on pricing, fishing duration, number and type of fishing gears, permit numbers, list of fishers etc. based on the ecosystems and biodiversity of the *beels*, previous year's permit price and mode of fishing type/practice etc. District administration then issues *beel*-wise permits to fishers based on gears to be used. Permit owning fishers, individually/in group will harvest fish from designated *beels* in buffer zones during 01 December – 31 March (17 Agrahayan – 17 Chaitra). Harvesting is inaugurated in the presence of representatives from administration, civil society, THMC and project management by permit holder fishers in designated fishing ground and following rules and regulations. To be mentioned, this new model of buffer zone fish harvesting has replaced earlier *beel*-based *chai* approach and distant/remote *beel* fishing approach. However, conditional *burcunga chai* (trap) and *lar borshi* (hook) fishing in rainy season, may be continued.

Selection of fishers, gears and permits

- Considering previous years' permit price for remote *beels* fishing, the value of the specific *beel* is determined in consultation with the representatives from THSBSS society, project management, fishers from neighbouring villages and local administration. Thus the value of the water bodies in the buffer zone will be re-assessed after every 03 years;
- Based on the type of *beel* and *dair* (canal), fishing duration and fishing gear type, the number of fishers, permits and permit fees is ascertained; for example one *Garo* net can be used by maximum of 03 fishers, 1 *Chouhanda* net can be with maximum 16 fishers, max. four fishers against 01 *Chai* (fishing trap) with maximum 20 traps can be used;
- Interested fishers will apply, (mentioning the *beel*/*dair*, fishing gear to be used, photographs and membership number) to the ADC (revenue) with recommendations from Union Co-management Committee. The fisher will deposit a caution money worth Tk.100 (non-refundable) to the Upazila Nirbahi Officer in favour of Buffer Zone Fish Harvesting Operation Programme;
- The Buffer Zone Fish Harvesting Operation committee will review applications from the fishers and make the draft lists of the illegible fishers against designated *beel*/*dair* (river channel)

- Project coordinator will produce the applications to the 'non-commercial fishing in buffer zone' committee for review; the committee will review and finalize the list of selected fishers against designated *beel*/dair (river channel);
- In case the number of interested fishers with designated fishing gear in a particular *beel* outnumber allowable permit number, i. understanding amongst the interested fishers, ii. Prioritizing the fishers from neighbouring villages, iii. Prioritizing relatively poor fishers in the organization, iv lottery amongst the fishers, will be applied to select the fisher(s);
- Selected fishers, based on lists and type of permits will submit designated permit fee to the Upazila Nirbahi Officer, Tahirpur, in favour of Buffer Zone Fish Harvesting Operation Programme;
- Upazila Nirbahi Officer, Tahirpur will send the list of finally selected fishers (with photographs) and money-receipt to the ADC (revenue), Sunamganj. ADC (revenue) will issue the permits as per the lists of the fishers with the prior approval from DC, Sunamganj;
- Upazila Nirbahi Officer, Tahirpur will distribute the permits for designated *beels*/dair (river channel) to selected fishers.

Terms and conditions for fishing

- One fisher/group can have maximum one permit for a *beel* and may take maximum two permits for entire buffer zone;
- Authorized (by Tanguar Haor Management authority) fishing gear only be used for fishing; Mono-filament gill net or other prohibited gears cannot be used;
- Each authorized fisher/(each member of group) should carry his permit, while fishing;
- Permit cannot be sold out or handover to others;
- *Beel* connective streams/canal/river should not be blocked; required opening for boat navigation should be maintained;
- Temporary blockade with branches/thread-net can be allowed if required for fishing; bamboo or earthen dams cannot be built in such cases;
- Any arrangement to reduce water depth, with irrigation or drainage or any other artificial means, is prohibited;
- For irrigation to boro rice field from any *beel*, farmers should take prior permission from the authority and minimally required controlled-irrigation can be permitted;
- Un-authorized way of fishing (e.g. chemicals/poison fishing etc) are prohibited;
- Any activities that can disturb birds (resident/migratory) in the *beel* should be avoided; any restriction from entry/ killing/catching/disturbance to resident or migratory birds should be strictly avoided;
- *Beel*-based wildlife e.g. snakes, frogs, snails, mollusks, crabs, turtles, fishing cats, mongoose etc. should not be harmed anyway; in case any wildlife is trapped while fishing, should immediately be released to nature without any harm and will be informed to the authority;
- Swamp vegetation in the *beel* or *kanda* should not be harmed anyway;
- Fingerlings of Chital, Sarputi, Rita, Baghair, Mohashol and Nanid species cannot be captured; any such fingerlings, if found in net or any fishing gear, it should be immediately released to water;
- Fishers should carry separate water bucket to ease immediate release of snails, mollusks, crabs, turtles etc. to nature;
- If the project establishes any *kanda* in the buffer zone of the *beel*, no fishing is allowed and *kandha* cannot be removed, in any case;
- Fishing is allowed during 6:00am to 6:00pm; Authorized fishers can stay in *beel*-surrounding lands for protection/patrolling purpose;

- Fishers will maintain records of fish amount and other relevant information in the forms provided by the authority and submit the forms to the authority;
- Authorized fishers should restrict any illegal fishing activities in *beels* and *haors*;
- If any fishing activities found in a *beel* during night time (with torchlight or other powerful lights and catch or any other means), permits and membership (in the organizations) of permit-holder fishers will be confiscated, his /their all savings and deposits will be confiscated and regulatory actions will be taken against him/them;
- Authorized fishers abide by any other conditions, if proclaimed;
- In case of any above mentioned conditioned are breached, concerned fisher(s)' permit, membership of organization will be confiscated and legal actions will be taken against him/them;
- In case of any other issue or conflict arise, not mentioned in this terms and conditions, decisions from the authority will be the final judgment;

Benefit Sharing

Along with the guidance from MoEF and 12th meeting (09/06/2009) of Tanguar Haor Management Committee, distribution of earnings from permit for fishing in *beels*/river channel in buffer zone of Tanguar Haor are as follows:

- a. 76% amount of permit fee (community 36% and management expenses for Community watch group 40%) will be deposited to Central fund of Tanguar Haor community-based co-management society;
- b. Remaining 24% amount will be deposited to defined code of Government treasury.

Information sharing and archiving

All permit-holder fishers will provide following information:

- All required/requested information on daily catch and other relevant information will be provided to the designated member of village-watch committee;
- Preserve and produce (if requested) income and expenditure of *beel*-fishing to Community Watch Group.

Management expenditure

Community guards will be engaged to protect Tanguar Haor and its resource- based and these guards are being paid by Central Co-management Committee; in this connection, as per decision of THMC, the permit fees from buffer zone fishing will be deposited in the CCC fund and CCC will maintain all administrative expenditures from this fund. The accrued money earned by non-refundable fee at the time of receiving the applications from the fishers will be spent for running and monitoring the Buffer Zone Fish Harvesting Programme in Tanguar Haor.

Livelihood Opportunities for Farmers

IUCN, with the help of Swiss Agency for Development and Cooperation has prepared a guideline for livelihood enhancement and income generation for the people of Tanguar Haor in 2007. The objectives of the guidelines were to; a) identify households living below poverty line; b) develop strategies for livelihood enhancement of the households living below poverty line c) develop a central management committee for fund management and develop future directions.

Livelihood enhancement programme particularly targets population living below poverty line through categorising them into:

1. Fisherman
2. Landless agriculture farmer
3. Marginalised farmer having land less than 0.5 hectre
4. Coal/Sand/ Stone/ Earthwork labourer
5. Small businessman with capital on 1000-5000 Taka

Criteria for farmer selection under livelihood enhancement programme:

Even though all people living at Tanguar Haor will be under the coverage of livelihood enhancement programme, particular emphasis will be given to:

1. Permanent resident of Tanguar Haor
2. Landless
3. Two-thirds of yearly income comes from agriculture
4. Village committee member but unable to pay monthly subscription fee
5. People interested to become member of village committee but unable to pay monthly subscription fee
6. Age should be 20-60 years
7. Fisherman not involved in commercial fishing at Tanguar Haor

Livelihood Activities

Livelihood enhancement programme could be both at individual and organizational level. Considering occupation category and severity of poverty poor farmers' livelihood scope could be enhanced through:

Grain Storage support (at least for six months): Due to lack of proper storage facilities, most of the farmers are compelled to sell their agriculture produce immediately after harvesting at very low price. IUCN Bangladesh has developed a guideline for Rice Storage in Bengali, which was widely disseminated to the local people. Under livelihood enhancement programme, storage infrastructure could be built in the villages and ensure poor farmers accessibility to storage facilities at minimum cost.

Lease of Hijal and Koroch Plantation: At Tanguar Haor local government leases Hijal and Koroch plantation or *khas* land for afforestation after every three years. Local government may lease those plantations to poor farmers at priority basis under an organizational structure.

Lease of Haat/ Bazar: Local government leases local *haat/bazaar* every year through open auction. Under livelihood enhancement programme, poor farmers' organizations' may give priority to lease such *haat/bazaar*

Leasing of boat stand: Internal and external communication at Tanguar Haor is water based and mostly dependent on boat, therefore a number of boat stands are there. Poor farmers' organizations could be given priority to those boats leased by the local Government every year.

Promoting stockiest business under organization: Farmers organizations may be facilitated with establishment of stocking opportunities so that they can collect fishes to the fisherman at fair price and sell with proficient profit.

Nursery development: Poor farmers either through organization or individually establish nursery for Hijal, Koroch, Borun or other locally available fruit, timber or medicinal species. Within three or four years these nursery become productive through selling nursery raised seedlings.

Leasing productive *khas* agricultural land: A considerable area of *khas* productive land is available in the Tanguar Haor area which could be leased to poor farmer or farmer organizations. This option has a multiplier effect through lessening dependency of landless poor farmers on powerful money lender and providing them with an opportunity of enhancing their livelihood.

Eco-tourism: There is high potentiality of promoting eco-tourism in Tanguar Haor. Every year quite a good number of local tourists visit Tanguar Haor. However, tourist facilities are inadequate which restricts more tourists from visiting this beautiful nature spot. Local people could be trained on eco-tourism and service delivery to tourists provided which will increase local peoples' livelihood opportunities as well as help to increase local and international tourists. Moreover, locally produced goods such as *Sital Pati*, Decorated bed sheet, scented rice, Ghee etc. could be sold to tourists that will contribute to local economy as well. To facilitate eco-tourism at Tanguar Haor, local administration or district administration may build some infrastructures such as Big boat to cruise in the Tanguar Haor, tourists accommodation facilities and lease infrastructures to local poor famers organization on priority basis.

Formation of Surveillance team: Upon instruction by Ministry of Environment and Forests, District administration decided to form a Surveillance team in collaboration with Ansar and local community. This is to mention that currently Tanguar Haor is guarded by 10 Police and 40 Anser members. But it is decided by Tanguar Haor Management Committee that Police and Anser would be replaced by local poor people over time (The decision is available in Bengali). Inclusion of local people will not only save Tanguar Haor from illegal harvesting but also create permanent employment opportunity for people engaged in the surveillance team.

5.2.4 Resource Mobilisation and Financial Management

IUCN Bangladesh has proposed a co-management model for Tanguar Haor under the CBSMTH project. To execute this model, they have proposed a resource allocation. The model divides the resource allocation system into two parts: one in co-management preparatory phase and another one is co-management development phase.

The report suggests that Ministry of Environment and Forests on behalf of Government of Bangladesh will allocate government owned resources to the communities for sustainable use. Experience shows that Government of Bangladesh provided resources to community organisations having legal entity. Considering the situation of Tanguar Haor, the model proposes a single organisation which can be named as Tanguar Haor Development constitution/memorandum of understanding through a process of piloting and developing leaders to represent themselves at a central level organization- tentatively termed as Tanguar Haor Management Authority (THMA).

A temporary arrangement of resource allocation has to be organised before getting legal entity of the THMA. It needs piloting of resource harvest as well as alternative IGAs in this preparatory phase for developing more pragmatic approaches to be followed in the development phase. Steps to be taken for resource allocation in the preparatory phase are given below-

1. Resource harvest piloting should be performed in the whole territory to understand socio-political dynamics, social behaviour and management load in the project.
2. Resource should be demarcated at union level on the basis of mouza map and union boundary. Some beels might be located among two unions should be kept untouched at this moment.
3. At least four *beels* should be identified as sanctuary. *Beel* can be selected on the basis of CNRS survey and opinion of the participants in the workshops organised at upazila level in May 2007.
4. Tanguar Haor resources should not be allocated to the groups at village level and responsibility of resource management should be given to the union committee instead of groups.
5. Adhoc UC should be assigned to prepare lists of resource harvesters from their respective unions. Special measure should be taken to enlist only the direct resource dependents in the list. For example, only the fishers should be selected for fish harvest. Reed collectors should be selected for reed harvest.
6. Enlisted harvesters will get a share of the collected resources. It may range from 20% to 40% depending upon the market price of the resources, types and existing traditional system in the area.
7. Collected resources should be sold in the market under the supervision of THMC and project implementing organisations and to be distributed according to the guidelines of the agreement to be performed by Government of Bangladesh with the Adhoc UC.
8. A benefit sharing agreement has to be performed with the four Adhoc UC following existing Government of Bangladesh agreements in the cases of social forestry in the country. For example, in the case of road side plantation supported by the World Food Program, groups receive 60%, local government (UP) receives 20% and the implementing organisation (NGO) receives remaining 20% of the produce. Similar option can also be followed in this case with some modification. Here 60% should be given to THMA and the remaining 40% should be kept as Tanguar Haor Development Fund to be utilised only for the development of Tanguar Haor.
9. A regulation may be established so that THMA does not distribute this 60% money to their members. A portion of this money should be spent to meet operational cost which has to be planned by them and to be approved by the THMC.

10. In order to develop a constructive competition among the UCs, the (UCs) should be allowed to utilise collected savings in self-help credit (SHC) and encourage UCs to operate office by their own income.
11. A technical body under the leadership of IUCN having mandate from Ramsar Bureau is required to advice Government of Bangladesh and community to monitor and supervise the co-management system and take proper initiatives in the course of time.

Resource Allocation System

In reality, resource allocation system as proposed in the preparatory phase is very complex and whole responsibility goes to the implementing organisations. Another problem is that this practice would not develop ownership of resources among the Tanguar Haor community. Of course they should pay a certain costs to utilise resources. Government of Bangladesh in consultation with the Technical committee can set an amount of revenue to be paid by the THMA every year. In this case Government of Bangladesh's responsibility would be to collect revenue and monitor the wise-use principal of Ramsar. In other words, Ramsar wise-use principals can be a part of the agreement to be followed by the THMA. Government of Bangladesh would supervise whether the Tanguar Haor community is following the conditions of the agreement or not. THMA will pay the revenue from their income. Over time THMA will take the responsibility to recover revenue from selling licence and permit. Similarly, the resource harvesters will enjoy more freedom to sale their harvested resources at any place where they feel comfortable. It may require 3-5 years to attain the stage.

To create a greater magnitude of income and governance, Tanguar Haor should encompass all available resources, scopes and opportunities such as *beel*, *khal*, canal, river as well as ferries, transports and markets to utilise them in their favour and also to develop an interdependent relationship with the local government. Such mechanism will involve maximum people of the community in the process. For example, union committee can adopt a policy not to sell resources to any traders not having proper licence from the UP. It will create demand for license. Introduction of licence to the traders, retailers and transports will enhance income of the union parishad. Similarly, UP can restrict access of the people into the *haor* without having valid permit from the THMA. Provision of licence and permit for resource harvest will enhance income to the federation. Respective union parishad should play active role in identifying the territory of the union.

Groups at village level should sit with union committee to raise their demand to get access to resources. Union committee should provide legal access (license and permits) to the individuals on the basis of the set criteria like proportion of households, experience, skill and regularity of membership.

Resource Access Mechanism

Every interested household which has been involved with resource collection should have licence for resource harvest, trading, retailing and marketing. Resource harvesters should have specific permit for specific gears like *thela jal*, *borshi*, *kona jal*, *jhaki jal*, *da*, boat etc. to harvest specific resource for a specific period of time.

Licensing System

Harvest licence and gear permit should be of different types on the basis of nature of the resources they want to harvest. Fees for harvest licence and gear permit would be fixed by the central committee on the basis of their budget and target.

In the preparatory phase, resource harvesters should pay very minimum fees on the basis of existing average income of the members for licence and permit to harvest resources. This fee has to be negotiated with Government of Bangladesh and Adhoc UC.

License should be of two types. One is related with trades and business. This should be provided by UP. For instance, UP should give licence to the traders, retailers and transports (which need to carry coal, stone, fish and other business goods) within the jurisdiction of Tanguar Haor boundary. Another license should be for resource harvest particularly in the Tanguar Haor boundary. This license should be given by the union committee as per allocation from the central committee and approval from the THMC.

Resource Protection Mechanism

Every people of Tanguar Haor periphery is entitled to the benefit from the resources, therefore strategy should be taken that encourages all to protect resources for the sake of their own interest. Respective union committee should recruit guards from their own community. These guards should be under the management of central committee. Only the license holders should be allowed to get access to resources on the basis of gear permit for a specific period of time. Specific member of the HHs would be allowed to produce specific production and sale the produces and resources to the specific retailers in the market. In parallel to the community level protection system, GoB may also continue their support to establish rules of law in the area.

Resource Harvest Mechanism

Since Tanguar Haor is a Ramsar site, Wise-use principle should be followed during resource harvest. Different strategy should be taken for different resources. For fish, Tanguar Haor may use similar approach as practised in MACH and CBFM. Considering the situation such as area, mode of operation, potentiality of production, traditional knowledge and perception of the community, Tanguar Haor should have three specific zones such as sanctuary, sustainable use zone and monsoon zone. How much area should be kept as sanctuary to maintain fish stock? In Hail Haor, MACH has established sanctuary in less than 5% of the whole area and achieved more than 100% increased fish stock after two years. CBFM has established sanctuary in less than 2% of the whole area and achieved 100% increased fish stock after three years. As we are still in the dark about the stock of fish in Tanguar Haor, we should keep at least 10% of the total Tanguar Haor water area as sanctuary to test the case. A continuous process of fish stock monitoring system would enable us to calculate maximum sustainable yield (MSY) of the resource on the basis of which we would be able to decide more confidently on it.

Remaining 90% of the water area (during dry season) should be considered as sustainable use zone where fish harvest should be allowed through license, permit and restricted gear. 2 years rotational fishing in the sustainable use zone would justify the argument for not applying buffer zone concept in this area.

Monsoon zone is the part outside the demarcated area of sanctuary and sustainable resource use zone. People may be allowed to harvest fish freely in the rainy season with only restricted gear. However, no fishing should be allowed during three months from March to May to facilitate natural breeding system of fish.

In the cases of other resources for example, reeds, grass, snails, migratory birds and others harvest mechanism should be developed on the basis of reproductively and season; but not applying the same course of sanctuary and sustainable use zones. For example, reed should be harvested in March because reed grows rapidly in this period and attain survival length before the flash flood of monsoon

Financial Management

IUCN Bangladesh has been implementing, Community-based Sustainable Management of Tanguar Haor Project since December 2006 in favour of Ministry of Environment and Forests (MoEF) with financial assistance from Swiss Agency for Development and Cooperation (SDC). The project will phase out by developing a framework plan that will help to ensure sustainability during post-project period. As exit strategy of the project, some significant progress has already been made, including (i) in Tanguar Haor, five *beel*s out of 54 are reserved as no fishing zone by gazette notification, (ii) MoEF promulgated 'Fish resource distribution rules' in other *beel*s from sustainable use zone, and (iii) allocation of Tk 10,00,000 as innovation fund in favour of fishers' organizations in the Tanguar Haor.

The project also introduced a Self help Credit Programme with the aim of improving socio-economic condition and enhancing financial capacity of the Tanguar Haor community. IUCN has developed a detailed guideline for the operationalisation of this credit programme which is also available in Bengali

In case of savings, the project promoted kinds of savings scheme:

- a) Compulsory savings: This savings scheme starts with having membership at Village Co-management Committee with monthly subscription fee of 10 taka only
- b) Voluntary savings: Any member of the community can have their savings at their convenience.

The CBSMTH project inspires local community to save their extra income as a risk insurance and lean period. IUCN Bangladesh has developed a detailed guideline for savings collection and utilisation which is available in Bengali.

5.2.5 Training and Capacity Development

Training, coaching, mentoring and participatory and transparent accounting procedures, enhance the capacities of communities to actively participate as a partner to government in the context of Tanguar Haor Management Committee deliberations on the overall management of Tanguar Haor, including determining sustainable resource harvesting levels, combating illegal uses of natural resources and promoting livelihoods and income generating alternatives for community members. IUCN Bangladesh, as a component of CBSTHM project, organized a number of training and capacity activities aimed at promoting wise use of wetlands while keeping the wetlands values and functions in balance. The trainings are to be sufficiently effective, economically and socially viable, to secure adequate scope towards multi stakeholders of wetlands management.

One of the major focuses of community training at Tanguar Haor was to promote leadership. The emergence of community leadership will be able to articulate community interests in the domain of livelihoods improvements as well as in terms of management of Tanguar Haor as a whole is a key condition for success. Community structures and community leadership have been established, but these are not yet autonomous. The effort to identify and build the capacity of community leaders with a view first to the short-term, but also with a view to having a new generation of leaders. IUCN Bangladesh has developed manual for Leadership training with detailed guidelines which are available in Bengali. Under CBSTHM project, a number of leadership trainings were conducted using the manual.

Another focus of the training was to the creation of homogenous groups of men and/or women should be promoted. The economic and social conditions of the group members, as well as their needs, aspirations and requirements should thus be similar. They are to be conceived firstly as starting-bases for self-help activities, secondly as instruments for participation in local decision making and thirdly as managers of natural resources in their wetlands and watersheds.

