



BANGLADESH NATIONAL CONSERVATION STRATEGY 2021-2036



Ministry of Environment, Forest and Climate Change
Government of the People's Republic of Bangladesh



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2021

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FOREWORD

The Government of Bangladesh is committed to conserving and protecting the nature and natural resources of the country by pursuing the Clause 18A of the Constitution of Bangladesh, which mentions the the *State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future generations*. Accordingly, Bangladesh's current development policies put greater emphasis on sustainable development, restoration and conservation of natural resources. Bangladesh has recently taken a policy leap in developing long-term strategies like Bangladesh Delta Plan 2100, Vision 2041, the 20-year perspective plan, 2021-2041, and the 8th Five Year Plan, 2020-2025 to match its long-term development and conservation related challenges. The National Conservation Strategy (NCS), 2021 to 2036, was also formulated in view of the long-term global and national perspectives of the environment and development nexus and to fulfil the global commitments and constitutional obligations regarding natural resource management.

Formulation of NCS began soon after Bangladesh endorsed the World Conservation Strategy in the 1980s. However, the first draft of the NCS was completed in 1993. Following the recent directive from the Cabinet, Ministry of Environment, Forest and Climate Change updated the draft incorporating the latest national and global priorities and perspectives related to the nature conservation. An expert committee consisting renowned sectoral experts and scientists formulated the draft of the NCS. Finalization of the NCS involves the views and inputs from an extensive baseline study, stakeholder consultations and consultation with government officials.

Based on the expert opinions received through consultations and inline with the 2030 Agenda for Sustainable Development Sustainable Development Goals core elements of the NCS are formed. A total of 25 sectors were identified that directly or indirectly influence the state of natural resources in Bangladesh. These sectors were analysed for their links to SDGs and other international commitments, and finally, conservation strategies and action points were identified for each of these NCS sectors. The document provides 15-year strategic framework for guiding the sectors to consult towards making informed decisions in conserving nature and biodiversity while managing the natural resources.

Implementation of NCS is the responsibility of the government and all other non-government actors involved with the economic development of Bangladesh. As Bangladesh is in the process of graduating as a middle-income country, the updated NCS will guide ensuring socially inclusive and environmentally sustainable economic growth.

The Ministry of Environment, Forest and Climate Change would like to thank everyone who contributed during the NCS update process. I also extend special appreciation to IUCN for providing technical and expert support and the Bangladesh Climate Change Trust for providing support in financing the activities towards development of the NCS.



Dr. Farhina Ahmed
Secretary

Ministry of Environment, Forest and Climate Change

ABBREVIATIONS AND ACRONYMS

AIS	Agricultural Information Services
AIGs	Alternative Income Generators
ANR	Assisted Natural Regeneration
BADC	Bangladesh Agriculture Development Corporation
BAEC	Bangladesh Atomic Energy Commission
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agriculture University
BARC	Bangladesh Agricultural Research Council
BBRC	Bangladesh Biodiversity Research Centre
BBA	Bangladesh Bridge Authority
BBS	Bangladesh Bureau of Statistics
BCC	Bangladesh Computer Council
BCCTF	Bangladesh Climate Change Trust Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCSIR	Bangladesh Council of Scientific and Industrial Research
BCIC	Bangladesh Commercial Industries Corporation
BDP	Bangladesh Delta Plan
BEPRC	Bangladesh Energy and Power Research Council
BERC	Bangladesh Energy Regulatory Commission
BFRI	Bangladesh Forest Research Institute
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BINA	Bangladesh Institute of Nuclear Agriculture
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
BJRI	Bangladesh Jute Research Institute
BLRI	Bangladesh Livestock Research Institute
BMD	Bangladesh Meteorological Department
BMDA	Barind Multipurpose Development Authority
Bn	Billion