To establish an effective co-management regime, capacity building training helps in building confidence and establish rapport with the community, sensitise the participants on the power of cooperative group action followed by the information on various possible forms of training, enabling the participants to select, understanding various dimensions of group functioning and dealing with group processes in order to function more effectively. In addition, capacity building activities will equip the community with improved understanding on the effective management of wetlands, providing managers with information on the concepts of wetlands and wetlands natural resources management and importance of peoples' participation in the process supported by some exposure activities, develop an understanding of the local community with whom they are going to work. Build capacities in assessing the available resources and constraints, identifying needs, planning, implementation, monitoring and evaluation of the Tanguar Haor management programmes.

Issues for Capacity Building Training

Decision making process of the community

Capacity building contributes in decision making process regarding Tanguar Haor management rules and regulations. Weekly or monthly meeting could be a space where the community can show their capacity to ensure intensive supervision and monitoring at group level.

Supervision and monitoring

Supervision and monitoring is another area where communities' capacity should be enhanced. In the initial stage, PNGOs will provide staff support to monitor and supervise the activities at group level.

Linkage and networking

Effective linkage and networking ability reduces cost and maximizes benefit. Moreover, it redistributes the risk and promotes collaborative learning for sustainable resources management. Village/Union/District committee in long run should establish strong linkage and network with the following institutions for their own interest.

Other federations and co-operatives working in co-management in the country

Concern industries to supply raw materials

Concern markets to sale produces of the members

Concern traders to sale harvested resources

Existing legal aid providers to receive legal aid services for the members

Different financial institutions to receive financial support.

Sustainability issues

Organisational sustainability is the key to successful establishment of co-management regime at Tanguar Haor. Training on organizational sustainability may focus on the following initiatives

Development of organisational constitution

Registration with government body

Democratic practice through following organisational rules and regulations

Increasing leadership skills through training and practice

Establishing transparency and accountability through a system of internal audit and annual profit distribution

Financial sustainability

Introducing self-help credit among the members

Develop annual budget to run union, upazila and district

Selling licence and permits to the members

Establish micro-enterprises at upazila and district level

Asking donor funds to meet operational costs

Gender Dimension

The participation of women in the Coordination Committees at the village, Union and Central level is noted, although women tend to sit together, remain silent and unless prompted defer to the men. There are one or two examples of women who will speak in public. The participation of women in the Participatory Resource Management Plans seems positive and their participation in income generating activities and in benefiting from loans from the savings scheme (Social Capital) is important. The project will have to maintain a specific emphasis on participation of the poorest, landless and women.

Training Methods and Tools

There is no fixed training method that covers every issue rather it is based on the context, needs, situation analysis, mandate, goal and targets determined by the training institute/trainers and other relevant authorities interested on the subject. A checklist of methods usually followed depending upon the situation is given below.

- Question Answer Method
- Simulation
- Brain Storming
- Role Play
- Lecture and Discussion
- Group Discussion
- Small Group Discussion
- Seminar
- Demonstration
- Workshop
- Field Visit
- Film Show

- Case Study
- Buss Group

A wide range of training tools are available to facilitate training. The training Institute or organizer would select the tools based on the results of their training needs assessment.

- Audio (Radio, Tape Recorder etc.)
- Visual (Poster, Flip-chart, Handout, Slides, White board etc.)
- Audio-Visual (TV, Video Film, Sound Slide etc.)
- Multimedia

Framework for Training and Learning

During the training, the role of trainer becomes very crucial in terms of making the participants realize the importance and relevance of working in groups. When the participants from different villages come together, it is very important to make everyone feel welcome and part of the group. Here, the trainer can take the lead and start with introductions. Introductions are important and should not be regarded lightly. It is critical to get everyone, especially the shy participants involved and talking to one another, by breaking the tensions and nervousness in the beginning. The introductions should encourage a greater sense of equality among them. This helps to create an open and trusting learning atmosphere, relaxes the participants and gains their commitment.

While meeting for the first time in a formal group gathering, there is often a certain degree of nervousness among the participants. They may be uncertain about what to do after they have greeted each other. Most of them might be asking themselves, Shall I start talking? Will others like me? Won't I make a fool of myself? The initial conversation is likely to be guarded and superficial. Any attempt to relax the group and break the ice must offer the group members the following-

- A safe, clear and acceptable structure
- Conversation subjects, which are both interesting and non-threatening
- Enough scope for making and receiving distinct impressions of each other (but preventing competition)
- Some actions, when possible, to relieve the tension
- The possibility for laughter, for the same reason

Both individual and group training promote learning, yet differently. Even learning varies with adult and children. Adult learning is volitional and autonomous. Forced learning does not last. Adults need to be interested and ready before they learn something. If they have come non-voluntarily or as a result of external demands, they will need extra support, encouragement and guidance. Learning improves when self-directedness is encouraged when learners are involved in planning and monitoring the process. Interest can be heightened by feedback on progress in the desired direction of learning. Unlike children's learning, which is for postponed application, adults want to learn today what they can apply tomorrow. Hypothetical problems, or content areas far removed from their reality appear a 'waste of time'. Learning is easier when it involves practical material related to current or perceived future concerns of the learner.

In brief, these are some of the key characteristics of an effective learning environment. In order to build it and sustain it, there are several things a trainer needs to do:

1. The design of the training should be such that it always helps in building the environment, keeping learners involved and the pedagogy alive and relevant.
2. Shared responsibility for learning by the learners; involving the learner, soliciting their support, commitment, responsibility feedback towards building and maintaining the learning environment, supporting their roles as facilitators, counselors, and friends with their peer groups.
3. Physical aspects of the training, ensuring that all physical, administrative aspects (food, travel) of training are well co-coordinated and managed and do not cause stress and anxiety of any kind to the learners. Even small things like the cleanliness and organization of training room, advance preparation/installation of

technical aids, organizing small rooms for group exercises, noise effects, too much movements in the room- people coming and going etc. become important issues for the trainers to ensure that the learners do not get disturbed or have to fend for themselves in the process.

4. Most importantly, the trainer's behavior becomes a significant contributor to the learning environment. Knowledge of training design alone is not enough, their understanding about themselves is crucial- their perspectives, values, behavior, action- how do they respond to learners, how do they care, what effort they put into the content areas, how do they enhance the self-esteem of learners, etc. All these set the normative structures for the training. What do they do to set up the others in the training? What do they do to set up the learning environment? All these have implications of what the learners would do when they go back from their training center?

The Conditions for Effective Learning

- *An environment of active people:* People learn when they feel they are personally involved with others in a learning process.
- *A climate of respect:* When a high value is placed on individuals and a sense of caring prevails.
- *A climate of acceptance:* Accepting a person means that s/he can be himself/herself and express her/his beliefs without fear.
- *An atmosphere of trust:* When people have a feeling of trust in them and in others.
- *A climate of self discovery:* When learners are helped to find out about themselves and to meet their own needs, rather than having their needs dictated to them.
- *A non-threatening climate:* So that persons can confront each other and new ideas without fear.
- *A climate of openness:* When personal concern, feelings, ideas and beliefs can be expressed and examined openly.
- *An emphasis on the uniquely personal nature of learning:* When each individual knows that his/her values, beliefs, feelings and views are important and significant.
- *A climate in which differences are thought to be good and desirable:* When differences in people are as acceptable as differences in ideas.
- *A climate which recognizes the right of individuals to make mistakes:* Learning is facilitated when error is accepted as a natural part of the learning process.
- *An atmosphere that tolerates ambiguity:* When alternative solutions can be explored without the pressures of having to find an immediate single answer.
- *An emphasis on co-operative evaluation and self-evaluation:* When people can see themselves as they really are, with the help of their peers.

5.2.6 Disaster Management Guidelines

'Bangladesh is a land of disasters' - has become one of the most cited phrases in the disaster literature. Unique geophysical position, the Himalayas in the north and The Bay of Bengal in the south, makes Bangladesh one of the most disaster prone countries. Different regions of the country are exposed to different disasters, ranging from hydro-meteorological to geological disasters. The *haors* mostly situated in the Northeastern region of the country, are extremely productive and provides numerous services, but they are also highly vulnerable to various disasters such as flash flood, early flood, hail storm and river and wave erosion. These disasters not only inundate and damage the homesteads and other infrastructures of the local communities, but also damage the only crop they grow in many cases.

Like other parts of the *haor* basin, Tanguar Haor is remotely placed and vulnerable to various natural disasters that effect lives and livelihoods of the region. Vast extent of water bodies and prolonged duration of submergence has made the area remote and difficult for human settlement. This sheer remoteness and isolation has also negatively influenced the availability of other amenities like schooling and health care facilities. Additionally,

migration due to lack of jobs, especially in the monsoon season and too much dependency on natural resources brought added vulnerability to the local communities. Crop failure due to early monsoon flash-flood and wave related erosion to the infrastructure came out to be the major types of natural disasters and driving force for vulnerability and poverty of the area.

Natural Disasters

Natural disasters, more specifically hydro-meteorological events, play an important role to *haor* ecosystem and biodiversity. Different forms of floods (flash, rain and monsoon) are not uncommon to Tanguar Haor, but flash floods have become a common phenomenon and these now cause considerable damage to rice paddies at the beginning of every monsoon season. Run-off during exceptionally heavy rainfall occurring in neighboring upland areas is responsible for flash floods. Such floods occur as waters from the hilly upstream rush to the plains with high velocity, mauling standing crops and destroying physical infrastructure. Flash floods cause extensive damages to crops and property, particularly in the *haor* areas.

Major floods have been taking place at regular intervals (1974, 1988, 1995, 2000 and 2004) that resulted in huge loss of homesteads, agriculture, livestock and people's livelihoods and led to outbreak of water borne diseases in the affected areas. Flood induced soil erosion is also in an increasing trend. Conversely, severe soil erosion in the water catchment areas of all the great rivers has resulted in greatly increased rates of siltation and this has now become a serious problem. Moreover, small *beels* are being drained annually to increase catches and this is increasing the rate of sedimentation.

Chaitra and *Boishak* (corresponding to English calendar months of January and February) are the return period of natural disasters when there are storms and hail storms with high velocity winds. And early floods take place in April-May that generally causes severe damages. In *haor* area, major crop damage occurs in *Bhadra* (August-September) and *Aashwin* (September-October) due to excessive rainfall and cyclonic storms. A lower level of crop loss in *Srabon* (July-August) could be expected due to rainfall induced water logging, since transplanting aman paddy becomes difficult in inundated low lying lands, which has a great potential to reduce yield for late transplanting of the seedlings. (Haor Master Plan, 2012).

IUCN Bangladesh country office conducted a study on disaster frequency and probability that may cause vulnerability to the people of Tanguar Haor and reported that flash flood as the most destructive form of disaster for this region followed by heavy rainfall; hail storms and erosion

(See Table 5.9).

Table 5.9: Frequency and probability of disasters (IUCN Study, 2012)

Type of Hazard	Reported Events / Incidents 1989 – 2009	Probability of Occurrence	Level of vulnerability
Flash Flood	1	1	1
Heavy Rainfall	2	2	2
Hail Storm	2	2	2
Soil Erosion	2	2	2
Drought in winter	3	2	2

1 = High; 2 = Moderate; 3 = Low; 4 = Very low

Human Hazards

Water extraction: Water extraction from the *beels* and rivers at Tanguar Haor occurs in the drier winter months, mainly for the irrigation of rice fields, but occasionally also for other crops. Later in the winter months water may also be extracted from *beels* in order to maximise fishing outputs. The effects of water extraction on the environment depends upon the volumes extracted, if *beels* are actually pumped dry and if this drying out would otherwise not occur naturally in some areas and is only accelerated by the pumping. Decreasing

overall water volumes affects the amount of available habitat for organisms such as fish, molluscs, turtles and frogs and leads to higher water temperatures. The latter may lead to oxygen depletion, which will in turn have an impact on fish and molluscs.

Controlling water levels: Low, submersible dikes have been constructed along the western and north-western section of Tanguar Haor which serve to prolong the growing season of crops cultivated along the periphery of the *haor*. During most years, *haor* leaseholders construct earthen dams across the main outlet rivers leading from the *haor* to prolong the growing season of fish that have migrated to the *haor* floodplain and to prevent the return migration of these species. Later in the winter season, the dams are breached and the fish are harvested. Both practices of water manipulation are at odds with each other: construction of dams shortens the growing season for winter crops grown in the lower parts of the *haor* (as these can only be planted later in the season), while dike construction delays flooding of the *haor* and fish migration. In order to preserve the integrity of the *haor*, the hydrological regime should be kept as natural as possible.

Vegetation harvesting & habitat changes: The natural habitats at Tanguar Haor have been suffering because of conversion to agriculture and unsustainable utilisation of plant resources. Plants are harvested at Tanguar Haor for a whole variety of uses, the main ones of which are collecting for fuel, thatch and fodder, grazing and browsing by livestock and collecting of branches and reeds for fish trap construction. Swamp forests vegetation like *Barringtonia acutangula* (Hijal) and *Pongamia pinnata* (Koroch) trees that were once common at the *haor*, have now become very rare due to water disturbance and flood anomalies. Reed beds dominated by *Phragmites karka* have been severely disappeared or have become very rare, probably due to a combination of over-utilization (of useful species) and changes in water quality (leading to poorer light penetration). As a result of excessive temperature and pollution, populations of *Labeo rohita* and *Labeo gonius* have decreased, and *Catla* is now rare.

Hunting & trapping: Turtle and snake populations seem to be greatly reduced because of hunting, mainly for (snake) skins and (turtle) meat, although many snakes are also killed out of fear, or because they are piscivorous. Mammal populations have become severely depleted and many species have become locally extinct, due to a combination of habitat destruction and hunting.

Introduction of exotic species: Among the introduced fish species, Tilapia and African Magur is likely to have affected indigenous fish populations, both by competition for food and space and carnivory by the catfish.

In case of plant community, the local people intentionally grow *Ipomoea fistulosa* (native to South America), a large woody herb that invades former grassland and reedland as its stems are used for fencing and as fuel. Water hyacinth (*Eichhornia crassipes*) is also another threat to local ecosystem which forms very dense mats that block waterways, shade out submerged plants and cause waters to become oxygen-depleted and inimical to fish.

Pollution: Water pollution has become a major concern for maintaining Tanguar Haor ecosystem health. The use of agro-chemicals, especially in ricefields, affects aquatic organisms. Human excreta are another major pollutant as there are few sanitary latrines at Tanguar Haor and solid household waste is often simply discarded in the *haor*. With a local population of about 60,000 this will affect water quality, adding to eutrophication and increasing the level of coliform bacteria.

Disturbances: Ecological disturbance has appeared as a problem at Tanguar Haor, especially in the winter season when fishing activities, agriculture and livestock grazing all peaks and there is an influx of an additional several thousand fishermen to the *haor*, along with their families. During the past decade (and perhaps longer), the seasonal fishing camp has been located in the central part of the Tanguar Haor, thereby causing maximal disturbance.

This disturbance particularly affects ducks and migratory birds because of heavy hunting pressure in the region and probably elsewhere in the flyway are already very wary of humans. Disruption in nutrient cycle due to disturbance is another concern that may contribute to a change in biotic community.

Climate Change Impacts

Changing climatic parameters have been exerting additional pressures to the already pressurized wetland ecosystems. Wetland systems are vulnerable to changes in quantity and quality of their water supply and it is expected that climate change will have a pronounced effect on wetlands through alterations in hydrological regimes with great global variability. Climate change is recognized as a major threat to the survival of species and integrity of ecosystems worldwide (Hulme, 2005). Pressures on wetlands are likely to be mediated through changes in hydrology, direct and indirect effects of changes in temperatures, as well as land use change (Ferrati *et al.*, 2005).

Examples of impacts resulting from projected changes in extreme climate events (Ramsar [STRP] 2002) include: change in base flows; altered hydrology (depth and hydroperiod); increased flooding, landslide, and mudslide damage; increased soil erosion; increased flood runoff resulting in a decrease in recharge of some floodplain aquifers; decreased water resource quantity and quality. Under currently predicted future climate scenarios, the spread of exotics will probably be enhanced, which could increase pressure on watersheds and ecosystems (Root *et al.*, 2003). IUCN (2012) reported a number of future consequences for *haors* and *baors* in Bangladesh in face of climate change, which are equally applicable to Tanguar Haor:

- Rising temperature will lower water quality in wetland through a fall in oxygen concentrations, release of phosphorus from sediments, increased thermal stability and altered mixing patterns.
- Higher temperatures will negatively affect micro-organisms and benthic invertebrates and the distribution of many species of fish and oxygen depletion. The thermal optima for many mid to high-latitude cold-water species are lower than 20°C.
- Species extinctions are expected when warm summer temperatures and anoxia (oxygen depletion) eliminate deep cold-water refuges.
- The seasonal migration patterns and routes of many wetland species will need to change and some may be threatened with extinction.
- Small increases in the variability of precipitation regimes will significantly impact wetland plants and animals at different stages of their life cycles.
- In monsoonal regions, increased variability risks diminishing wetland biodiversity and prolonged dry periods promote terrestrialisation of wetlands.
- In dry land wetlands, changes in precipitation regimes may cause biodiversity loss.
- Expansion in range for many invasive aquatic weeds.
- Water levels are expected to increase in *haors* at high latitudes, where climate models indicate increased precipitation, while water levels at mid and low latitudes are projected to decline.
- Closed *haors*, *baors*, *beels* are most vulnerable to a change in climate because of their sensitivity to changes in the balance of inflows and evaporation. Changes in inflows to such *haors*, *baors*, *beels* can have very substantial effects and under some climatic conditions, they may disappear entirely.

Impacts of Disasters

Disaster affects every aspects of life, which is very true for disconnected *haor* people. Every disaster makes their life even harder affecting settlements, livelihood, mobility and health. They, thereby, either forced to migrate or console themselves as disasters are their ultimate fate.

Table 5.10: Challenges posed by disasters in Tanguar Haor (Source: IUCN, 2012)

Dimensions	Challenges/Risks	Nature of Manifestations	Existing Coping Measures
Health/ Reproductive health	- Inaccessibility of health facilities - Inadequate medical facilities	- Loss of income - Uncared/unprotected health - Deprived/grossly inadequate medical facilities - Incur more costs/opportunity costs - Increased child mortality and MMR (maternal mortality rates)	Received medical care from local healers or pharmacy owners
Migration	Family insecurity/loss of properties	- Loss of livelihood or professions (traditional fishers) - Increased costs of adaptation	Making relatives responsible
Income	- Unemployment - Lack of institutional loans/credit - Food insecurity	- Malnutrition - Starvation - Distress selling - Failure to repay loan installments	Eating shingra, selling household goods/utensils etc.
Education/ Awareness	Inaccessibility to schools, because roads are submerged	- Teachers cannot go to school - Decreased competency amongst the students - Increased costs to schools	Hiring additional teachers as substitutes Hiring private tutors for children
Transportation	Increased costs of commuting by boat	Restricted access to social services/detached from social networks	Alternative communication systems such as mobile telephones
Fuel/energy	- Accessing fuel wood (especially during disasters) - Storage of fuel wood	- Incur extra costs for buying fuel wood - Increased risks and workload for females (as collectors) for collecting twigs, branches, litter etc. - Scarcity of fodder (which is otherwise used for livestock)	House building materials (like bamboo) are used up for cooking Use of fodder as fuel (straw for instance) Collection and preservation of cow dung/dry weeds
Local institutions/ government/ NGOs/UDMC	Local institutions are dysfunctional and do not provide necessary services	Deprivation from social safety nets and services offered by the public and private sector	Reliance on relatives, mohajon, etc.
Ecosystem/ natural wealth	Increased dependency on natural resources/ ecosystem services	- Overexploitation of natural resources - Depletion of local species	

Health: Health facilities are disproportionately affected by disasters in Tanguar Haor. Minimum health care service is absent in the *haor* region and people mostly depend on quack or pharmacies for day to day health problem, even these services also become unavailable during a disaster period. No existing task force or emergency medical services are found in the villages of Tanguar Haor (IUCN, 2012). Villagers have to travel several miles to reach the nearest hospital situated in Tahirpur, Dharmapasha, Madhyanagar and Kalmakanda. It takes a long time to reach the doctor or hospitals, as generally they use boat, motorcycle and rickshaw-van as transport and that too is costly.

Very few villages have tube-wells and they depend on surface water for drinking and other purposes. This is often not safe and hence pushes them into the risks of being contaminated by water borne diseases. During flood time, all tube-wells go under water and people have to drink contaminated surface water that may cause stomach pain and Diarrhoea.

Migration: Migration is common for the people of Tanguar Haor area, either as a coping mechanism or forced because of landlessness, loss of livelihoods and assets due to natural disasters, limited or no access to resources, influences of vested interest groups and commercial businessmen (fishermen), lack of capital such as boats or fishing gears, difficulty in getting fishing permits because of competition between elitist groups and local people, etc. Massive migrations also take place due to regular occurrence of pre-monsoon flash floods. Being the main disaster for the *haor* areas, it destroys crops and infrastructure and repeatedly pushes them into a state of helplessness and poverty.

Fishing: During flash floods, local people at Tanguar Haor practice *uijja* fishing, which is an indigenous method of fishing. Generally it seems floods and precipitation facilitate fishing but prolonged rain and intense flood make fishing difficult. Even though there is no established early warning system but with the advance and progress of mobile technology now-a-days news and warning of disasters are mostly received via mobile communication. Local people also use their traditional knowledge, word of mouth as warning for such events. CNRS (A national NGO) has started an early warning system for the past 2 years in the *haor* area to forecast rainfall in the Meghalaya region, which causes flash floods in Tanguar Haor.

Agriculture: Flooding is a huge problem for farmers, as their livelihoods are affected by the availability of agricultural land. The farmers have no access to agricultural activities during monsoon, so they either survive by fishing or migrate to other areas. Since they are seasonal fishermen, they are lacking appropriate knowledge on fishing which results in over or unregulated catch.

Disaster Risk Reduction and Preparedness

Disaster risk and climate change are two threats that correlate positively reinforcing each other in Tanguar Haor. Climate change in conjunction with a range of other pressures may pose far greater immediate concern for Tanguar Haor and their water resources in the short to medium term. Even though wetland ecosystems act as sinks for carbon and contribute and provide numerous ecosystem services, they are particularly vulnerable to climate change. Disaster Risk Reduction (DRR) therefore can be seen as a means of strengthening livelihood security, reducing vulnerability and increase opportunities of pursuing sustainable livelihoods. Climate change and its potential negative impacts such as increased storm surge and floods will be affecting the most vulnerable communities living in *haor* areas. Thus, DRR can be used as a powerful tool to understand the threats being faced by communities living in those areas in a way that preparedness and adaptation methods can be devised accordingly.

IUCN conducted a study under the auspices of the project 'Community Based Sustainable Management of Tanguar Haor, Phase-II' during January-February 2010, to capture people's vulnerabilities induced by climate change manifestations. The study also documented the current coping strategies and recommendations from the local level, for reducing people's risks resulting from disasters. The study was conducted in 9 villages randomly selected from 4 Unions, namely Uttar Sripur, Dakhhin Sripur, Uttar Bangshikunda and Dakhhin Bangshikunda. A total of 23 FGDs were performed, where various stakeholders were consulted. About 240 community members and field workers shared their perceptions regarding disasters and recommended a number of measures that they viewed as strategies for risk reduction.

Existing mechanisms of preparedness include the following:

Policy: People hardly receive any preparedness or emergency aid from GO/NGOs/other sources. No government intervention is visible for addressing vulnerabilities or emergency aid is not received from NGO's. In terms of policy planning, people's reflections of organizations or individuals are strongly negative. At the upazila or union level, there are no strategy plans or functional Task Force.

Housing: Most of the houses in the *haor* area are flimsy and have little protection against wave erosion and high wind. Currently soil, bamboo, corrugated steel sheet, *Chhon* (hay) and wood are used to build most of the houses. Due to poor construction materials, these houses need to be repaired almost every year, following a flood.

Existing Coping strategies:

- Use of indigenous knowledge.
- Storing food, oil, dry foods and preparing special oven that can be used during disasters.
- Building false roofs above the flood water level.
- Fishing is an alternative income source during floods

Recommendations

Indicators of potential DRR impact: Indicator/s for measuring impact of a DRR initiative is highly essential and necessary that without proper indicator based evaluation DRR impact assessment cannot be completed.

Institutional support: Institutional involvement is extremely important for any DRR initiative. Involvement of both GO and NGOs to reduce the vulnerability of the community and to strengthening the resilience is essential.

Gender Sensitive DRR: Women are greatly affected by disasters and most cases their vulnerability is more than of men. DRR therefore should be gender sensitive and address both sensitivity and needs of women.

Wider lesson-learning: Lesson-learning is an integral part of any DRR initiative, it could be cross-ecosystem, cross-society or even cross-country. Lessons, either good or bad from one initiative can be useful to another engagement. Increase the width of learning practice would definitely help to increase the efficiency.

Based on local people's understanding and experience (IUCN, 2012), a number of the recommendations are prioritized, which are as follows:

- Multipurpose shelters, serving as disaster shelter, school, community clinic, market, etc.
- Infrastructure development such as building roads and submersible *pucca* (concrete) embankments, protection walls, etc.
- Alternate cropping practices such as early variety and floating gardens (*baira*) and training on techniques such as IPM (Integrated Pest management)
- Improved housing with flood protection wall made of bricks, cement and stones around the houses. In general most of the homesteads should be protected by planting *Hijal*, *Karoch*, *chailla ghash*, *nol khagra* (reeds) and bamboo, as an alternative to building expensive stone walls. People here build false roofs/ceiling (*macha*) during floods and water logging. Raise the plinth of homes can greatly reduce their vulnerabilities during and after floods.
- Alternative income generating opportunities such as 'Ecotourism facilities/guiding' for lean season (or during seasonal ban on fish catch)
- Access to proper health care and sanitation facilities, by installing sanitary latrines and tube wells

Future Coping Strategies

- Dredging of adjacent river and *beels* for increasing water retention capacity and making embankments.
- Constructing wave protection wall surrounding the village, with stones, *chailla* grass, bamboo, *erailla* grass and if nothing else is readily available, even water hyacinth.
- Plantation of *Hijal*, *Koroch* and *Haor bon* (Swamp forest) which can protect the surge of large waves.
- Ensuring proper sanitation.
- Assuring drinking water availability during flood and post flood situation.
- Re-activate community clinics at union level. Assuring availability of doctor and medicine as well as maternal/post natal healthcare

- Getting training for making oral-saline and on other medication.
- Increase the number of tube wells.
- Raising the height of the surrounding embankment of the *beel*.
- Establishing cyclone / flood centers.
- Drought tolerant crops should be introduced.
- Training on IPM (Integrated pest management).
- Documentation of local, traditional and indigenous knowledge and coping practices for facilitating adaptation

5.2.7 Gender Management Guidelines

Gender Management under this framework will enable future promoters, actors, professionals and agencies concerned in their interventions based on primary information about the current state of affair of women in terms of their role and rights in reproductive activities, productive activities, community management and organizational activities. The plan will have a significant contribution to future initiatives for the promotion of women's rights and gender development initiatives.

The Gender Management Plan for Tanguar Haor will reveal the actual status of women as well as gender imbalances (in terms of access over assets and participation) in the area, it will concentrate on how to improve the specific problems experiencing by women and enhance and continue the ongoing opportunities they have in future.

The Present Context

Occupational Status

Both male and female residents perceive agriculture to be the most prominent occupation. Amongst the male population, fishing, business and small businesses are the other major occupations of the male population. Those who do not have land to cultivate and necessary instruments and permission for fishing (during specific time periods) usually engage in migratory work.

In the Gender Baseline Report (2010), the community has prioritized cooking and backyard gardening as the main tasks to be performed by female. Livestock and poultry rearing, handicrafts/cottage industries, household cleaning and the supply of safe water are the other alternative livelihoods for female population. The Gender Baseline Report (2010) reveals an interesting trend about perception of female activities. Female respondents of the report prioritized household cleaning and the supply of safe water, but male respondents prioritized handicrafts/cottage industries and helping in agricultural work are priority work for women. This cultural perception of male about their counterpart is important to encourage future support in economic activities. It is possible to enhance their financial and human capital, along with ensuring their rights over resources.

Rights and Control over Assets

Reproductive Activities

The reproductive role includes activities that take place mainly at household level, such as domestic chores, caring for youth and old people, looking after the health of household members, their education, etc. These activities are unpaid because they are seen as 'natural'. Among all the productive activities listed, household water collection, cooking for family members, cleaning homesteads, maintaining household goods, washing clothes of family members, household poultry rearing, looking after children's education, collection of green leafy vegetables for consumption are done only by women. The following table illustrates the reproductive activities performed by men and women and control over tangible assets.

Table 5.11: Gender segregated reproductive activities

1 = Only Female, 2 = Mainly Female Partially Male, 3 = Male and Female equally, 4 = Mainly Male Partially Female, 5 = Only Male, 6 = Male (Himself), 7 = Female (Herself), 8 = Male Neighbor / Male Community Member, 9 = Female Neighbor / Female Community Member

Reproductive Activities	Who does what reproductive activities & Control over Tangible Assets																
	1%	Control over Tangible Assets								5%				Control over Tangible Assets			
		1%	2%	3%	4%	5%	6%	7%	8%	9%	2%		3%	4%	5%	6%	
1. Household water collecting	100	12.7	41.5	16.9	0.8	28											
2. Collecting fuel (Wood / any other kind of fuel) for cooking	99.2	0.8	11.9	0.8	74.6	11.9											
3. Cooking for family members	100	29.4	19.3	9.2	10.1	5	26.1			0.8							
4. Clearing homestead	100	33.6	23.5	10.9	30.3	1.7											
5. Maintaining household goods	100	20.2	31.9	5.9	42												
6. Cleaning cloths of Family Members	100	23.5	21.8	29.4	7.6	6.7	10.9										
7. Household poultry rearing	100	21	22.7	26.9	23.5	3.4	2.5										
8. Household vegetable cultivation for h/h consumption	99.2	10.2	25.4	19.5	39	5.1			0.8					100			
9. Household related repairing work	56.3	3	20.9	11.9	31.3	32.8					38.7	13	26.1	60.9	5	33.7	66.7
10. Looking after children and elderly	98.3	29.9	31.6	7.7	20.5	5.1	5.1								1.7	100	
11. Looking after children's and education	100		52.1	12.6	26.1	3.4	5		0.8								
12. Taking children and elderly to the doctor	96.6		11.3	3.5	52.2	25.2	7		0.9		3.4	25			75		
13. Catching fish for h/h consumption	17.6	19	9.5	14.3	14.3		42.9				73.1		5.7	94.3	9.2	90.9	9.1
14. Collecting green leafy vegetables for consumption	100	37.8	16.8	32.8	5	0.8	6.7										

Source: Gender Baseline Report (2010)

Although most of the reproductive activities are done by the female members, they significantly lack control over the necessary tangible assets.

The productive role refers to activities of women and men that produce economic resources, in cash or kind. In many contexts, women work at home and their productive work is invisible (e.g. doing piecework for factories from home) subsistence farming or contribution to cash crop farming, in which many women are involved, is a productive task. In many contexts, men are involved in more remunerative and formal forms of work than women. The following table shows the productive works performed by male and female.

Table 5.12: Gender segregated productive activities at Tanguar Haor

1 = Only Female, 2 = Mainly Female Partially Male, 3 = Male and Female equally, 4 = Mainly Male Partially Female, 5 = Only Male
6 = Male (Himself), 7 = Female (Herself)

Productive Activities (Agriculture)		Who does what productive activities Vs Control over Tangible Asset																													
		C.O.					C.O.					C.O.					C.O.					C.O.					C.O.				
	1%	1%	2%	3%	4%	5%	2%	1%	2%	3%	4%	5%	3%	2%	3%	4%	5%	4%	2%	3%	4%	5%	5%	1%	2%	3%	4%	5%	6%	3%	6%
1. Rice seed preservation	7.4				100	7.4				100	18.5	60	20	20	25.9				85.7	14.3	40.7							18.2	81.8		
2. Seedbed preparation																															
3. Fertilizing																															
4. Weeding																															
5. Harvesting																															
6. Paddy processing	3.7					100					3.7	100																			
7. Paddy refining	55.6	33.3	6.7	53.3	6.7	29.6	75	25																							
8. Rice boiling	70.4	52.6	5.3	42.1		14.8	50	50			11.1	100																			
9. Rice drying	51.9	35.7	7.1	57.1		33.3	77.8	22.2			11.1	100																			
10. Rice preservation	3.7		100				25.9	14.3	28.5		42.9	14.3	66.7	5.6																	
11. Straw drying											14.8	75	25																		
12. Straw preservation											14.8	100																			
13. Selling rice											14.8	100																			
14. Seed preparation	11.1						100	29.5		37.5	62.5	51.9	64.3	14.3	21.4																

Source: Gender Baseline Report (2010)

Agricultural activities are done mainly by the male members of the community. The three agricultural activities done by the female members of the community are: rice boiling, paddy refining and rice drying. In all these activities only females and males and females together control the necessary tangible assets. The activity of rice preservation is mostly done by males and females together and in most cases they control the tangible assets needed. Other notable findings from the above table are:

- i) In 81.5% cases paddy processing is done by male members, while required tangible assets in 40.9% cases are controlled by female members;
- ii) Although rice boiling and rice drying is mostly done by females (70.4% and 51.9% respectively), males share some control over the tangible assets necessary for this work;
- iii) Straw drying, straw preservation and the selling of rice is mostly done by male members (81.5%, 70.4% and 66.7%), but female members share considerable control over the tangible assets;
- iv) Although seed preparation is mostly done by male and female members equally (51.9%), mostly male members control the tangible assets.

Poultry is a productive activity done by the active participation of male and female members of a household. Poultry works are done by both males and females equally in most cases. While bringing ducks back to duck houses and collecting eggs are performed by male and female equally, male members control the required assets for collecting eggs and female members control the tangible assets for bringing ducks back to the house.

Among all the activities of livestock rearing and maintenance, only treatment of the cattle is done by the female members and selling cattle and cleaning sheds are performed by male and female members equally in most cases. Taking cattle for grazing and selling milk is done by male members in 83.3% cases.

Fisheries are mostly done by the male members. Catching fish is mostly done by male, majority of the respondents informed women have the rights over men in intangible assets. The two important activities performed by male and female equally are making fishing gears at home (38.5%) and managing money for buying fishing instruments.

Two most important tasks of producing handicraft items - packaging of the handicraft items for selling and preserving the products until sold, are the main three tasks done by the female members. Male members collect raw materials for handicraft. Selling handicraft items in the market and other activities are performed by female members and male members equally. Male members also perform the activity of managing capital for handicrafts business in most cases.

In small business, male members control the tangible assets for different activities. Even for the work done by female members, it is the male members who control the tangible assets. In all the productive activities in most of the cases both male and female are found to be participating equally.

Community Management and Decision Making

The following table reveals the involvement of men and women in community management and decision making in Tanguar Haor.

Table 5.13: Gender segregated community activities at Tanguar Haor

1 = Only Female, 2 = Mainly Female Partially Male, 3 = Male and Female equally, 4 = Mainly Male Partially Female, 5 = Only Male, 6 = Male (Himself), 7 = Female (Herself)

Community Managing & Political Activities		Who Participates and who controls intangible assets																				Who Leads								
1	C1	C3	C4	C5	2	C1	C2	C5	3	C1	C2	C3	C4	C5	4	C1	C3	C4	C5	5	C1	C2	C3	C4	C5	1	2	3	4	5
1. Training decision of becoming member of the organization									27.7			3	81.8	15.2	32.8				4.3	95.7								0.8	51.7	47.5
2. In village co-management committee election									29.4			82.9	17.1		67.2					100								18.5	75.4	5.9
3. In organization decision taking									21.8		4	96			53.8		44.4	31.7	23.8	24.4				3.4	95.5			19.5	61	19.5
4. In the annual planing of the organization									20.2			100			58.8		7.4	26.5	66.2	21					100			22.9	59.3	17.8
5. In decision taking regarding giving financial support									23.5			100			68.1			40.5	59.5	8.4				10	90			5.9	81.4	12.7
6. In union co-management committee activities									22.4			100			65.5		27	51.4	45.9	12.1				30.8	69.2			23.3	60.3	16.4
7. In fisherman society									6.3			100			35.9		91.3		8.7	57.8				2.9	97.1			14.3		86.7
8. In youth society	1.6			100											4.7			100	93.8	3.4			15.5		81	3.2		28.5		68.3
9. In female group	60.9	75.7	5.4	2.7	16.2	6.3	100		6.3			100			1.6	100				25	93.8	6.3				61.9	6.3	25.4	3.2	3.2
10. In farmers group	25			100											32.8	14.3	19	4.8	61.9	42.2		4		12	84	4.8	12.7	9.5	7.3	
11. In laborer union (Coal/Sand/Stone etc)									14.3			87.5	12.5		17.5			100		68.3	4.8			47.6	31	15.7	6.3	50.8	22.2	20.6
12. In voluntary organization									62.5	2.5		10	82.5	5	35.9			95.2	4.8	1.6			100			9.5		19	68.3	3.2
13. In other organization									32.9			28.6	71.4		65.9			81.1	18.9	1.2			100			2.4	17.9	78.6	1.2	
14. In political activities									19.5			91.3	8.7		68.6		3.8	82.1	14.1	11.9			7.7	30.8	61.5		9.3	72.9	17.8	
15. In community level conflict resolution									10.9			100			24.4			42.9	57.1	64.7			17.6	2.7	79.7		7.5	30.5	61.9	
16. In other NGO activities	6.8	87.5			12.5	17.9	5	60	35	22.2		96.2	3.8		32.5			59.5	40.5	20.5			8.7	8.7	82.6	0.9	15.4	9.4	69.2	5.1
17. In building infrastructure (Bridge)									20.2			95.8	4.2		21		4.2	33.3	62.5	58.8			8.7		91.3		9.3	37.3	53.4	
18. In protecting village from strong curent									14.3			76.5	17.6	5.9	72.3		17.9	55	26.2	13.4				6.7	93.3		10.2	68.5	21.2	
19. In ensuring govt. facilities (VGD and VGF) from UP					21				100			47.1			13	75.9	11.1	31.9					2.7	97.3		25.4	39.8			34.7

Source: Gender Baseline Report (2010)

Female members participate in political activities (60.9%) and in farmers group (25%). Even in the activities of the female group, male members have control over intangible assets in 16.2% cases. Moreover, activities of the farmers' groups to some extent are done by female members; all the necessary intangible assets are completely controlled by the male members. In 17.9 % cases mainly female members and partially male members are involved with other NGO activities; in 35% cases male members control the necessary intangible assets. For the community management and political activities done by male and female members equally, the involved intangible assets are also mostly controlled by them, with the exceptions in taking decision of becoming member of the organization, involvement in voluntary organization and in other organizations, where intangible assets are mostly controlled by the male members in 81.8%, 82.5% and 71.4% respectively. Further, for the activities dominated by male members or done completely by male members, male members control the intangible assets. In terms of leading the community and political activities, female members' role is marginalized except in female groups. Interestingly in leading labor unions, the participation of male and female members is equal. In reality, most of the community management and political activities are led by mostly male members in the community.

Table 5.14: Gender segregated household activities

Properties	Male				Female			
	Yes		No		Yes		No	
	N	%	N	%	N	%	N	%
1. Taking care of Children	57	72.2	22	27.8	31	77.5	9	22.5
2. Asset	39	49.4	40	50.6	16	40	24	60
3. Investment	73	92.4	6	7.6	37	92.5	3	7.5
4. Engaging in Service (Female)	6	7.6	73	92.4	18	45	22	55
5. Children's Marriage	1	1.3	78	98.7	2	5	38	95
6. Children's Education	35	44.3	44	55.7	23	57.5	17	42.5
7. Freedom of Movement for female	7	8.9	72	91.1	0	0	40	100

Source: Gender Baseline Report (2010)

From the above table some interesting observations can be drawn: female members perceive having no freedom of movement, while at least in 8.9% cases male members claim female members have this freedom.

Among all other decisions, similarities between male and female responses are found, except for female engagement in service where males believe that females have the capacity to make this decision (7.6%) and female members claim to have higher capacity of making decision regarding engagement in services (45%). In general, both male and female respondents agree that female members are merely involved in decision making about asset, female members' engagement in services, children's marriage and education and female members freedom of movement.

Policy Guidelines

Considering the present gender roles and responsibilities of Tanguar Haor, the following guideline will help to step upward the gender balance in home and outside for the community:

- To ease the activities, roles and responsibilities performed by women as discussed above, it is necessary to support them with both hardware and software tools.
 - The hardware tools include installation of tube-wells for drinking water, improved stove for cooking, easy access to collect dry leaves, establishment of sanitary latrines, more sustainable houses, easy access to loans with minimum interest etc.
 - The priority software tools include training on alternatives income generating (AIG) activities.

- To reduce the discrimination to women, educational facilities and opportunities are required to be enhanced as prerequisite action.
- In next level, it is required to create employment opportunity for women considering their educational qualification and social context.
- Capacity building about conducting small business can help them to earn economic empowerment.
- Women involvement in community decision making depends significantly on how their male counterparts perceive it. Therefore, rather than concentrating only on capacity building of women, it is necessary to change the world view of men also. Awareness raising campaign along with facilities to initiate household level income generating activities can be promoted. It will help to motivate men and women to work jointly and cooperatively.



Chapter 6

Justification for Implementation of Tanguar Haor Management Plan Framework and Guidelines



This chapter presents rationale for developing the Tanguar Haor Management Plan Framework and Guidelines. Giving priority on both biodiversity conservation and poverty alleviation, this framework attempts to give a future direction for sustainable management of Tanguar Haor.

6.1 Socio-Economic Justification: A Focus on Poverty Alleviation and Social Equity

Community based management has been argued as important prerequisite for sustainable management of Tanguar Haor in the THMPFG. It is generally perceived that commercial fishing would not be successful at Tanguar Haor; rather the local community is perceived here to be the only party with a long-term interest in maintaining the integrity of an area and ultimately the most successful caretakers of the environment. Hence, the THMPFG recommends several programmes of resource substitution and increasing local welfare, as ways in which pressures on the area's natural resources may be reduced and an attempt at habitat restoration succeed.

As noted in the preceeding chapters, empirical evidence shows that the local community at Tanguar Haor is extremely poor and vulnerable. These people are almost entirely dependent on the *haor* for their income, employment and livelihood. Paddy cultivation and fishing are the two major income sources with many other minor sources such as duck rearing and cattle/buffalo fattening. The socio-economic structure of the *haor* villages is influenced by its length, breadth, remoteness and low level of education. Having average household size of nearly 6, annual average income is about BDT 7306 per month (Baseline Study Report, IUCN, 2012). Compared to national average income condition, the statistics shows a good position though Haque and Kazal (2008) argued that the income distribution is highly unequal and followed a skewness with few large farmers and a majority of rather small farmers. Probably the most significant factor contributing to local poverty is the lack of access to the *haor* resources. Before intervention by CBSMTH, the local people had virtually no access to the *haor* fisheries, which are the most valuable resource in the area, as this is leased out and the leaseholders have for a long time made use of externally recruited fisher folk for annual harvesting. In addition, they are denied free access to the *haor* for duck keeping, buffalo and cattle grazing and reed and grass collecting. This economic marginalisation has undoubtedly contributed to over-utilisation of the scant resources they have access to, such as cultivable land, peripheral grazing areas and limited fuel resources. Where possible, they attempt to cultivate *beel* edges with rice, resulting in the sharp decline of this habitat, while some are enticed to engage in hunting and trapping.

With the implementation of the CBSMTH, the scenario has improved considerably and commercial lease-hold based fishing has been replaced by community based fishery management. The CBSMTH has also lead to an increased level of organisation and that has contributed to increased community access to external aid, funding agencies and further government support. The Tanguar Haor Management Plan Framework and Guidelines also emphasises on the community's access and sustainable utilization of Tanguar Haor resources.

6.2 Conservation Value and Benefits to Global Biodiversity

The importance of Tanguar Haor to conservation is outlined in detail in Chapter 2 and is evident that the site is of significance for the maintenance of national, regional and global biodiversity. Tanguar Haor provides a habitat and breeding area for various globally endangered species and is important for maintaining regional habitat diversity. The area is also important for sheer numbers of wildlife. It supports what is perhaps the country's richest freshwater fishery and annually provides a refuge for around 30,000-40,000 (occasionally 60,000) waterfowls, many of which are migratory. Tanguar Haor also provides a habitat for various wetland plant species that are threatened, rapidly disappearing or rare in the *haor* basin and Bangladesh as a whole.

Tanguar Haor provides various types of ecosystem services including habitat for a vast number of invertebrate, fish, amphibian, reptile, bird and mammal species, of which a number are rare and/or endangered. The *haor* also functions as a water storage area, providing drinking water and irrigation water (especially for rice), while helping to maintain river levels in the Patlai and the Surma in the dry months. In the wet season, it absorbs floodwaters, thereby mitigating the impact of floods in downstream areas and in addition recharging the area's ground waters. Silt, especially from the Jadukata River, is deposited in the *haor* and water quality (of outflowing water) is thereby improved. These functions, though of immense value, are difficult to quantify. Haque *et al.* (2012), using existing literature attempted to estimate economic value of Tanguar Haor based on ecosystem services. In the study he estimates annual income per hectare of specific land use with respect to a particular ecosystem product or service. Direct economic activities in the *haor* such as rice/crop production, fishing or agriculture small business including dry fish business, tea stall, vegetable selling, fishing gear business etc. have direct market value and are easy to quantify. However, regulating, supporting and cultural services are estimated using indirect methods. For

instance, recreational value is estimated using 'Willingness to pay' or value flood protection service is estimated using 'Opportunity cost' of constructing dams. Using a 10% discount rate²¹, (Haque *et al.*, 2012) shows a Net Present Value (NPV)²² of 97.8 million BDT or 377 million USD for Tanguar Haor. Present value of Tanguar Haor ecosystem services have been projected including all these 4 types of services over 30 years of time starting from 2006 as IUCN's intervention in post-leasing ban period. It is assumed that the projected benefits from the services will remain constant throughout the period as of now and the year 2036; benefits are seen highest in terms of accruing (increased) income from provisional services followed by supporting, regulatory and cultural services (see Chapter 2, 2.3).

6.2.1 Current Situation and Future Direction under THMPFG

Activities that have been carried out under various phases of the CBSMTH project are expected to continue through an institutional partnership among the community, local government, central line agencies, non-government entities, and donors. Although the exact form of the governance structure still remains a point of discussion and consultation, several possible institutional arrangements and governance models are being tossed about (see Chapter 5). These activities include environmental awareness programmes, monitoring of waterfowl and hunting, establishing of tree nurseries and some replanting of swamp forest trees, formation of social capital, livelihood diversification and abolishment of lease-holder system with community based fishery management.

As proposed by Giesen *et al.* (2000), a few recommendations have been implemented such as Ministry of Land handing over the control of the haor to Ministry of Environment and Forests, and banning private leasehold in Tanguar Haor to manage the *haor* in a more environmentally friendly way, continuing replanting efforts and reducing hunting pressures. However, many expectations of Giesen *et al.* (2000) are yet to fully mature, such as complete containment of bird and fish poaching in the *haor*. In addition to Giesen *et al.* (2000) recommendations, this THMPFG also suggests to provide emphasis on sustainable fishing with annual restocking of major carp species carried out by Department of Fisheries. The local community will have to be more actively involved in fisheries and forestry, and continue to enhance their livelihood with full and effective access to natural resources of the *haor*. MoEF may establish a permanent or regular presence in the area, to carry out an ongoing awareness programme and monitor wildlife populations and fishing. Bird numbers is expected to increase slowly and some species may reappear in the area.

The benefits to global biodiversity brought about by implementation of the THMPFG are clear and evident. Moving towards full community-based management means moving away from a leasing system which promote short-term views on natural resource exploitation and encourages over-exploitation. The local community will be trained in sustainable management techniques, receive support from administrative bodies and be the recipient of awareness and education programmes that promote environmental understanding and wise use of natural resources. The natural ecosystem will be restored by means of replanting and protection of *beel* edge habitats. Lastly, the local community will be provided with alternatives for various over-exploited resources (e.g. fuelwood), receive economic assistance in order to reduce dependence on (and over-utilisation of) natural resources.

6.3 Legal Obligations

There are various legal obligations that Bangladesh has towards sustainable management of Tanguar Haor. Firstly, the declaration of Tanguar Haor as an 'Ecologically Critical Area' has implications that stem from the Environmental Conservation Act (1995) and Environmental Conservation Rules (1997). As signatory to a number of international agreements and conventions, Bangladesh is bound to meet certain legal obligations that are connected with these. The most relevant of these in the context of conservation of Tanguar Haor are the Ramsar Convention, the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The implications are discussed below.

²¹ The discount rate is a rate used to convert future value into current or present value. This is realized through the mechanism known as discounting. For instance, if somebody offers to pay to you 105 USD one year from now, the present value is 100 USD at a discount rate of 5%. This is because you would earn interest of 5 USD on a deposit of 100 USD.

²² NPV is a calculation technique used to estimate the value or net benefit over the lifetime of a particular project, often for long-term investments, such as installing energy efficient machines. It allows the decision-maker to compare different alternatives on a similar time scale by converting all options to current monetary figures. A project is considered acceptable (or unacceptable) if the NPV is positive (or negative) over the expected lifetime of the project.

6.3.1 Ecologically Critical Area

Tanguar Haor was declared as 'Ecologically Critical Area' in 1999 according to guidelines as mentioned in the Environmental Conservation Act (1995) and Environmental Conservation Rules (1997). According to the legislation, such areas are to be protected and that exploitation of such areas, unless specifically permitted by Government of Bangladesh, is prohibited. As a result of this official nomination, MoEF has gained legal control over Tanguar Haor after the current 1-year lease expired in April 2000.

6.3.2 Obligations to International Conventions

Ramsar Convention

Bangladesh became a signatory of the Ramsar Convention – officially the Convention on Wetlands of International Importance especially as Waterfowl Habitat – in May 1992. On 20th January 2000, Ministry of Environment and Forests officially nominated Tanguar Haor as Bangladesh's 2nd Ramsar Site or wetland of international importance. Bangladesh's membership of the Ramsar Convention means that it is obliged to sustainably manage its wetlands and wetland resources. The nomination of Tanguar Haor as a Ramsar Site means, this general obligation becomes binding for this particular area. In other words, Bangladesh has committed itself to sustainable management of Tanguar Haor and its resources.

CBD

As a signatory of the Convention on Biological Diversity (Rio de Janeiro, 1992), Bangladesh pledges to conserve biological diversity in the country, promote the sustainable use of its natural resources and encourage equitable sharing of the benefits of genetic resources. For the most part, obligations stemming from the CBD membership are similar to those of the Ramsar Convention, except for benefits of genetic resources, which are currently not an issue at Tanguar Haor (except in the broader sense of biodiversity conservation).

CITES

Bangladesh signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1981 and ratified it in 1982. As a result, the country is legally bound to protect endangered species from over-exploitation, by means of a system of import/export permits. However, the CITES only prevents or regulates international trade in species, and although some of these species may be trapped and hunted at Tanguar Haor, this is generally not for the purpose of international trade. Locally hunted turtles for example, generally end up in the pot.

6.4 Potential for Replication

6.4.1 Essential Criteria

In principle, THMPFG recommends three steps that include habitat restoration, relieving pressures on the resources and capacity building can be applied in many other ecosystems and/or areas where Ministry of Environment and Forests aims to preserve biodiversity and/or instill sustainable utilisation of resources. In smaller wetlands, such as single *beels*, *duars*, *chars* or small islands, the model can probably be applied without much ado, once an agreement has been reached with the local community, local administration and other local stakeholders. At the larger haors however, application is not as straightforward as most of these have been leased by MoL to commercial leaseholders to exploit the fisheries resources.

The criteria for replication are therefore:

- The area must be of interest to biodiversity conservation and not be so heavily degraded that most of the biodiversity value has been lost. Low value to biodiversity means little donor interest and not meeting the requirements for Ecologically Critical Areas.
- There must be opportunities for relieving pressures on the resources, for example by resource substitution or implementing income generation projects. Funds must be available for this purpose.
- Control of the area and its resources must be with the local community or Ministry of Environment and Forests. In the case of larger bodies of water and wetlands that are leased out commercially, these should

be declared Ecologically Critical Areas (if they meet the conditions for this) and control handed over from Ministry of Land to Ministry of Environment and Forests for management.

- Lastly, there must be institutional capacity within Ministry of Environment and Forests for managing such areas. The ministry should therefore focus on developing and nurturing this capacity.

6.4.2 Priority Sites for Replication

A degree of national consensus is called for in identifying and prioritizing the potential sites for replication. Such a consensus may draw on, and be informed by the relevant policies (especially the ones concerning wetland management and distribution) and the emerging co-management regime. Such a consensus should cover and focus on such issues as a listing of priority wetland sites for conservation, lists of threatened sites and accounts of root causes and a detailed summary of which interventions or actions are required to achieve sustainable wetland management. If requested, the Ramsar Convention Bureau may provide financial support for the production of such a document. Such a document should provide a blueprint for further actions in wetland management in Bangladesh.

6.4.3 Financing of Replication Efforts

In general, the components described in the proposed model (Chapter 4), which involve community livelihood, ecosystem restoration, institutional capacity building, and co-management are eligible for funding from social development, governance, and environmental funds, such as those that are operated by bilateral and multilateral donors. In the case of sites that harbour biodiversity of global significance, restoration and capacity building may also be eligible for GEF support. Proposed component activities, which involves resource substitution, income generation and welfare uplifting, may be funded by Government of Bangladesh directly or out of development funds. There is a wide range of donor funds targeting the latter, such as the social investment portfolio of the World Bank, Asian Development Bank (ADB) and many of the programmes operated by bilateral donors in Bangladesh.

On the basis of the above criteria, considerations, and information about financing opportunities, Ministry of Environment and Forests should take lead in co-ordinating and encouraging formulation of concrete proposals and associated exploration towards replication of the Tanguar Haor model for wetland management.

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Appendix

Appendix 1: Selected Proceedings of Consultative Meetings

Community Based Sustainable Management of Tanguar Haor Project (phase Iii) Minutes of Consultation Meeting to Finalize the Tanguar Haor Management Plan Framework (THMPF)

Meeting-01

Date: 07.06.2015

Time: 08:30 am - 09:00 pm

Venue: Emma Nuelle's Inn, Dhaka

A day- long meeting was held in Dhaka to finalize the Tanguar Hoar Management Plan Framework. Project staffs of IUCN and concerned consultants attended the meeting, discussed and intensively worked for developing the framework in a final shape. At the beginning of meeting, the lead consultant Dr. Khan presented the latest development of the framework. In that case, he said the developing framework would act as a guiding manual for sustainable use of Tanguar Haor resources. Then he sat with the other consultant to write the remaining parts of the framework. The consultants in discussion with the project staffs provided necessary inputs in different chapters of the developing framework. The consultants added information and sources relevant to the subjects under each chapter. Dr. Khan informed that the developing framework is expected to contain summaries and references of all relevant documents, so far developed for Tanguar Haor. He also opined that it would be helpful for various scientific researches to be conducted in future.

Major Decisions:

- The Tanguar Hoar Management Plan Framework will be published in a book.
- The publication section of IUCN will ensure copyright of the framework book.
- All Manuals developed during the project period and meeting minutes related to the Tanguar Hoar Management Plan Framework will be included in appendix.
- Recommendations from various studies will be added in the framework.
- The fisheries part of Tanguar Hoar Management Plan Framework needs to be revised.
- Overall structure of Tanguar Hoar Management Plan Framework needs framing with setting footnotes where appropriate.

Meeting-02

Date: 27.06.2015

Time: 02:30 pm - 06:00 pm

Venue: Conference Room, IUCN Bangladesh Country Office

A meeting was held in Dhaka to finalize the Tanguar Hoar Management Plan Framework (THMPF). Project staffs of IUCN and concerned consultants attended the meeting, discussed and intensively worked for developing the framework in a final shape.

At the beginning of meeting, the lead consultant Dr. Khan presented the latest development of the framework. Then he sat with the participants including IUCN staff and other consultants to write and review the remaining parts of the framework. He added one extra page for recognizing team involved in reviewing and updating the framework exercise. The consultants in discussion with the project staffs provided necessary inputs in different chapters of the developing framework. The Project Manager and PISC of THP contributed significantly in

developing some important chapters including risk analysis. The newly assigned consultant also provided support to the lead consultant in editing necessary chapters of the developing framework. He put his observations particularly on chapter 5, which was found much elaborated comparing to other chapters of the framework. He was advised by the lead consultant to insert number in each table and figure used in the framework. The new consultant informed to receive all texts as final for further revision and fine-tuning.

Major Decisions:

- IUCN guideline will be followed for formatting framework.
- Photographs relevant to each chapter will be added.
- Models used in Chapter Three & Four will be set as image format for clear understanding.
- Chapter Five will be segregated into necessary sections.

Meeting-03

Date: 03 March, Monday, 2014

Time: 10.00 AM-2:15 PM

Venue: FLAMBE RESTAURANT, Gulshan-2 Dhaka

The first meeting on Tanguar Haor Management Plan and Framework was held on 03 March 2014 in Dhaka. It was a consultation meeting to identify and discuss the Management Strategy for Tanguar Haor. The meeting was presided over by Dr. Mohammad Nasiruddin, Joint Secretary (Dev.), Ministry of Environment and Forests and NPD of CBSMTH project.

IUCN Bangladesh Country Office organized the meeting which was attended by some senior Government officials including Mr. Mihir kanti Majumder, Former Secretary, Government of Bangladesh, Mr. Mohammad Firoz Mia, Additional Secretary, Ministry of Public Administration, Dr. Md. Ruhul Amin, Director of Bangladesh Haor and Wetland Development Board, Mr. Md. Zafar Siddique, Director of Department. of Environment and other Government officials from relevant ministries/departments, especially the Ministry of Land, Planning Commission and Bangladesh Fisheries Research Institute. Besides, a number of academicians of different universities including Dr. Niaz Ahmed Khan, Department of Development Studies, University of Dhaka, Dr. Md. Mostafa Firoz, Professor, Department of Zoology, Zahangirnagar, Dr. Aktarul Islam Chowdhury, Professor, Shahjalal University of Science and Technology and Mr. Abdul Baten, Independent University Bangladesh were present in the meeting.

Participation of few consultants namely Mr. Azharul Majumder, Junaid Kabir Chowdhury, Executive Directors of CNRS, Arranayak Foundation, TARA, ERA and other representatives from various NGOs contributed significantly in the meeting discussions. The meeting was also attended by the senior management of IUCN Bangladesh including the Country Representative and Programme Coordinator and, was moderated by the Project Manager of CBSMTH project.

Major Decisions:

1. The Tanguar Haor community people will be capacitated in many ways of financial management for effectively operating the SCM fund.
2. The whole boundary of Tanguar Haor requires to be demarcated separately. In that case public land in the haor area may need to be acquired.
3. Local community should be well-informed of the government's plan for Tanguar Haor.
4. The proposed Tanguar Haor authority would be regulated by Act and will function as a semi-autonomous body with the jurisdiction of exercising power in all cases of administration and management. Secretaries of the Ministry of Agriculture and of the Ministry of Land will be included in the steering committee of the proposed authority.
5. The co-management committees under Tanguar Haor Somaj Bhittik Soho Beyabostapona Society (THSSBS) will be recognized with adequate role and power.

6. The co-management committees will comprise of all relevant stakeholders including civil society, women and media representatives.
7. The proposed Tanguar Haor Act would allow the committees to make necessary decisions demanding on situation.
8. Initiative will be taken to bring Tanguar Haor out of the 'ECA' (Ecologically Critical Area) status.
9. Director General and Director of Bangladesh Haor and Wetland Development Board (BHWDB) will be considered to place in the steering committee and in the management committee respectively.
10. The local MP needs to be posted only to the steering committee instead of being placed at the management committee.
11. Initiative will be taken to renew the Memorandum of Understanding (MoU) for another 10 years after its term ends on June'2014.
12. The proposed Tanguar Haor Steering Committee will be concise.
13. The proposed framework will act as a guiding manual for sustainable use of Tanguar Haor resources.
14. Representatives from local NGO and civil society were highly proposed to be included in the management committee of Tanguar Haor authority.
15. UNO and Assistant land commissioner of Tahirpur and Dharmapasha, discussed to be placed at the management committee.
16. The proposed Tanguar Haor Act will be accommodative with co-management committees.
17. The proposed framework for Tanguar Haor will act as a guiding manual for sustainable use of Tanguar Haor resources.
18. The definite characteristics of Tanguar Haor, responsible for its 'ECA' status and Importance as well as means of specifying Tanguar Haor area demarcation will be addressed in framework.
19. Necessary initiative will be taken for implementing the research outcomes.
20. The Tanguar Haor framework should mention the ways of conducting programme based activities and resource protection activities.
21. Advice of the national scientific body will be taken for conducting different scientific studies.
22. The existing situation of Tanguar Haor; including extreme poverty rate, overpopulation, low literacy rate, poor health and sanitation; decided to be taken into prime concern before establishing the proposed authority.
23. The proposed framework should address the climate change impact on Tanguar Haor.

Appendix 2: Training Manual on Sustainable Yield and Fisheries Management in Tanguar Haor

Objective of the Training

After attending the training the participants would learn and achieve:

Capacity building of fisher community

For better management

For necessary guidance

For fisheries resource management of Tanguar Haor

To control illegal fishing

To understand level of sustainable yield

For awareness building

Participants will have increased capacity of monitor, planning and execution of SYL based fisheries management

Increase record keeping of fish harvest

Required Information and Necessary Preparation

Duration of the training is one day; the number of session is seven. Number of trainings may be 10-12. The trainings have to be organized locally. Before orientation, the resource person should have the detail idea and necessary preparations on all subject/topics/sessions.

The Trainer will have to study the handout for detail concept of the subject & training procedure; otherwise training approaches would not be appropriate. If required, trainer may add few items or collect related material and arrange to add in the handout to distribute.

Trainer will ensure the different materials, such as poster paper, handout, charts, flip charts, display board, penaflex extension materials before training to avoid hazardous situation.

Besides these items, other materials such as blank poster paper, sample card, marker, pin, scotch tape, binders clip, pen, note book/Katha, pencil should be arranged before training and distribute as needed.

Training room and nearby areas to be little decorated with fastoons, posters, charts and banners to create a learning environment.

Active participation should be ensured during the conducting of the sessions. Priority to be given to share the experiences of the participants and drive (to fit) those experiences and opinions to the desired line of examples. Thus, the training would become participatory, lively and an effective one.

To consider that all participants are equal, thus opinion of any participants (if appears not relevant) to be listened carefully and respond accordingly.

However, if a participant is found slow in grasping the session, assist and allow him or her to cover the gaps.

Allow topic of discussion to be relevant. To use some techniques to ensure topic is related to discussions with matched examples.

The overall environment of the training to be attractive and open to all.

For refreshing the training environment, especially after lunch, better to use short cultural tips to maintain the required level of attention.

Technical Preparations

Preparation, availability and fixing banner

Festoons, charts, display boards

Use related jokes and other method for ice breaking session by him/herself or from participants

Encourage and use of short time activities as part of encouraging cultural activities for refreshing the training

environment, especially after lunch session

Prepare some slides, check and ensure opening in computer or ensure charts with key information

Arrange pre and post evaluation test with multiple choice, single or mix type questions

May use cards to find out group outcome (in addition of flip chart use)

Visit minimum half an hour before training starts to ensure everything is in place

After closing, also to check if everything is checked properly

It is also expected that trainer and training coordinator is ensured.

Training Programme

Session 1: Inauguration, Introduction, Objective of the Training and Training Rules

Session 2: Fisheries Introductory Part: Base situation about Species, Habitat, Migration and Recruitment

Session 3: Harvesting, over fishing, un-authorised fishing conservation and control for getting more for longer time

Session 4: Estimation of stock and permissible level of fishing

Session 5: Monitoring and Decision Making: indicators, where to monitor, when to monitor

Session 6: Necessity of consumption and fisheries management plan

Session 7: Evaluation and Closing

Sample Handouts and Schedules

Programme of One Day Training

Session 1: Inauguration, Introduction, Objective of the Training and Training Rules

Objective:

To Inaugurate and Welcome the participants

To introduce each other and ice breaking

To inform every participant about the objective, expectations and norms & rules during the training course

Time: 30 Minutes

Methods:

Self Motivation

Materials:

Card (from Art Paper), Flip Chart, Art Liner

Preparation:

Handout and Transparency Sheet and prints if required.

Step 1: Inauguration and Welcome Address

05 Minutes

Trainer invites the person selected by the authority on the basis of prior discussions for inauguration & welcome speech

In this part, the duty of the trainer will be to inform the person of the following subjects

Aim of the training

Topics of session

Expectations

The time for his/her welcome speech

Trainer will write down the answer on the flip chart

Name
Designation
Work Station
The subject which he/she has interest

Trainer will request the participants to introduce the subject which is written down on the flip chart

Then give thanks to all

Step 2:	Introduce to Each Other and Trainer Too	10 Minutes
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Trainer will inquire the participants during introduction on what specific work area they are interested in within the training

Step 3:	Inform to everybody the objective of the training	05 Minutes
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Display the Handout and transparency sheet
Discuss in detail topic of session

Step 4:	Prepare Customs and Manner /Rules	05 Minutes
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Necessary or required norms to follow are:

Switched off mobile

At a time more than one person should not go out side

No smoking

Take permission by raising hand to say something

Participants not to take permission from the trainer to go outside of the class room unless urgent

Trainer will thank to all participants of this session

Session 2: Fisheries Introductory Part: Base Situation about Species, Habitat, Migration and Recruitment

Objective:

To know base situation and data about Tanguar Haor

To know the present situation/status of the species and habitat of Tanguar Haor

To know state of the fish migration

To know where and how fish breed

To know how breeding and migration play role in natural recruitment of fish

Time: 45 Minutes

Materials:

Map, flip chart, picture, data, table, (Map of Tanguar Haor)

Process:

Handout and Transparency Sheet

Feature of Tanguar Haor ecosystem

Terrestrial & aquatic

Core zone & buffer zone
 Beels (deep & shallow)
 Rivers
 Canal & Dairs
 Tanguar Haor ecological boundary

Step 1:	Species	15 Minutes
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Fish and Non-Fish Organisms
 Species composition and biodiversity
 Species variation and preferences of beel, river and outside but related rivers and haors
 Fish production data
 Role of Tanguar Haor Fisheries to the other adjacent water bodies

Step 2:	Habitat	10 Minutes
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- Beel, River, Khal, Floodplain, adjoining habitats
- Migratory beel to beel dairs/nala and role during Ujja
- Swamps & Reeds
- Fish Sanctuary
- Aquatic vegetation
- Significance of Core Zone & Buffer Zone to fisheries stock

Step 3:	Migration and Recruitment	25 Minutes
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- Some information about fish migration
- Fish migration and movement
- Fish breeding and breeding migration
- Ujja fishing and return migration
- Natural recruitment

Session 3: Harvesting, Over fishing, Un-authorised Fishing, Conservation and Control for Getting more for Longer Time

Objective:

To know harvesting process

To know the present status of over fishing

Risk or consequence of over fishing

How to control over fishing

How to control Ujja Fishing in particular

To understand conservation is not a restriction but an approach to get optimum fish for longer period instead of getting maximum fish for few days

To inform need of conservation, process of conservation

Time: 45 Minutes

Materials:

Map, figures, data, pictures, flip chart

Preparation:

Handout and Transparency sheets

Step 1: Harvesting

10 Minutes

- What is harvesting
- How to harvest
- Proper timing and method (including proper gear and seasons) of harvesting
- Selective gears, selective species with size and area for harvesting
- Existing laws in Bangladesh for fish harvesting
- System of commercial and non-commercial fish harvesting under the project

Step 2: Consumption and Over fishing

15 Minutes

- Need for fish consumption and harvesting need
- What is the overfishing?
- The present status of over fishing
- Why to control over fishing
- How to control over fishing
- How harvesting affects fish population and fish pyramid
- Impact of linear fixing of trap, impact of blockage of fish middle to shore or vice versa
- Benefit to control over fishing and ujja fishing

Step 3: Conservation

10 Minutes

- Need of conservation in Tanguar Haor
- Without conservation what will happen in Tanguar Haor
- Process of conservation (non structural and structural)
- Advanced fish sanctuary and integration with advanced swamp forestry
- Rivers, canals, dairs, Chhara
- Why Tanguar Haor community will observe ban period for fishing?
- Possible impact of non-commercial fishing in Tanguar Haor biodiversity

Step 4: Illegal fishing

10 Minutes

- Understanding of authorized and non authorized fishing
- What is illegal fishing, perception of legal and illegal at the community level
- Conception of rights of fishing and need for control (through un-authorised fishing)
- Permissible limit/activity/for consumption/sell
- Present status of un-authorised fishing in Tanguar Haor
- Control of un-authorised fishing for getting more (more balanced) for longer period
- Role of Tanguar Haor community for controlling of illegal fishing

Session 4: Estimation of Stock and Permissible Level of Fishing

Objective:

To know what is stock

To know use of fishers by other organisms

Time: 45 Minutes

Materials:

Map, figures, data, pictures, flip chart

Preparation:

Handout and Transparency sheets

Step 1: Fish Conservation

03 Minutes

- Review of fisheries conservation.
- Role community based conservation approach

Step 2: Understanding of SYL-MSY

05 Minutes

- Estimation process of fish stock, especially on Tanguar Haor or any other beel
- Use of Fish use by different organisms/animals
- Process of deciding harvest level
- Use of LK on recovery pace of harvest

Step 3: Role of recruitment and other factors in SYL-MSY estimation

05 Minutes

- What is recruitment and relation with breeding and hatchling migration?
- Place and distance of recruitment
- Role of Rivers, Canals, Dairs & Chhara in natural recruitment
- Problems of recruitment
- How to enhance recruitment
- Fine mesh net use and recruitment
- Embankment/dyke and sluices hindering recruitment
- Pre-monsoon dyke for crop and restriction of entry of juveniles from river

Step 4: Applicability in Tanguar Haor context and species/group and waterbody based

05 Minutes

- Average context of SYL
- Different SYL for different fish group/species or waterbody/beel based
- Criteria to consider in SYL application

Step 5: Recorded fish harvest

05 Minutes

- Core Area
- Non-Core Area
- Correction in Non-Core Fish Harvest data
- Application of such data in SYL estimation process

Step 6:	Estimation of Un-authorised fishing	05 Minutes
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- Types of un-authorised fishing (about 4 types)
- How to estimate that level or quantity

Step 7:	Estimation of Use of Fish by other animals and organisms	05 Minutes
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- Animals and organisms that consume fish
- Estimation of number of such animals, season of use
- Per animal estimated fish consumption, number of days to apply for estimation/calculation

Step 8:	Estimation of non-harvested stock	05 Minutes
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- Estimate non harvested fish from the beel/waterbody
- Express it in percentage from the estimated harvest, use and un-authorised fishing

Step 9:	Estimation of Stock	05 Minutes
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- Combining harvested and non-harvested estimation, determining approximate stock of fish for Tanguar Haor or beel/waterbody based

Step 10:	Harvest Limit	03 Minutes
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- Harvest limit or Sustainable Harvest Limit (SYL) or MSY
- Assess for each fish group or waterbody based on all calculation and pattern of recruitment

Report of Community led framework for estimation of sustainable exploitation level of fish and reeds in Tanguar Haor may be consulted (Ahmed 2011) and Fisheries Monitoring Plan by Munir Ahmed (Ahmed 2008) may be referred

Session 5: Monitoring, Indicators, Where to monitor, When to Monitor

Objective:

To know the necessity of monitoring of Tanguar Haor Fisheries

Process of Monitoring

Present monitoring status/approach of Tanguar Haor fisheries and other aspects

When, how and then by them [Please verify]

Time: 60 Minutes

Materials:

Map, figures, data, pictures, flip chart

Preparation:

Handout and Transparency sheets

Step 1: Species Monitoring**10 Minutes**

- Indigenous
- Threatened
- Vulnerable
- Extinct
- Available/abundant
- Past and Future Indication
- Future Projection of Species (50 years, 25 years, 10 year, 5 years, ago and step by step future projection),
- Selection of Species to Monitor (comprising category, economic, food chain and ecological
- Species and Population size
- Community led monitoring system, Why? How? Tanguar Haor community role

Step 2: Monitoring during Commercial and Non Commercial Fish Harvesting

- Monitoring- Gears (CFH)
- Spots (CFH)
- Species (CFH)
- Gears (Non CFH)
- Spots (Non CFH)
- Species (Non CFH)
- Non fish organisms

Step 3: Habitat Monitoring**10 Minutes**

- Beels: Deeper, medium depth, shallow, floodplain
- River, Khals, Connecting Dairs
- Seasonal connectivity
- Selection of habitat and habitat part for monitoring condition of habitat specially on blockage and siltation
- Aquatic vegetation

Step 4: Breeding and Migration and Species Monitoring**10 Minutes**

- Observation on gonadal development in pre-monsoon and from late winter
- Monitoring breeding of fishes in the river and khals
- Monitoring fish movement and migration
- Monitoring ujja process
- Monitoring breeding ground and breeding condition
- Monitoring return migration
- Monitoring hatchling migration

Step 5: Monitoring Status of Non-Fish Organisms**10 Minutes**

- Snail and Mussel
- Small Snails (Geri)
- Other Aquatic Organisms

- Breeding of Snails
- Utilization of small snails in fish food chain

Step 6:	Monitoring of Status of Swamps and Reeds	0 Minutes
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- Status of existing/earlier swamp & reeds monitoring through counting number, quality, growth
- Monitoring planted swamp saplings in different Kandas
- Monitoring of Swamp Demo Block

Step 7:	Monitoring of Fish Stock	10 Minutes
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- Present catch data of Tanguar Haor
- Previous data of the project to be used
- Trends of stock data to be checked
- Catch and Harvest Monitoring

Session 6: Necessity of Fisheries Management Plan & Conservation and Consumption Based on SYL

Objective:

To prepare a management plan/decision

To make the participants aware that harvest for consumption and commercial harvest is needed

To make the participants how to determine harvest level considering above requirements and by keeping seed fishes

Time: 60 Minutes

Materials:

Map, figures, data, pictures, flip chart

Preparation:

Handout and Transparency sheets

Step 1:	Conservation plan process and plan	10 Minutes
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- Conservation is not restriction but it introduce a management
- Physical Interventions for conservation (Sanctuary, Swamp Forestry)
- Non physical but management interventions (level, gear, time)

Step 2:	Management Plan and Process	30 Minutes
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- Plan of conservation and if that adequate or not
- Execution status of the plan and expected conservation level

Step 3:	Consumption of fish in the diet	10 Minutes
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- Understanding of fish harvest and level for one meal and others
- Level for more than one meal and concept of un-authorised fishing

Step 4 Application of SYL**10 Minutes**

- Understanding the process of SYL Application
- How to take decision about SYL application

Step 5 Prediction, monitoring and Correction/Revised SYL**10 Minutes**

- How to predict stock based on changed recruitment pattern if any
- Adjustment in prediction based on harvest data, indicative monitoring data and correcting/improving revised SYL

Session 7: Evaluation and Closing

Objective:

Evaluation of learning

Implementation process of learning

To adopt better management of Tanguar Haor Fisheries

Time: 30 Minutes

Materials: Some cards

Participants will write the easiest topic (which they feel) in the card. Than trainer will ask and evaluate the status of learning.

Annex I: Brief about Tanguar Haor Fisheries

Objectives

Objective of the project is to build capacity of certain group of community people to deal fisheries resources in Tanguar Haor.

Specific objective of this document is to provide necessary guideline and information for the project personnel and resource person to conduct training to target participants on monitoring and management of fisheries resources and for estimating maximum sustainable yields for Tanguar Haor.

Training Approach

Training conducting approach conservation of resources session break down / 3 days / 2 days / 1 day may be.

Guide line for Resource person / Trainer

Initially preparation

Venue & Environment maintain

Training conducting material

Duster, marker

Flip-chart

Banner

RP to visit early to the area and especially from where participants come from.

Training Courses and Duration

Two types of training are proposed but project may include additional type if required. One Refreshers Course may be considered in addition of proposed two if training batches are repeated in next year.

First Level

The training would be 3 days and one day but number of batches would be many and determined as per requirement and availability of resources.

Second Level

In the second level training, it should be one day training but this may be splitted two half days if that suits better with the community and found effective.

Structure of the Training Courses

Frequency/Rounds and Numbers

It is recommended that trainings can be three times in a year or minimum of two in two major seasons. First level training is conducted twice second level training may be conducted a minimum of two times. Thus, it means that same participant would receive the same training twice a year. Especially one day training for a participant would not be enough. Instead of training of two subsequent day, two different days (with season variation) if so, would contribute more in building capacity as participant would be able to remember and get scope to practice, and may have more practical queries to solve in the second training.

The number of batches as mentioned already depends of how many people should be trained and what geographical area is to be cover.

Training Materials and Handouts

Knowledge sharing through discussion and group work would be the main focus however, written handouts can be provided. In such case, font size should be made bigger and should have adequate and clear diagrams or photos. For first level training participants, the written handout would provide for a point of reference as a trainer for the second level of training, where on can consult those materials when they need or feel for it.

Proposed Training Course

Tentative structure of the programme, with numbers of broad topics as sessions have been given in another section. However, trainer and course coordinator take the freedom to pin point training programmes with sessions and necessary breaks.

Guideline for RP/Trainer

This has been already described and detail information is in the annex.

Monitoring by the Community

Monitoring of fishers Resources by the Community people.

Minimum 3 years have to monitor and after every 5 year indicators and plan to reset again. The monitoring and management plan to consider part of minimum 25 years regional/haor plan

Table II a.: Tentative Monitoring Plan

Sl	Items on which monitoring is required	Where to monitor	When to monitor	Frequency/ Number of Times to monitor	Remarks
A	Category/ Species and Population				
1	Brood Fish	Pre Monsoon	Before Breeding time	Once a year but in two times (small fish and carps/Catfishes)	Trained Community Person
2	Juvenile	Linking Khal, Jadukata	Wet, dry, pre, post monsoon (hatching and non-hatching period)	Three times/year	"
3	Indigenous Small Fish	Floodplain, Beel, River	Wet and dry season	Two Times minimum	"
4	Catfish	Beel, River	Monsoon and post monsoon, dry	From 5 places minimum	"
5	Carps	"	3 seasons	"	"
6	Eels	Khal & Beel	Dry and pre-monsoon	From 3 Places minimum	"
7	Threatened	Khal, Beel, FP	Any time	From minimum 5 places	"
8	Snails	FP, Beel	Pre, wet season	"	"
9	Other/Ujja	Linking Khal, River	Pre-monsoon	Minimum 7 places	"
10	Poaching	All Habitat	Wet, Dry – night also	Minimum 10 places	"
11	Recruitment	All Habitat	Early wet, dry	Minimum 7 places	"
B	Habitat & Swamps-Reeds				
12	Khal Morphology	Khal	Dry and Pre Monsoon	3 places	"
13	River Depth	River	Dry Season"	2 places	"
14	Connecting Channel	Channel	Dry and Pre-monsoon	4 places	"
15	Siltation/Through Streams	Hill Stream	Northern Part of TH	3 places	"
16	Beel	Beel	Dry and Pre	Minimum 3 beels	"
17	Floodplain	FP	Wet and Pre	Minimum 4 areas	"
18	Swamps and Reeds	Existing Blocks/ Area	Dry	5-7 areas	"
19	Planted Swamps and Reeds	Planted Blocks	3 seasons	1 area	"
20	Ujja Fishing	Linking khals	Pre- Monsoon	7 areas minimum	"
C	Swamp and Reeds Demo Block	Lechamara Kanda	Post, pre and dry season	1 area	Staff/ Community
D	Advanced Fish sanctuary	Rowa Beel	Post Monsoon and dry	1 area	Staff/ Community

In Tanguar Haor, monitoring sites or area for proposed monitoring is on the basis of species, habitat, migration status including *ujja* and recruitment. The aspects can be covered by monitoring *beel*, river, hill stream, channels connecting two *beels* and also the floodplain. The following map showing the subject to cover and places to consider for monitoring. In the monitoring three aspects are very important, a) species, b) habitat and c) *ujja* movement. Among the species it needs to monitor deep *beel*, medium depth *beel* and smaller or shallow *beels* from the commercial catch. Habitat also similar way but it may be pointed out that one of the target for monitoring habitat is on the degradation of the habitats of Tanguar Haor and its adjoining areas due to siltation coming from the Meghalayan through the hill streams. Thus, as far as the Jadukata river is to monitor for species and for habitat. As mentioned already that fish's move and migrate from the Tanguar Haor to the Jadukata through the water flow that crosses Matian and Baldar Haors and through the opening through the bridge/culverts in the road between Tahirpur and Tekerghat. This opening has to be monitored for assess migration, *ujja*, return migration and hatchling movement (recruitment). Figure II b. gives an indicative information of the training programme.

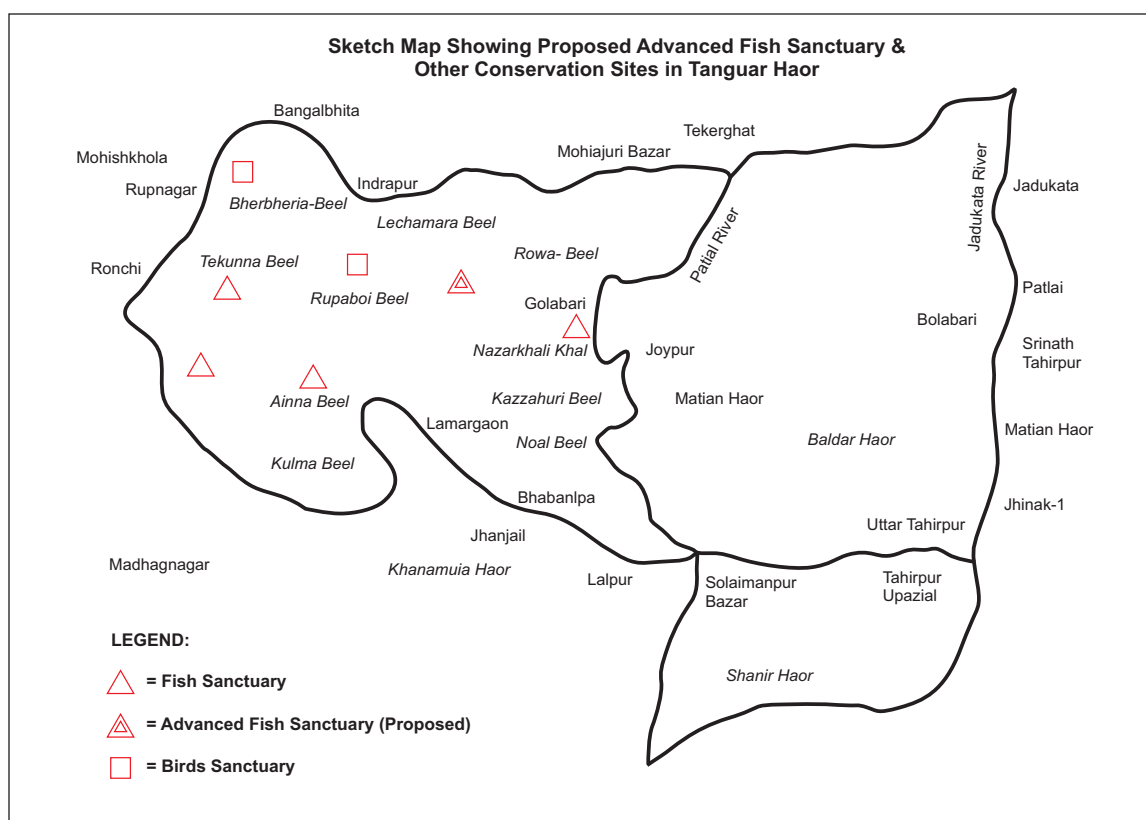


Figure II a.: Sketch map showing proposed monitoring sites by the community

Sketch map showing possible monitoring sites/locations

Detail information regarding fisheries monitoring of Tanguar Haor is described in that report (Ahmed 2008).

Capacity Building through Training

Capacity building is the main objective of the trainings. Through this training participants will learn how to monitor fisheries resources in detail. Thus, a team of community people would be equipped with better knowledge to take a decision about harvest control and permissible limit of fisheries resources of Tanguar Haor.

Appendix 3: Suggested Training Programme for the Community on Assessment and Monitoring of Reed and Tree Resources

An outline of suggested training programme for the community members on assessment and monitoring of reed and tree resources.

Goals and objectives of training

The goal of this training is to let the personnel (trainees) be able to fill out the Forms (two in number) and calculate out the desired numbers.

The specific objectives are

Get acquainted with the Maps.

Develop the capability of reading maps.

Learn the preliminary use of GPS and develop the capability of reading the Latitude and Longitude from the GPS, reading the Lat-Long of a point on the map, reaching a given Lat-Long position in the field using the GPS.

Develop their capacity of measuring the tree height.

Develop their capacity of assessing the BA of trees per acre.

Lay out right angle in the field.

Lay out plots on the field.

Estimate the volume of a tree branch.

Estimate the FF.

Weigh the harvested reeds.

Tag the harvested reed sample.

Develop their capacity to fill out the two forms.

Calculate the required numbers.

Tools and equipments that will be necessary to provide the training

Hand held compass preferably Silva Compass. May be 2 in number.

Simple GPS. May be one along with batteries.

GIS maps generated from the satellite imageries. For the whole of Tangaur Haor, showing the Reed and Forest patches.

A few of the mauza maps of the Tangaur Haor Area. Few copies (photo copied) of the Mauza maps of the location, where the training will be given, must be made available.

Divider at least one.

Acre comb or one plastic sheet with square grid for area measurement.

One plain table.

One trough compass.

Abney's level. May be 2 in number.

Wedge prisms. Two in number of which one having BAF 10 and other having BAF 5.

Metallic tapes. One 100 feet and two 33 feet.

Ranging rods. May be straight bamboo poles of about 10 feet length, 4 in number.

Logs of various diameters ranging from 1.5 inch to 6 inches and length from 4 to 12 feet. Six to ten such logs.

Jute rope of about 1/4th diameter and length about 400 feet may be in two pieces.

One forester's knife.

One dao. [Verify Terminology]

Sickles two in number.

Bamboo poles 6 numbers, of about 10 to 12 feet in length with 1ft X 1ft red flags.

Weighing scale one, sensitive of 1 ounce.

Tags (water proof) at least 12 in number.

White board, board markers, etc.

Board pin (12 No) or magic tape.

Two forms have been developed for collecting data for the assessment and monitoring of reeds and trees. These are Form 01 and Form 02.

Form 01

To collect data on reeds for assessment & monitoring.

Three representative locations in each of the 9 sites (FID # 17, 22, 38, 76, 88, 91,95, 101 and 142) selected at random will be identified. At each of these 27 points 3 by 3 feet plots will be laid. From each of these 27 plots (3 by 3 feet) data will be collected in this form.

Location of the sample site			
Patch number on the delineated GIS map			
Sample Plot Number			
Upazila Name		Union Name	
Ward Name		Village name	
Para Name			
GPS readings			
GPS of the sampling site as obtained from the GIS map:			
North		East	
GPS of the sample plot laid in the field (Field Reading):			
North		East	
Physical features of the site:			
Kanda/ Low land/ Others			
Land Tenure (locally known as):			
Ijmal/ Govt. Khash/ Private/ Others (such as leased, encroached, under possession, etc.)			
If "Others" write a note			
Data collected:			
Date of data collection			
Plot size		3 X 3 ft	
Average height of the reed in the plot		Feet	
Weight of the reed immediately after harvest from the plot in pounds		Pounds	
Weight of the reed, air dried for about a week from the day of harvest in pounds.		Pounds	
Tools to be taken to field			
One GPS.			
GIS maps showing patch and area of the patch.			

One sickle for harvesting reed.
 Some thin log line (very light weight may be of nylon).
 One weighing scale sensitive to one ounce.
 Set of plastic rods.
 Four plastic rods of 3 feet in length each.
 One plastic rod of 4 feet 2.9 inch in length (sample plot diagonal).
 Data recording sheet.
 Clip board for filed data recording.
 Pencil (2B).
 Eraser.
 One Knife.
 Two small (1ft x 1ft) red flags.
 Two bamboo poles of about 10 feet length each.

Form 02

To collect data on trees for assessment & monitoring.

There are three classes of densities in the tree covered area. Number sample plots have been weighted as per the proportion of the areas of these three densities observed. 3 samples will be taken in thick area, 4 samples will be taken in light area and 2 samples will be taken in very light area (see Annexure 04). At each of the 9 sample locations, data will be collected in this form (which will be used to calculate the yield).

Location of The sample site			
Patch number on the delineated GIS map			
Sample Plot Number			
Upazila Name		Union Name	
Ward Name		Village name	
Para Name			
GPS readings			
GPS of the sampling site (patch) as obtained from the GIS map:			
North		East	
GPS of the sample plot laid in the field:			
North		East	
Physical features of The site:			
Kanda/ Low land/ Others			
Land Tenure (locally known as):			
Ijmal/ Govt. Khash/ Private/ Others (such as leased, encroached, under possession, etc.)			
If "Others" write a note here:			
Data collection:			
Date of data collection			

Plot size (Since the trees are very scattered the plot size 66X66 is being used. The size of the plot may be increased if the trees are too scattered so that a reasonable number of both the species are available in the plot)			66ft X 66ft
The following data of each tree within the plot (66x66) will be collected.			
Tree Number			
Species			
Estimated Form Factor			
Height in feet		DBH in Inches	
Bottom 1/3rd of the bole			
	Branch Number	Ocular	Ocular Estimate
	Branch # 1	Big/ Medium/ Small	Cft of wood
	Branch # 2	Big/ Medium/ Small	Cft of wood
	Branch # 3	Big/ Medium/ Small	Cft of wood
	Branch # 4	Big/ Medium/ Small	Cft of wood
	Branch # 5	Big/ Medium/ Small	Cft of wood
	Branch # 6	Big/ Medium/ Small	Cft of wood
	Branch # 7	Big/ Medium/ Small	Cft of wood
	Branch # 8	Big/ Medium/ Small	Cft of wood
	Branch # 9	Big/ Medium/ Small	Cft of wood
	Branch # 10	Big/ Medium/ Small	Cft of wood
Mid 1/3rd of the bole			
	Branch Number	Ocular	Ocular Estimate
	Branch # 1	Big/ Medium/ Small	Cft of wood
	Branch # 2	Big/ Medium/ Small	Cft of wood
	Branch # 3	Big/ Medium/ Small	Cft of wood
	Branch # 4	Big/ Medium/ Small	Cft of wood
	Branch # 5	Big/ Medium/ Small	Cft of wood
	Branch # 6	Big/ Medium/ Small	Cft of wood
	Branch # 7	Big/ Medium/ Small	Cft of wood
	Branch # 8	Big/ Medium/ Small	Cft of wood
	Branch # 9	Big/ Medium/ Small	Cft of wood
	Branch # 10	Big/ Medium/ Small	Cft of wood
Top 1/3rd of the bole			
	Branch Number	Ocular	Ocular Estimate
	Branch # 1	Big/ Medium/ Small	Cft of wood

	Branch # 2	Big/ Medium/ Small	Cft of wood
	Branch # 3	Big/ Medium/ Small	Cft of wood
	Branch # 4	Big/ Medium/ Small	Cft of wood
	Branch # 5	Big/ Medium/ Small	Cft of wood
	Branch # 6	Big/ Medium/ Small	Cft of wood
	Branch # 7	Big/ Medium/ Small	Cft of wood
	Branch # 8	Big/ Medium/ Small	Cft of wood
	Branch # 9	Big/ Medium/ Small	Cft of wood
	Branch # 10	Big/ Medium/ Small	Cft of wood

Tools to be taken to field

One GPS.

GIS maps showing patch and area of the patch.

One Abney's level.

Two wedge prism of 10 & 5 BAF.

One dao.

One 100 feet metallic tape.

Nylon rope (medium size about 200 feet long).

One small pot of red paint and a small brush.

Four ranging rods (straight bamboo poles of about 10 feet in length).

Data recording sheet.

Clip board for filed data recording.

Pencil (2B).

Eraser.

One Knife.

Four small (1ft x 1ft) red flags.

The silvicultural system suggested:

Ploarding at 5 year cycle.

All The branches on the lower 1/3rd of the bole will be harvested.

50% (by volume) of the branches on the middle 1/3rd of the bole will be harvested, preferably the bigger ones. It is estimated that about 1/3rd of the number of branches will be harvested to harvest 50% of the volume.

None of the branches on the top 1/3rd of the bole will be cut or harvested.

While harvesting these 'khataas' as branches, the top of every 5TH or 6TH Hijal tree, especially in areas that are not closely stocked, will also be cut at a point where the diameter is about 2.5 to 3 inches to induce the production of more branches in future.

Yield calculations

The total tree covered area in Tanguar Haor is 170 acres. Thus the area that will be worked every year is $(170/5 =)$ 34.0 acres say 34 acres. This will be distributed as under:

In thick area

$(34.0 * 0.290 = 9.86)$ say 10 acres. Since 29% of the total 170 acre is thick area.

In light area

$(34 * 0.458 = 15.57)$ say 16 acres. Since 46% of the total 170 acre is light area.

In very light area

$(34 * 0.251 = 8.53)$ say 8 acres. Since 25% of the total 170 acre is light area.

The annual yield will be prescribed as acres.

Expected annual yield has to be primarily prescribed in acres, category (thick, light & very light) wise.

Secondarily, the number of Katha and volume in Cft per acre, category wise (thick, light & very light), may be calculated.

Training (Course Outline originally designed)

This course outline for the community training was designed with the intention that the community personnel will acquire the knowledge of inventorying the natural resources (reeds & trees) and undertake the inventory to collect the required data for formulating the required management prescriptions. It was anticipated that these community personnel shall acquire the skill through intermittent practice so that they can do the monitoring as and when required.

Duration: Four days.

Trainers: Preferably a team of three (One forester, one GIS personnel and one good GPS user)

DAY 01

Use of hand held compass (60 minutes)

A hand held compass (may be a Silva Compass) will be shown to the trainees and described.

They will be show how the geographical direction is read from the compass.

It will be shown how a North South line is laid in the field with the help of the compass.

Every trainee will read the direction using the compass and shall establish a North South line on the ground.

Preliminary use of GPS (120 minutes)

A GPS will be shown to the trainees.

A general idea of what can be done by this instrument will be explained.

An idea of the Latitude and Longitude will be given to the trainees.

GPS reading of given point will be read and the trainees will be shown how the Latitude and Longitude are read from the GPS.

A map of the Tanguar Haor having the grid of latitude & Longitude will be laid before the trainees and they will require reading the Lat-Long of a few points on the maps laid out before them.

The Lat-Long of a given point in the field will be read using the GPS. These readings will be noted on the note book.

The trainees will require locating the point (GPS of the map) in the field.

Every trainee will practice reading Latitude and Longitude from the GPS and find out that position on the Map.

Map reading (60 minutes)

A Mauza map of the locality (the place where the training will be given) will be shown to the trainees.

The mauza map of the locality will be laid on a plain table.

Using the trough compass and the North line on the map it will be oriented.

The scale of the mauza map will be explained to the trainees.

All the legends of the Mauza map will be explained.

Using the divider the trainees will be shown how a given distance (of the field) is found out, using the map and its scale.

Nearby physical features will be noted and explained to the trainees.

Using the nearby physical features such as corner of a plot, pond, mosque, river curve, bridge, culvert, etc. The trainees will be shown how the approximate location, is identified on the map.

Some measurements of the nearby physical feature will be taken and it will be examined how they agree or disagree with the map.

Using the square grid it will be shown how the area of plot on the map can be found out.

Trainees will be shown how a line is extended, using the ranging rods or poles.

Each trainee will practice

Extend a line straight using ranging rods.

Orientation of a map.

Identify location using physical features and map features.

Reading the length of a plot line on the map with divider, calculate the field length using the scale of the map and verify that by physically measuring that line (may be an ile) on the ground.

Calculate the area of a plot using plastic grid sheet.

Harvest reeds & estimate quantity (1/2 day, afternoon)

Locate the sample patch using GPS

Select a representative sample point in the selected patch.

Lay out a 3ft x 3ft plot.

Harvest the reed weigh and tag.

Take air dried weight after 1 week of harvest.

Record data on the Form 01.

Calculations.

DAY 02

Basal Area & Point Sampling (one day)

Basal area:

The trainees will be explained what is basal area.

The trainees will be explained what is a cylinder.

Trainees will be explained how the volume of a cylinder is calculated.

Measure height of a tree using Abney's level (by using only % slope):

An Abney's level will be shown to the trainees and its use will be explained.

Trainees will be explained what we mean by tree height.

Trainees will be explained what is meant by percent slope and how %slope is used to find height.

Trainees will be taught how to measure the base line.

The "Eye Height" will be explained and everybody will find out his own eye-height .

Trainees will be explained how to use the Abney's level.

Trainees will be taught how to read the %slope from the Abney's level.

Trainees will be physically shown what (%slope) need to be read from the Abney's level.

Trainees will be taught how to measure the Base Line.

Trainees will be explained how to calculate out the height of a tree.

Wedge prism:

A wedge prism will be shown and what is done by this.

The BAF of a prism will be explained.

The trainees will be shown what is prism count.

Every trainee will practice reading prism count.

Trainees will be explained how the Basal Area per Acre is calculated.

Estimate the FF:

Trainees will be explained about the tapering of a tree (bole).

The volume of the cylinder against the volume of wood will be explained.

The term Form Factor will be explained to the trainees.

Trainees will be explained how to use the FF.

Assess the volume of wood per acre:

Trainees will be explained what is volume of wood.

Trainees will be told about the volume of wood.

Some explanation of volume vs weight will be given.

Trainees will be given an idea about the volume of wood in a given tree.

Trainees will be given an idea about the volume of wood per acre.

Trainees will be shown how the volume of wood per acre is calculated.

Fill out the relevant portion of the Form 02:

The trainees will be shown the Form 02 and it will be explained what are to be filled in.

Trainees will be shown how the required numbers are to be calculated from exercises done so far.

How parts of the Form 02 will be filled using the information so far collected from the field.

DAY 03

Locate Sample Site, Sample Point, Measure Tree Height & Estimate Branch Volume. (One day)

Locate the sample patch using GPS:

The sample patch will be explained to the trainees.

A GIS-map showing the sample sites for the trees will be laid before the trainees & it will be explained.

The trainees will be explained what is latitude & longitude and will be shown that these are written on the map (placed before them).

Trainees will be explained how to read the lat-long of a given point from the map.

The trainees will be explained how to locate that point in the field using the GPS.

The trainees will practice this with the GPS.

Select a representative Hijal and a representative Koroj tree.

Trainees will be given a vivid understanding about the term "Representative".

Explain the trainees as to what parameters are observed to select representative tree (Height of most tree, Form of most tree, Crown shape of most tree, Crown depth of most tree, etc.).

Each trainee will select representative tree separately.

The trainees will argue among them as to why that given tree was selected by him.

The trainees will be led to discuss and the trainer will facilitate the selection of a representative tree.

Measure logs to get an understanding about the volume of a branch.

The trainees will be given an idea of Quarter Girth Formula.

Trainees will be explained and taught about the measurement of length and mid girth of a log.

Trainees will be shown how these measurements are used to compute the volume of the log.

Every trainee will measure 4 logs (of different size and length) and find out the volume.

Every log they will be placed before them and they will look at these from distance as well as closely to visualize how a log of given volume look like.

Each trainee will be shown 5 different logs (numbered from 01 to 05) and asked to estimate the volume of each log and note them in their note book.

Each of these 5 logs will be measured by the trainees to calculate the volume of each log.

The volume calculated will be compared with their estimated volume to refine their volume estimate of tree branches.

Divide the tree height into 3 equal parts visually.

The trainees using their previous class teachings will measure the height of the representative tree that they selected.

Trainees with trainer's facilitation will find out the length of the 1/3rd of the bole height.

Trainees with trainer's facilitation will visually apportion the total height into 3 equal parts and find out an apparent natural marking on the bole dividing that into 3 equal parts.

Trainees with trainer's facilitation will refine their apportion activity.

Trainees with trainer's facilitation will count the branches in every 1/3rd of the bole, estimate the volume of each and note them.

Plot layout:

A point will be selected in the field.

The North South line passing through this point will be laid in the field using a (Silva) compass.

The trainees will be shown how a right angle is laid in the field, using metallic tape and one side of the right angle corroborates with the North South line laid.

The trainees with facilitation from the trainer will extend the lines to lay a 66 by 66 feet plot in the field.

Trainees will count the number of trees species wise and record these in their note book.

Fill out the Form 02:

The form 02 will be shown to the trainees and explained.

Using the note book recordings, each trainee will be shown as to how the required numbers required for filling the Form 02 are to be calculated.

Each trainee will fill up the Form 02.

The trainees with facilitation from the trainer will undertake all the calculations to make the required assessment.

DAY 04

Using Form 01 and 02, calculate the required numbers.

Constraints and Revision of the Training Module.

The above stated original course outline could not be implemented for various reasons such as Community personnel possessing the basic education required were not available.

Four day training was viewed to be too long.

Fund constrain.

Under this given situation it has been decided that
 the community will be given a very short training of about a day
 the data collection or the inventory required for formulation of prescription under this given assignment will be
 done engaging forestry students from Shahjalla University, Sylhet
 a revised training out line for one day training will be developed
 The one day training will be imparted.

In view of the above a revised training module was developed as under and the one day training was imparted to
 the local community personnel on September 26th 2013. The list of the names of the trainees is given in Annexure
 08.

Training Program (revised): Tentative Schedule

Date: September 26th 2013

Time: 10.30 AM to 5.30 PM

Venue: Tahirpur

From	To	Training mode	Remarks
1030	1100	Class room (theoretical)	Introduction & orientation. One set of hand outs will be given to each of the trainees. Show all the instruments. Read latitude & longitude on the globe.
1100	1115		Tea break
1115	1200	Class room (theoretical)	Explain the following instruments: Silva Compass. Metallic tape. Ranging rods. GPS. Abney's Level. Poly-bags used for nursery.
1200	1210		Break
1210	1300	Class room (theoretical)	Setting of right angle in the field using tape. Nursery techniques. Plantation techniques
1300	1330		Lunch & prayer break
1330	1430	Out door (Hand on)	Use of Silva Compass. Setting straight line using ranging rods. Setting of right angle in the field using tape. Measure dbh. Measure tree height using Abney's Level. Read latitude and longitude on the GPS. Map reading.
1430	1440		Break
1440	1615	Out door (Hand on)	Visit a forest nursery. Observe and practice some ongoing nursery activities. Practice some planting techniques. Visit a natural regeneration site. Observe & practice in some ongoing maintenance activities. Visit a log depot (may be a saw mills). Measure a few logs and calculate their volume of wood, using quarter girth formula.
1615	1630		Discussions and question answers.

Note: The local IUCN office will be arranging visits to a forest nursery & log (timber) depot. Sample poly-bags of three different sizes (7x5, 10x6 and 16x9 inches) shall be arranged by the local IUCN office for demonstration purpose.

Every trainee should be given at least The followings:

One clip-board

One 2B pencil

One eraser

One set of 16 handouts

4 white sheets of A4 size

Instruments Required for the Training

Community training of the Tanguar Haor area

Tahirpur, Sunamgonj

Under Tanguar Haor Project

Sl No.	Name of the instrument required	Number required
1	Wedge prism of BAF 10	2
2	Abney's Level	2
3	Silva Compass	2
4	33 feet metallic tape	2
5	100 feet metallic tape	1
6	Globes of bigger size	1
7	GPS along with batteries	2
8	Mauza map	2
9	GIS map	2
10	Logs of different diameter & length	5
11	10 ft long straight bamboo poles	9
12	Round bamboo sticks of about ½ inch dia and 12 inches long.	9
13	Spring balance (20 Kg)	1
14	Aluminum tree caliper	2
15	Polythene bags with holes punched 16" x 9" = 10 numbers 10" x 6" = 10 numbers 7" x 5" = 10 numbers	30

Appendix 4: Tentative Drafts of the Proposed Co-management Structure, Act and Rules Concerning a Possible Tanguar Haor Authority*

A. Re-designed Co-management Structure of Tanguar Haor

Tanguar Haor Shomajvittik Society

(Under this society, the 3-tier community based committee at village; union and central level are functioning as associated committee in the redesigned co-management structure)

10. Village Community Based Committee (This name replaces existing Village co-Management Committee)

The VCC is formed with elected an elected President, General Secretary, Treasurer, Office Secretary, Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary.

10.1 Election:

1. The VCC will comprise of 9 executive members. President, General Secretary, Treasurer, Office Secretary will be elected by the votes of the general body members of this committee.
2. Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary will be elected by the votes of the regular general body members of respective professions.
3. The post for Office Secretary, Small Business Secretary and Handicraft Secretary will be reserved for women members.

10.2 ToR of Village Community Based Committee:

1. Follow policy and guidelines of Tanguar Haor co-management structure, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
2. Participate actively in conserving the natural resources and biodiversity of Tanguar Haor as well as maintaining its ecosystem integrity.
3. Cooperate for resisting and preventing Tanguar Haor people from doing any activities harmful to Tanguar Haor biodiversity and ecosystem.
4. Plan and execute activities relating to Tanguar Haor natural resources, biodiversity conservation, ecosystem improvement, sustainable management, and organizational, financial, social and livelihood issues.
5. Create mass awareness among Tanguar Haor community, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
6. Ensure sustainable use of land, fisheries, forest and water resources following respective modalities/manuals according to the 'Wise-Use Principles'.
7. Participate in harvesting of fish, reeds and other resources in core zone and buffer zone under license/permit system.
8. Abstain from fish harvesting in Tanguar Haor during ban period and motivate others to stop fishing in breeding season.
9. Abstain from creating any obstructions at the fish migratory routes and fish harvesting in breeding season.
10. Provide support in conserving spawning ground, migratory routes and sanctuaries of fisheries and other species.
11. Abstain from catching rare species of fishes, wildlife and birds. Release those species alive at first sight, if caught in net or any gear.
12. Abstain from destroying aquatic species like oyster, snail, crab, turtle, snake etc. living in beels/kanda.

* Extracted from the original Bangla version.

13. Follow land use policy for ecosystem based homestead extension, land use and conservation.
14. Pump water from beels for irrigation in a particular way as well as at a sustainable level, following water use policy and participate in the activity for maintaining water flow of Tanguar Haor.
15. Conserve kandas of haor and actively participate to maintain reserved forests for ensuring habitat improvement, rich biodiversity and ecosystem integrity of flora/fauna.
16. Make afforestation of suitable species in the homestead and social afforestation in the selected levees of Tanguar Haor.
17. Apply compost and integrated pest management system in crop cultivation.
18. Provide support in climate resilient crop cultivation and extension.
19. Abstain from cultivation /raring activity that create negative impact on biodiversity and ecosystem of the haor.
20. Cattle rearing in the selected levees of Tanguar Haor at moderate level and prevent outsiders from ranching cattle and duck in the haor.
21. Repair crops protected dam and maintain navigation of river/channel/canal.
22. Take different activities for financial, social and livelihood improvement.
23. Strengthen resources guarding by providing support to community guards and socially resist miscreants involved in illegal extraction, stealing and over extraction of the Tanguar Haor resources.
24. Regularly participate in meetings on Tanguar Haor relating to sustainable management, organizational, financial, social and livelihood issues and increase the no. of community members.
25. Actively participate in any activities undertaken by the co-management committee for the sake of sustainable management in Tanguar Haor.
26. Provide support to other committees in establishing and strengthening Tanguar Haor co-management system.

11. Union Community Based Committee (This name replaces existing Union Co-management Committee)

The UCC will be formed with an elected President, General Secretary, Treasurer, Office Secretary, Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary.

11.1 Election:

1. President, General Secretary, Treasurer, Office Secretary, Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary will be elected among the members.
2. The post for Office Secretary, Small Business Secretary and Handicraft Secretary will be reserved for women members.

11.2 ToR of Union Community Based Committee:

1. Organize and sensitize community members to follow policy and guidelines of Tanguar Haor co-management structure, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
2. Ensure active participation of community people through mobilization in conservation of Tanguar Haor natural resources and biodiversity, ecosystem improvement, and co- management activity.
3. Increase awareness among community people for implementing the existing acts regarding ecosystem improvement and conservation of fisheries/birds/wildlife/swamp forest resources of Tanguar Haor.
4. Provide support for preventing and resisting Tanguar Haor people from doing any activities harmful to Tanguar Haor biodiversity and ecosystem.
5. Plan and implement activities at union level following village based planning relating to Tanguar Haor natural resources, biodiversity conservation, ecosystem improvement, sustainable management,

organizational, financial, social and livelihood issues, while through ensuring participation of Tanguar Haor community.

6. Take steps for creating mass awareness among Tanguar Haor community, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
 7. Organize and motivate community people for sustainable use of land, fisheries, forest and water resources following the 'Wise-Use Principles'.
 8. Coordinate and monitor harvesting of fish, reeds and other resources in core zone and buffer zone under license/permit system.
 9. Properly observe fish ban period through mobilization of Tanguar Haor community.
 10. Prevent people from creating any obstructions at the fish migratory routes in breeding season and resist those from fish harvesting during this period.
 11. Provide support and ensure members participation in conserving spawning ground, migratory routes and sanctuaries of fisheries and other species.
 12. Pump water from beels for irrigation in a particular way as well as at a sustainable level, following water use policy, and ensure maintaining water flow of Tanguar Haor.
 13. Conserve kandas of haor and ensure active participation of community members in maintaining reserved forests, for habitat improvement, rich biodiversity and ecosystem integrity of Tanguar Haor flora/fauna.
 14. Aware and support community people for making afforestation of suitable species in the homestead and social afforestation in the selected levees of Tanguar Haor.
 15. Mobilize and support community people for applying compost and integrated pest management system in crop cultivation.
 16. Mobilize and support community people for climate resilient crop cultivation and extension.
 17. Discourage community people from cultivation /raring activity that create negative impact on biodiversity and ecosystem of the haor.
 18. Motivate community people for cattle rearing in the selected levees of Tanguar Haor at moderate level and prevent outsiders from ranching cattle and duck in the haor.
 19. Support and ensure community participation in repairing crops protected dam and maintaining navigation of river/channel/canal.
 20. Take different activities for financial, social and livelihood improvement of community members, in order to reduce their dependency on Tanguar Haor resources.
 21. Strengthen resources guarding by monitoring activity of community guards, deployed for conserving the natural resources and biodiversity of Tanguar Haor as well as maintaining its ecosystem integrity, and take measures to resist miscreants socially who are involved in illegal extraction Tanguar Haor resources.
 22. Arrange regular meetings and other motivating activities on sustainable management, organizational, financial, social and livelihood issues of Tanguar Haor.
 23. Encourage and support community members for promoting eco-tourism.
 24. Actively participate in any activities undertaken by the co-management committee for the sake of sustainable management in Tanguar Haor.
 25. Provide support to other committees in establishing and strengthening Tanguar Haor co-management system.
12. **Central Community Based Committee (This name replaces existing Central Co-management Committee)**

The CCC will be formed with an elected President, General Secretary, Treasurer, Office Secretary, Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary.

12.1 Election:

1. President, General Secretary, Treasurer, Office Secretary, Agriculture Secretary, Fisherman Secretary, Livestock Secretary, Small Business Secretary and Handicraft Secretary will be elected among the members.
2. The post for Office Secretary, Small Business Secretary and Handicraft Secretary will be reserved for women members.

12.2 ToR of Central Community Based Committee:

1. Implement policy and guidelines of Tanguar Haor co-management structure, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
2. Ensure active participation of Tanguar Haor people in conserving the natural resources and biodiversity of Tanguar Haor as well as maintaining its ecosystem integrity.
3. Take initiatives for implementing the existing acts regarding ecosystem improvement and conservation of fisheries/birds/wildlife/swamp forest resources of Tanguar Haor.
4. Conduct awareness campaign for resisting Tanguar Haor people from doing any activities harmful to Tanguar Haor biodiversity and ecosystem.
5. Take initiative and provide support for preparing and implementing plan of village and union committee.
6. Ensure implementation of activities creating mass awareness among Tanguar Haor community, aiming to conserve the natural resources and biodiversity of Tanguar Haor as well as to maintain its ecosystem integrity.
7. Take steps for ensuring sustainable use of land, fisheries, forest and water resources following the 'Wise-Use Principles'.
8. Take actions to distribute license/permit system among members for harvesting of fish, reeds and other resources in core zone and buffer zone under.
9. Take steps for properly observing fish ban period through mobilization of Tanguar Haor community.
10. Take necessary actions for maintaining the fish migratory routes in breeding season and preventing illegal fish harvesting during this period.
11. Take necessary steps for conserving spawning ground, migratory routes and sanctuaries of fisheries and other species.
12. Initiate for repairing and maintaining crops protected dams, and running water flow of Tanguar Haor.
13. Ensure retake and conservation of haor kandas as well as maintenance of reserved forests, for habitat improvement, rich biodiversity and ecosystem integrity of Tanguar Haor flora/fauna.
14. Ensure implementation of ecosystem based homestead extension activity.
15. Ensure afforestation of suitable species in the homestead and social afforestation in the selected levees of Tanguar Haor.
16. Ensure applying compost and integrated pest management system in crop cultivation.
17. Take actions for climate resilient crop cultivation and extension.
18. Take initiatives to resist community people from cultivation /raring activity that create negative impact on biodiversity and ecosystem of the haor.
19. Take steps for cattle rearing in the selected levees of Tanguar Haor at moderate level and for preventing outsiders from ranching cattle and duck in the haor.
20. Support to produce resource harvesting and benefit sharing mechanism and make it effective.
21. Conduct different programs for financial, social and livelihood improvement of community members, in order to reduce their dependency on Tanguar Haor resources.
22. Take actions to strengthen resources guarding by monitoring the activity of community guards, deployed for conserving the natural resources and biodiversity of Tanguar Haor as well as maintaining its

ecosystem integrity, and take measures to resist miscreants socially who are involved in illegal extraction Tanguar Haor resources.

23. Take endeavours and provide support for promoting eco-tourism.
24. Conduct regular meetings and other motivating activities on sustainable management, organizational, financial, social and livelihood issues of Tanguar Haor.
25. Collection, management of fund and operate accounts for community organization.
26. Prepare progress report on implementing activities and financial status of the organization, and share with community members.
27. Work with conservation committees for protecting Tanguar Haor resources as well as maintaining law and order there, and cooperate local administration and the co-management committee.
28. Extend overall support for executing decisions and directions taken by Tanguar Haor co-management committee in conserving the natural resources and biodiversity of Tanguar Haor as well as maintaining its ecosystem integrity.
29. Submit the income and expenditure reports including the progress of the implementing activities to the co-management committee.

18. Tanguar Haor Union Conservation Committee

(Will function at union level)

The committee will be formed at union level comprising with the selected Union Parishad member, civil society member, representatives of fish trader group, youth group, minority group, community guard, and Union Community based Committee, and representative of government line agencies at Union level. Tanguar Haor Union Conservation Committee will operate its function at union level. This committee will play supportive role in Tanguar Haor Management as well as act as a social watchdog.

Structure of the Tanguar Haor Union Conservation Committee

Type of Member	Designation	Number
Female member of Union Parishad (Selected by Union Parishad Chairman)	Member	1 Person
Member of the Union Parishad Standing Committee on Environment Conservation and Tree Plantation/Fisheries and Livestock)	Member	1 Person
Representative from local wholesaler fish traders	Member	1 Person
Representative from Youth (Age limit 18-35; National Youth Policy 2003)	Member	1 Person
Representative from the Ethnic Minority groups (From Uttar Bangshikunda)	Member	1 Person
Representative from Community Guard (Selected by concerned Union Community based Committee under Tanguar Haor Community based Society)	Member	1 Person
Representative from the local potentials/Civil Society (Teachers, Physicians, Social Workers, Journalist, Religious leaders, Freedom Fighters and Cultural workers- at least 1 member must be female among them)	Member	4 Persons
Leaders of Union Community based Committee under Tanguar Haor Community based Society (President, General Secretary, Fisheries Secretary, Handicraft Secretary, Small Business Secretary)	Member	5 Persons
Selected Representative from the Tangua Nature Club	Member	1 Person
Representative of Government department at Union level (Land/Agriculture/ Fisheries/Forest)	Member	1 Person
Total Members		17 Persons

18.6 ToR of the Tanguar Haor Union Conservation Committee

1. To aim at maintaining the ecosystem integrity of Tanguar Haor, natural resources protection and biodiversity conservation, the committee will play facilitating role in implementation of the designed work plan of Union Community based Committee (UCC) and Village Community based Committee(VCC) as well as in ensuring sustainability of the achievements.
2. To aim at maintaining the ecosystem integrity of Tanguar Haor, natural resources protection and biodiversity conservation, the committee will play facilitating role in implementation of the designed work plan of Tanguar Haor Co-management Committee (THCC).
3. To provide suggestions and cooperation to the Tanguar Haor Society through observation, monitoring and supervision of the designed programme of the Society.
4. Take initiative to create social mobilization among the people of the Tanguar Haor area aiming at maintaining the ecosystem of Tanguar Haor, natural resources protection and biodiversity conservation.
5. Take steps, provide suggestions and cooperation for implementing the existing acts regarding ecosystem improvement and conservation of fisheries/birds/wildlife/swamp forest resources of Tanguar Haor.
6. Take steps, provide suggestions and cooperation for maintaining the water level of the wetland, navigation of wetland, conservation of sanctuaries, conservation of spawning ground of fisheries/birds/wildlife, maintenance of fish migratory routes of the river/channel/canal and habitat restoration, conservation and improvement for aquatic vegetation, plants including reeds, birds and wildlife.
7. Provide cooperation to the other committees in implementation and follow-up of the modalities/manuals of fisheries, forests, land, and water resources use/extraction according to wise use principle.
8. Produce the report through observation, monitoring and supervision of the harvesting activities of fish, reeds and other resources in core zone and buffer zone under license/permit system.
9. To take part in designing the modality of natural resources harvesting and sharing mechanism and observe the practice and cooperate in implementation of the modalities.
10. Observe the ban period of fishing in Tanguar Haor and take steps to protect the fish migratory routes in breeding season.
11. Afforestation of suitable species in the homestead and in the selected levees of Tanguar Haor, follow-up and provide support to social afforestation.
12. Follow-up of the progress and provide support to ecosystem based village protection activities.
13. Provide suggestions and support in following compost and integrated pest management system in crop cultivation.
14. Provide suggestions and support in climate resilient crop cultivation and extension.
15. Provide suggestions and support to take steps for imposing the ban of cultivation /raring system that create negative impact on biodiversity and ecosystem of the haor.
16. Provide suggestions and support to take steps in follow-up and implementation of the modality of the cattle rearing in the selected levees and duck rearing in the wetland at moderate level. Take steps to protect the owners of ranching cattle and duck from outside of the haor including their patrons.
17. Provide suggestions and support to operate the financial, social and livelihood improvement activities of the Society members for reducing the dependence on Tanguar Haor natural resources.
18. Provide suggestions and support to generate entrepreneurship in promoting eco-tourism in Tanguar Haor area.
19. To take support from the potentials in the society through sensitization for ensuring the protection of natural resources and maintaining the law and order in Tanguar Haor area as well as attain the responsive support from the concerned Union Parishads.
20. To take the necessary measures including social protection in order to protect illegal extraction, stealing and over extraction of the resources and maintain Tanguar Haor ecosystem.

21. To provide support to the Tanguar Haor Society and the local administration in operating the community guard engaged in protection of Tanguar Haor resources, and strengthening and ensuring of patrolling in Tanguar Haor area.
22. Provide all-out support in implementing the decisions and instructions of the co-management committee.
23. To ensure participation of the poor and all walk of the community in planning, implementation and conservation programme for natural resources management.
24. Prepare the income and expenditure reports including the progress of the designed activities regularly and produce to the committees in timely manner.

19. Tanguar Haor Co-management Committee

(Will function at whole Tanguar Haor area)

The committee will be formed at Upazila level comprising with the selected representatives from Tanguar Haor Union Conservation Committee, Central Committee of Tanguar Haor Society, civil society members, representatives of fish trader group, youth group, ethnic minority group, community guard, and Union Parishad Chairmen, and representative officials of government line agencies at Upazila level. Tanguar Haor Co-management Committee will operate its function at the whole area of Tanguar Haor. It will be the main local level driving force to manage the Tanguar Haor smoothly and sustainably.

Structure of the Tanguar Haor Co-management Committee

Type of Member	Designation	Number
Leaders of Central Committee under Tanguar Haor Community based Society (President, Secretary, Treasurer/ Fisheries Secretary, Handicraft Secretary/Small Business Secretary).	Member	3 Persons
Leaders of the Tanguar Haor Conservation Committee (President/Vice-President) (1 person x 4 Union)	Member	4 Persons
Representative from Community Guard (Selected by Tanguar Haor Community based Society)	Member	1 Person
Representative from the Civil Society (Teachers, Physicians, Social Workers, Journalist, Religious leaders, Freedom Fighters and Cultural workers- at least 1 member must be female among them)	Member	3 Persons
Representative from local wholesaler fish traders	Member	2 Person
Representative from Youth (Age limit 18-35)	Member	1 Person
Selected Representative from the Tangua Nature Club (Priority will be given to women)	Member	1 Person
Representative from the Ethnic Minority groups (From Uttar Bangshikunda)	Member	1 Person
Chairman of Union Parishad (4)	Member	4 Persons
Representative Government department (AC Land, Senior Upazila Fisheries Officer, Agriculture Extension Officer, Livestock Officer, Upazila Cooperative Officer/ First class officer- 2 Representatives from each Upazila will be selected by Upazila Nirbahi Officer Tahirpur and Dharmapasha Upazila)	Member	4 Persons
4 Officers of Law and Order division (Officer in Charge- Tahirpur and Dharmapasha Police Station/Upazila ANSAR and VDP Officer- Tahirpur and Dharmapasha)	Member	4 Persons
Total Members		28 Persons

19.6 ToR of Tanguar Haor Co-management Committee:

1. Design, implement and assessment of sustainable management plan for Tanguar Haor through direct participation of the dependent community with aiming at natural resources protection and biodiversity conservation, and maintaining the ecosystem integrity of Tanguar Haor.
2. Design/update and implement the sustainable management plan for Tanguar Haor through assessing the status of natural resources, biodiversity, and ecosystem condition after each 5 years interval and for reducing the possible negative impact of climate change. Moreover, to design the plan through engaging the bordering community of Tanguar Haor for developing the beel based natural resources management system or the more sustainable management system with the aim of sustainable management and creating sense of ownership among them on Tanguar Haor natural resources.
3. Take measures for maintaining the water level of wetland with good quality, navigation of river/channel/canal, conservation of sanctuaries, conservation of spawning ground of fisheries/birds/wildlife, maintenance of fish migratory routes of the river/channel/canal, and habitat restoration, conservation and improvement for aquatic vegetation, plants including reeds, birds and wildlife.
4. Take initiatives for designing the modalities/manuals of fisheries, forests, land, and water resources use/extraction according to wise use principle through engaging the dependent community and implement the approved modalities/manuals.
5. Take initiatives for designing the modalities of ecosystem based village protection activities, use of compost and integrated pest management system in crop cultivation, use of cattle grazing land, climate resilient crop cultivation and extension, and imposing ban on cultivation /aring system that creates negative impact on biodiversity and ecosystem of the haor, and also take measures for implementing those.
6. Take measures for implementing the existing acts regarding ecosystem improvement and conservation of fisheries/birds/wildlife/swamp forest resources of Tanguar Haor.
7. Take measures for bird census regularly, and monitor and evaluate the biodiversity status through community participation.
8. Take necessary actions for conservation of rare species of fish, bird, wildlife and plant.
9. Play active role in maintaining ecosystem integrity through protecting the entrance of exotic species in the haor.
10. Take initiatives in demarcation of ecological boundary, and landscape area of Tanguar Haor including boundary delineation and also take the necessary actions for maintaining those.
11. Design community awareness programme including day celebration on biodiversity conservation and sustainable management issues.
12. Take measures for observation of the ban period of fishing in Tanguar Haor, and protecting and maintaining the fish migratory routes in breeding season.
13. Take steps for afforestation of suitable species in the homestead and in the selected levees of Tanguar Haor, and take initiatives for social afforestation.
14. Operate the fish harvesting programme in core zone and buffer zone as per the approved modalities, select the fishermen and allocate the license/permit.
15. Take initiatives in designing the modality of natural resources extraction and benefit sharing mechanism and take actions in allocating the earned income/benefit equitably among the concerned stakeholders accordingly.
16. Take initiatives in processing and marketing of fisheries resources harvested from the core zone, and provide support in market extension of the other products.
17. Provide support to operate the financial, social and livelihood improvement activities of the Society members for reducing the dependence on Tanguar Haor natural resources.

18. Take actions in providing education, family planning, health care, hygiene and sanitation, fuel, electricity, safe potable water, improved homesteads facilities and protection of homesteads from wave erosion and flash flood through communication and coordination with the government concerned line agencies and non government organizations.
19. Provide suggestions and support to the skill development of women upholding the culture of the community and indigenous people, and operate various activities including income-generating activities.
20. Take initiatives in designing the modality of eco-tourism facility, promoting entrepreneurship on eco-tourism and managing eco-tourism in Tanguar Haor area.
21. Provide support to the Tanguar Haor Council in designing the guideline, strategy and act for Tanguar Haor management commensurate with the expert and long experienced wetland management strategies of different countries in the world.
22. Arrange the training and lesson learning visit for developing capacity of the members in their socio-economic improvement, leadership development, organizational development, conservation of natural resources and biodiversity, ecosystem management, etc.
23. Following the "Community Guard Recruitment and Operation Guideline" take the necessary measures for protection of illegal extraction, stealing and over extraction of the natural resources through taking support from the committees for Tanguar Haor. Take actions for formation and operation of 1 or 2 "Women Community Guard" comprising with the female members of the Society through the Tanguar Haor Conservation Committee at trial basis in order to protect the adjacent water bodies of the respective households in better way.
24. Take necessary actions for ensuring wise use principle of Tanguar Haor resources, protection of illegal extraction effectively and maintaining the law and order in Tanguar Haor area through coordination with the concerned line agencies at district and Upazila level.
25. Design the budget with plan, take approval from the National Steering Committee and collect fund from government and non-government organizations.
26. Deposit the collected money of different sources to the concerned bank account, preserve the income and expenditure statement and make ensure the annual audit.
27. Produce financial statement and progress report of accomplished activities to the meeting of Tanguar Haor Co-management Council.
28. Put the information and data regarding Tanguar Haor to the National Steering Committee for designing the guideline and act.
29. Make ensure transparency and accountability of the committee through implementing social accountability including social audit.
30. Establish the information communication system to provide the information for the mass awareness of the resource users.

20. Tanguar Haor Co-Management Council

Type of Member	Designation	Number
Deputy Commissioner	President	1 person
Director, Department of Environment, Sylhet	Member	1 person
3 Members of District Law and Order Committee (Police, BGB and ANSAR): Commanding Officer, 8 Battalion Border Guard, Border Guard of Bangladesh, Sunamganj; Superintendent of Police, Sunamganj; District ANSAR Commandant, Sunamganj	Member	3 Persons
Additional Deputy Commissioner (Revenue), Sunamganj	Member	1 Person
Upazila Nirbahi Officer, Tahirpur and Dharmapasha, Sunamganj	Member	2 Persons
Leaders of Tanguar Haor Co-Management Committee (Vice-President, Member Secretary, Treasurer and Secretary, Ecosystem and Biodiversity Conservation affairs.	Member	4 Persons
Central Leaders of Tanguar Haor Community based Society (President, Secretary, Treasurer and Fishery Secretary).	Member	4 Persons
Head of the different District level Government departments (Fishery/livestock/ Agriculture/Water Development Board/Local Government Engineering Department/Divisional Forest Officer/Bangladesh Haor and Wetland development Board, Sunamganj/Bangladesh Agricultural Development Corporation)	Member	8 Persons
4 Chairman of Local Union Council	Member	4 Persons
Leaders of the Tanguar Haor Conservation Committee (President/Vice-President) (1*4 Union)	Member	4 Persons
Representative from the wholesaler fish traders (Elected from the Co-Management Committee)	Member	1 Person
Representative from the Civil Society (Local Elites, Teachers, Physicians, Social Workers, Journalist, Religious leaders, Freedom Fighters and Cultural workers) Elected from the Co-Management Committee with at least one female representative.	Member	2 Persons
Youth Representatives (Age limit 18-35) elected from the Co-Management Committee	Member	1 Person
Selected Representative from the Tangua Nature Club (Elected from the Co-Management Committee)	Member	1 Person
Representatives from the Ethnic Minority groups (Elected from the Co-Management Committee)	Member	1 Person
President, Tanguar Haor Co-Management Committee	Member Secretary	1 Person
Total Members		39 Persons

20.6 ToR of Tanguar Haor Co-Management Council:

1. The council will provide overall cooperation and guidance and approve the budgets, work plan and modality prepared by the Tanguar Haor Co-Management Committee intended for conservation of the natural resources and biodiversity of Tanguar Haor and maintenance of its ecosystem integrity and making the sustainable management system effective. It will also present draft Policies to the National Steering Committee.
2. It will present the fishery, forest, land and water resources using policy and modality to the National Steering Committee for formation and approval which will ensure intensive engagement of the dependent community and wise use of the resources.

3. It will provide guidance for execution of the existing laws related to ecosystem development and conservation of fisheries/birds/wildlife/forest resources.
4. The council will provide guidance and assistance for taking necessary measures to protect entrance of unwanted exotic species in Tanguar Haor and conservation of rare species of fisheries, birds, wildlife and plants.
5. It will provide necessary assistance in order to demarcate the land and ecosystem boundary of Tanguar Haor and its adjoining landscape area.
6. The council will review the natural resources harvesting and income distribution policy and present it to the National Steering Committee for approval. It will also observe and evaluate the progress of implementation status of the approved policy/modality.
7. It will provide guidance and assistance for processing and marketing of fishery resources harvested from the core zone and marketing of the other products produced by the members.
8. It will provide guidance and assistance to ensure education, family planning, health services, hygienic sanitation, fuel, power and safe water and superior homestead as well as protection of homestead from the crash of webs during monsoon and crops from flash flood.
9. In order to conserve the biodiversity of Tanguar Haor through wise use of the resources the council will provide advice and cooperation to the people, institutions, awareness activities for skill development of local people, taking up better training and experiences sharing activities for those who are involved in co-management.
10. In order to reduce dependency on natural resources of Haor, it will provide necessary assistance in reviewing and approving sustainable programs taken for the development of economic, social and life standard of the members.
11. It will provide necessary assistance in reviewing and approving the policies taken for development of eco-tourism facilities in Tanguar Haor area.
12. It will present draft policies/strategies/laws to the Steering Committee for approval after preparing in line with the long practiced and well accepted wetland management strategies of different countries of the world.
13. In order to uphold the natural resources, biodiversity and ecological importance of the Haor, the council will present all innovative and appropriate action plans to the Steering Committee for approval, after preparing with involvement of different national/international, governmental and non-governmental institutions and universities.
14. Aiming to ensure sustainable management of the Haor, It will advise the co-management committee for developing a project proposal in order to create a conservation fund through communicating with different national/international governmental and non-governmental institutions.
15. It will provide assistance in adopting and implementing action plans in accordance with the advices of the National Scientific Body for Tanguar Haor and National Wetland Network established under the project titled Community based sustainable management of Tanguar Haor.
16. In order to ensure wise use of the Haor resources, maintenance of ecosystem as well as law and order, and prevention of illegal resources extraction, It will provide assistance to take necessary measures by coordinating with all concerned district level bodies.
17. The council will provide necessary assistance to the co-management committee in recruiting and operating the Community Guards as per provision of "Community Guard recruitment and operational Policy."
18. It will review and approve the financial statement of the Co-management committee along with the progress report of planned activities.
19. It will provide guidance to the Co-management committee and request to the National Steering Committee for taking necessary measures by regularly observing, monitoring and evaluating all the

activities taken up for upholding the rich resources, biodiversity and unique ecological character and importance of Tanguar Haor.

20. The council will ensure annual audit of the income and expenditure of the organization for maintaining accountability and transparency.

21. National Steering Committee

Type of Member	Designation	Number
Secretary, Ministry of Environment and Forests	President	1 Person
Joint Secretary (Development), Ministry of Environment and Forests	Member	1 Person
Representative from the Planning Commission	Member	1 Person
Representative from the Ministry of Home Affairs	Member	1 Person
Representative from the Ministry of Fisheries & Livestock	Member	1 Person
Representative from the Ministry of Water Resources	Member	1 Person
Representative from the Ministry of Land	Member	1 Person
Representative from Ministry of Agriculture	Member	1 Person
Representative from Economic Relations Division (ERD)	Member	1 Person
Representative from Implementation, Monitoring and Evaluation Division	Member	1 Person
Representative from Ministry of Relief and Rehabilitation	Member	1 Person
Representative from Department of Fisheries	Member	1 Person
Representative from Department of Forest	Member	1 Person
Representative from Water Development Board	Member	1 Person
Representative of Bangladesh Haor & Wetland Development Board	Member	1 Person
National Project Director, CBSMTH Project (Applicable upto June 30 2015)	Member	1 Person
Deputy Commissioner, Sunamgonj and President of Tanguar Haor Management Committee	Member	1 Person
Representative from SDC (Applicable upto June 30 2015)	Member	1 Person
Representative from IUCN Bangladesh Country Office	Member	1 Person
Nominated by the government- (1) One female member who is nationally and internationally recognized for her work in protection of environment and natural resources. (2) One media person / civil society member who has work experience at national and international level in protection of environment and natural resources.	Member	2 Persons
President and Member Secretary, Tanguar Haor Co-management Committee, Sunamgang	Member	1 Person
Deputy Chief, Ministry of Environment & Forest	Member	1 Person
Director (Natural Resources Management) Department of Environment	Member Secretary	1 Person
Total Members		29 Persons

21.3 ToR of National Steering Committee:

1. The committee will take necessary measures for innovating, if needed, more sustainable management modality and policy formulation in order to conserve the natural resources and biodiversity of Tanguar Haor and maintenance of its ecosystem integrity.
2. For policy formulation, It will take assistance from the the National Scientific Body and National Wetland Network by organizing meetings from time to time.
3. Provide overall cooperation and guidance for reviewing and approving policies/modalities, presented by the Tanguar Haor Community based Society, Tanguar Haor Co-management Committee and Council, in order to conserve the natural resources and biodiversity of Tanguar Haor, maintenance of its ecosystem integrity as well as making the sustainable management system effective.
4. Provide necessary staffs and budgetary support to the Tanguar Haor Co-management Committee, in order to effectively implement the activities, taken up to conserve the natural resources and biodiversity of the haor and maintenance of its ecosystem integrity as well as to make the sustainable management system effective.
5. Provide necessary assistance for implementation and approval of the activities taken up by the Council and Committee, in order to demarcate and protect the land and ecosystem boundary of Tanguar Haor and its adjoining landscape area.
6. In order to uphold the natural resources, biodiversity and ecological importance of the Haor, the committee will conduct research works by involving different national and international, governmental and non governmental institutions/universities, make necessary policies, strategies and laws which are prepared in accordance with the long practiced and well accepted wetland management strategies of the different countries of the world, provide training to persons, institutions and local community involved in such activities, and cooperate those for sharing experiences.
7. It will provide necessary guidance to the Council and Committee in order to conserve the natural resources and biodiversity of the Haor and manage the ecosystem as well as develop the life standard of the local community.
8. Based on availability of adequate number of competent researchers, it t will manage allocation of fund and provide necessary assistance to establish a National Wetland Research Institute under any government approved foreign university running in Bangladesh or under any public or government approved private university.
9. The committee will provide necessary guidance to the Tanguar Haor Co-management Council on the matters related to Ramsar Convention or any other international Treaty or Convention regarding wetland.
10. It will provide policy support and necessary assistance in monitoring, evaluation of the activities of Tanguar Haor Co-management Council, Tanguar Haor Co-management Committee, Tanguar Haor Union Conservation Committee and Village Co-management Committee, Union Co-management Committee, Central Co-management Committee formed under Tanguar Haor Community based Society, and also the activities implementing during project intervention. Moreover, it can appoint any competent governmental/non governmental body to regularly observe, monitor and evaluate the activities of any committee included in the co-management structure. Appointed body will present its activity report on observation, monitoring and evaluation in the meeting of Co-management Council and National Steering Committee. This Committee will take necessary measures and provide guidance to all concerned as per the recommendation of observation, monitoring and evaluation report after consideration of that report.
11. It will give approval of the proposed " Community Guard recruitment and operational Policy." and allocate lump grant in order to ensure wise use of the resources of Haor, maintenance of ecosystem, effectively preventing illegal resources extraction from the Haor and maintaining law and order.
12. It will fix up own working procedure to hold meeting of the National Steering Committee.

13. Member Secretary of this committee will preserve the meeting minutes of each meeting, distribute to the members and present it in the following meeting of the National Steering Committee.
14. The committee will provide assistance in implementation of the activities and goals of the current Community based sustainable management of Tanguar Haor Project-III Phase.

B. Proposed Tanguar Haor Management Rules 2014

Basis, effective date and Controlling Authority

These rules are framed as per power conferred vide Tanguar Haor Authority Act, 2014.

Shall come into immediate effect

Ministry of Forest and Environment is the authority which gives directives to ensure proper implementation of Tanguar Haor Management Rules, 2014 (Rule-3).

The Ministry of Forest and Environment and Offices/ Officials empowered by this Ministry are governed under these rules and can inspect Authority offices, Management Committee office and activities of the authority (Rule-4).

Proper use of Haor Resources (Rule-5) and Mass awareness (Rule-6)

Authority can prohibit extraction of resources to ensure measured use of Haor resources. No person or Institution/ firm shall extract resource from the Haor without having a license (Rule-5).

The Authority shall take following steps to improve mass awareness:

Taking huge publicity program;

Arrangement of meeting, Seminar, Symposium, Round-table conference, talk-show;

Aware people living in haor area about the need for preservation of Haor environment and bio-diversity, measured use of Haor resources, prohibited and sinful acts, developmental program to improve living standard of local people and special benefits of beneficiary (Rule-6).

Power and authority of the Executive Committee (Rule-8)

Person to preside over meeting: Executive Director.

Without violating provisions of the Act, following issues can be presented in the meeting:

Authority's fund, budget, investment and audit;

Analyze reports on monthly progress, monitoring and evaluating schemes under authority fund;

Decision making process:

Decision requires voting should be voted after presentation and approval at the meeting;

Committee member(s) has right not to vote but that should be recorded in resolution;

Member(s) can oppose any decision, which should be recorded and attached in the decision;

Decision should be unanimous or on simple majority;

Executive Director shall implement decision and preserve the resolution and all other relevant documents.

Income, Budget and Fund of the Authority (Rules-9, 10)

Collection and deposit:

Executive Director & officials responsible for collection is responsible for regular & fast assessment, collection and deposit in Authority Account;

No collection be kept pending. Bad-debts should be adjusted on proper manner;

Budget preparation approval:

Authority shall prepare & submit budget showing sectoral income-expenditure for govt. approval 3 months before completion of financial year;

Executive Director is primarily responsible for budget preparation. However, he can form committee(s) comprising Officials of the Authority;

Officials responsible shall consider all incomes and expenditures including those verified in advance.

Committees in the Authority

Upazila management committee shall comprise of.-

UNO	Chairperson
Elected representative (Chairman selected)	Member
Upazila Agriculture Officer	Member
Upazila Fisheries Officer	Member
Upazila Livestock Officer	Member
Upazila Engineer (LGED)	Member
Officer in Charge in Police Station	Member
Upazila Cooperative Officer	Member
Upazila Social Welfare Officer	Member
Upazila Youth Development Officer	Member
Upazila Ansar & VDP Officer	Member
Upazila Project Implementation Officer	Member
Local representative of BGB	Member
Tanguar Haor magt sub-committee chairperson	Member Secretary

2. Authority promulgated orders and circulars shall decide the ToR of the committee

Committee formation (Rule-12)

The Associate Haor Management Committee shall be formed under Financial Society Registration Act, 1860. The Associated Management Committee comprises central committee, Union committees.

The process of committee formation, management and conduct, functions and operational process shall be guided by orders/ circulars issued by the Authority.

Committee shall run as per schedule A of Rules.

Haor Natural Resources preservation

Licensing: Persons organizations must obtain license or permit for extraction from the Haor as per circular issued by the Authority. Licensing should ensure measured extraction and use of natural resources in the Haor (Rule-15).

Community Guarding: (1) Authority preserves the right to appoint guards as much as needed to conserve Haor natural resources.

(2) The process of such appointment, remuneration and all other issues shall be determined by orders and circulars of the Authority.

C. Proposed Tanguar Haor Management Authority

Establishment of the authority

The Government (M/O Forest and Environment) shall establish an Authority entitled, "Tanguar Haor Authority" at the earliest.

Authority will be a statutory body with continuity, a common seal and legal entitlement to acquire, possess and transfer both Movable and Non-movable Assets.

Authority will have Head Office at Sunamgonj Sadar and branches will be at Upazila HQ if needed (Sec-4)

Responsibility of the authority

The Authority shall establish the co-management system comprising of local people, local government and citizens with a view to maintain the quality of natural resources, maintain bio-diversity, arrange alternate income source for Haor dwellers and their overall standard of living.

2. (a) General Administration and functioning of the Authority shall be vested on Management Committee. The Management Committee shall have all power that the Authority has.

(b) The Management Committee shall follow rules, regulations, and circulars/orders issued by government time to time.

Formation of the Steering Committee

1. Steering committee shall be comprised of:

Honourble Minister, Ministry of Environment & Forests	Chair-person
Local MP	Member
Secretary, Forest and Environment Ministry	Member
Senior Secretary/ Secretary, M/O Public Administration	Member
Senior Secretary/ Secretary, M/O Fisheries and Livestock	Member
Senior Secretary/ Secretary, M/O Water Resources	Member
Senior Secretary/ Secretary, M/O Finance Division	Member
Senior Secretary/ Secretary, M/O Legislative & Parliament	Member
Senior Secretary/ Secretary, M/O Food & Disaster Mgt	Member
Senior Secretary/ Secretary, M/O Health & Fam. Welfare	Member
Senior Secretary/ Secretary, M/O Home Affairs	Member
Deputy Commissioner, Sunamgonj	Member
3 Experts nominated by Government	Member
Executive Director of the Authority	Member

2. Government has the right to cancel any of the nominations.

3. If required, Government can increase the size of the committee.

Power and authority of the steering committee

Finalize Authority's organizational structure and Terms of Reference;

Establishment of National Scientific body and National Wetland Network and take their support for policy formulation;

Establishment of Civil Society Platform and take their support for policy formulation;

Subject to support from universities and/or Government, help the Authority to establish National Wetland Research Institute;

Approve plan and budget of the Haor Management;

Ensure transparency and accountability of Authority;

Approve directives of the management committee;

Direct the management committee on Ramsar Contract and Wetland and other International contract or convention;

Direct steps to preserve of Bio-diversity and improve living standard of haor area;

Shall arrange national/international/development partner's help for general development of Haor and inhabitants there in;

Steering Committee meeting

There will be at least two meetings in a year, place & time of which shall be decided by Chairperson. Meeting can be arranged with a short notice;

Quorum will be with one third members, but no quorum is required for adjourned meetings;

Each member shall have one vote and Chairperson shall cast decisive vote, in case of equality;

Member secretary shall preserve the Minutes and send it to the members;

Decision of the steering committee shall not be illegal because of vacancy in member post or fault in committee formation;

Management Committee

Management Committee comprised of 30 members:

Local MP Advisor

Deputy Commissioner, Sunamgonj	Chair-person
Director, Department of Environment, Sylhet	Member
Upazila Parishad Chairmen, Tahirpur, Dharmapasha	Member
Commander, BGB, Battalion 8, Sunamgonj	Member
Police Super, Civil Surgeon, Deputy Director, Agricultural Extension	Member
District Education, Primary Education, fisheries, livestock Officers	Member
District Ansar Commandant, Ex-Engr, WDB, Sunamgonj	Member
Divisional forest officer, Sylhet	Member
UP Chairmen , North & south Sreepur, North and South Bangshikunda,	
Society based co-management committee president, Secretary and treasurer	Member
Two experts having contribution on environment nominated by Government	Member
Executive Director	Member Secretary

Functions and responsibilities of Management committee

Formulate policy for Haor Development, management and control;

Issue directives and circulars for smooth and proper functioning of society-based co-management committee;

Shall send Haor Management Plan for Steering Committee's approval;

Issue directives for improvement of living standard of beneficiaries;

Issue directives about using natural resources of Haor;

Direct to maintain bio-diversity in Haor area and Haor environment;

Implement multi-dimensional development program to improve living standard of Haor people;

Establish specialized information management system and educational information;

Raise awareness to maintain, preserve and develop overall Haor situation;

Improve professional capacity of persons related to environment preservation and development;

Formulate Haor management plan and

Provide support to maintain

Navigation of Haor, scientific, management of Swamp forest and Reeds, fish cultivation and extraction, forest live preservation and develop congenial communication in Haor area.

Improve tourism and overall living standard of Haor people.

Powers and Functions of the authority

1. Authority shall establish required number of co-management committees comprising Haor people and those shall be regulated by rules.

2. Powers and functions:

Formulate policy and recommend attaining aims and objectives;

Direct concerned to ensure best possible reservation and utilization of Haor resources;

Aware Haor people to preserve Haor resources and environment;

Arrange participation of govt, private party, Haor people, local Administration, NGO, gender-based organization and media;

Formulate policy to reduce pressure of people on Tanguar Haor and save natural resources;

Coordinate development and preservation of environment activities by different government organizations;

formulate plan and policy to save crops from flash flood and arrange employment for Haor people during rainy season;

Create congenial atmosphere to produce and market crops, develop communication and adapt climate;

Co-ordinate government bodies on basic amenities and services like education, health, family planning, sanitation etc.

Arrange alternate fuel to save Haor forest resources;

Save houses in Haor area during Rainy season;

The Management officials, with the help of NGOs shall ensure proper Administration and Finance;

Eco-system improvement, Natural Resources Management and Governance;

Livelihood improvement, capacity building and market extensions;

Monitoring and evaluation, Knowledge management;

Research;

Communications and Publications;

Health and Family Planning, water sanitation;

Education, community awareness and empowerment;

Formulate annual work plan in consultation with society based co-management committee;

Ownership of all Khasland in Tanguar Haor shall be at the hands of Authority and authority shall decide management of such lands;

Deputy Commissioner shall approve finally the exchange of lands beyond and within Haor;

Private lands shall be acquired through multi-level discussion;

Shall take disciplinary action against wastage and illegal extraction of Haor resources;

Carry out other responsibilities assigned by the government

Executive Director

Government shall appoint Executive Director and select terms and conditions of his service;

Executive Director shall be the Chief Executive Officer and shall ---

Be responsible to implement decisions and directives of Management Committee;

Exercise powers delegated by Management Committee;

Administer Authority administration;

Formulate management plan for Haor management and development;

Implement plans and programs approved by the Management Committee;

Formulate Authority budget;

Appoint and promote Authority officials taking recommendations of management committee within structural organization;

Ensure proper conduct and discipline of officers and staffs;

Perform other functions assigned by management committee.

Officials, Application of rules and Authority funds

Authority is empowered to appoint staffs and Officers including Executive Magistrate within the organizational structure and their services shall be regulated by regulations (Sec-16);

Authority shall abide by all rules and contracts on preservation of bio-diversity signed by government (Sec-17);

(a) Authority fund shall be comprised of money received from different sectors, grants from government, grants from local authority, grants from development partners and international bodies as per steering committee approval and from any other resources.

(b) Funds shall be kept in schedule bank under Authority account;

(c) Expenditures shall be met in accordance with rules, regulations and policy of the Authority;

(d) Can invest funds in any sector approved by Government (Sec-18).

Budget Management Plan Formulation and Maintenance of Accounts and Audit (Sec-19-21)

Authority shall prepare budget showing income and expenditure of next year including funds required from Government;

Shall prepare management plan for specific period and yearly budget to implement such plan. Steering committee shall approve such plan subject to approval of management committee and shall arrange funds required to implement such plan;

(a) Authority shall maintain accounts and prepare annual statements of accounts;

(b) C & AG shall audit such accounts annually and report thereof to government and Authority;

(c) Persons authorized by C & AG shall have authority to examine all relevant records and examine any staffs.

Annual report

Authority shall prepare and submit a report within 3 months of completion of financial year to the Government;

Government can ask for reports/returns on any issue at any time and the Authority is bound to submit such report;

Government can ask to inspect on any issue of the authority.

2. Authority can form community guard and that will be guided by rules.

Any act stated in schedule shall be treated as crime and shall be treated as offence.

Trying of such offence requires written complaint from Executive Director or persons authorized by him, shall be tried by mobile court under Mobile Court Act, 2011.

Offences

Offences under this Act are cognizable & would not amount to bail, and persons shall be punishable with maximum 50,000 taka and 3 months simple imprisonment (Sec-26);

Mobile court shall try these offences (Sec-27);

Government can frame rules and regulations notifying in the official gazette (Sec-28, 29);

Authority can impose conditions on agriculture, livestock rearing, birds rearing, etc. if it considers such activities shall harm bio-diversity (Sec-31);

Authority shall publish reliable English version of this Act in the Official Gazette and in case of contradiction, the Bangla version shall get priority over English version (Sec-32);

Clarification on any of the section shall be circulated through official gazette to remove obscurity (Sec-33);

Provisions of this Act shall get priority over all other laws enforced in the country (Sec-34).

About IUCN

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges.

IUCN's work focuses on valuing and conserving nature, ensuring effective and equitable governance of its use, and deploying nature-based solutions to global challenges in climate, food and development. IUCN supports scientific research, manages field projects all over the world, and brings governments, NGOs, the UN and companies together to develop policy, laws and best practice.

IUCN is the world's oldest and largest global environmental organization, with more than 1,300 government and NGO Members and almost 15,000 volunteer experts in some 160 countries. IUCN's work is supported by over 1,000 staff in 45 offices and hundreds of partners in public, NGO and private sectors around the world.



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