BNH	Bangladesh National Herbarium
BPDB	Bangladesh Power Development Board
BPC	Bangladesh Petroleum Corporation
BRRI	Bangladesh Rice Research Institute
BRTA	Bangladesh Road Transport Authority
BRA	Bangladesh Railway Authority
BR	Bangladesh Railway
BSCIC	Bangladesh Small and Cottage Industries Corporation
BSRI	Bangladesh Sugarcane Research Institute
BSFIC	Bangladesh Sugar and Food Industries Corporation
BSEC	Bangladesh Security and Exchange Commission
BTB	Bangladesh Tourism Board
BTRC	Bangladesh Telecommunication Regulatory Commission
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CAAB	Civil Aviation Authority of Bangladesh
CPA	Chittagong Port Authority
CBD	Convention on Biological Diversity
CDB	Cotton Development Board
CDA	Chattogram Development Authority
CHT	Chittagong Hill Tracts
DAE	Department of Agriculture Extension
DBHWD	Department of Bangladesh Haor and Wetlands Development
DDM	Department of Disaster Management
DESCO	Dhaka Electric Supply Company
DGHS	Directorate General of Health Science
DLS	Department of Livestock Services
DLRS	Directorate of Land Records and Surveys
DMD	Debt Management Department
DNCC	Dhaka North City Corporation
DoE	Department of Environment
DoF	Department of Fisheries
DoS	Department of Shipping
DPHE	Department of Public Health and Engineering

DPDC	Dhaka Power Distribution Company
DRR	Disaster Risk Reduction
DSCC	Dhaka South City Corporation
DTCA	Dhaka Transport Coordination Authority
DWA	Directorate of Women Affairs
EbA	Ecosystem-based Adaptation
ECAs	Ecologically Critical Areas
Eco-DRR	Ecosystem-based DRR
EEZ	Exclusive Economic Zone
EPB	Export Promotion Bureau
ERD	Economic Relation Division
ETP	Effluent Treatment Plant
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
FAP	Food Action Plan
FBCCI	Federation of Bangladesh Chambers of Commerce and Industries
FD	Forest Department
FIGNSP	Forest Information Generation and Networking Support Project
FPCO	Flood Plan Coordination organization
FSCD	Fire Service and Civil Defence
FY	Fiscal Year
GDP	Gross Domestic Product
GED	General Economic Division
GIS	Geographic Information System
GNI	Gross National Income
HLPW	High Level Panel on Water
ICT	Information and Communication Technology
IFC	International Finance Corporation
IMED	Implementation, Monitoring and Evaluation Division
IPM	Integrated Pest Management
IPNS	Integrated Plant Nutrient Management
IRRI	International Rice Research Institute
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management

JRC	Joint River Commission
KDA	Khulna Development Authority
Km	Kilometer
kWh	kilowatt-hour
LDCs	Least Developed Countries
LDN	Land Degradation Neutrality
LGD	Local Government Division
LGED	Local Government Engineering Department
LGIs	Local Government Institutions
LGRD	Local Government and Rural Development
LPB	Land Ports of Bangladesh
MCCI	Metropolitan Chamber of Commerce and Industries
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MMR	Maternal Mortality Rate
MoA	Ministry of Agriculture
MoCAT	Ministry of Civil Aviation and Tourism
MoCA	Ministry of Cultural Affairs
MoCHTA	Ministry of Chittagong Hill Tracts Affairs
MoD	Ministry of Defence
MoDMR	Ministry of Disaster Management and Relief
MoE	Ministry of Education
MoEFCC	Ministry of Environment, Forest and Climate Change
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoFL	Ministry of Fisheries and Livestock
MoHA	Ministry of Home Affairs
MoHFW	Ministry of Health and Family Welfare
MoHPW	Ministry of Housing and Public Works
MoI	Ministry of Information and Broadcasting
MoInd	Ministry of Industries
MoL	Ministry of Land
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MoLJPA	Ministry of Law, Justice and Parliamentary Affairs

MoP	Ministry of Planning
MoPEMR	Ministry of Power, Energy and Mineral Resources
MoPME	Ministry of Primary and Mass Education
MoRTB	Ministry of Road, Transport and Bridges
MoS	Ministry of Shipping
MoST	Ministry of Science and Technology
MoSICT	Ministry of Science, Information and Communication Technology
MoSIWT	Ministry of Shipping and Inland Water Transport
MPA	Marine Protected Area
MPA	Mongla Port Authority
MoTJ	Ministry of Textiles and Jute
MoWCA	Ministry of Women and Children Affairs
MoWR	Ministry of Water Resource
MW	Mega Watt
NAP	National Agricultural Policy
NAPP	National Action Program Plan
NAPA	National Adaptation Programme of Action
NARS	National Agricultural Research System
NAWASIC	National Water Supply and Sanitation Information Centre
NBR	National Board of Revenue
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategy and Action Plan
NCS	National Conservation Strategy
NCTB	National Curriculum and Textbook Board
NEC	National Economic Council
NGO	Non-Government Organization
NHA	National Housing Authority
NIB	National Institute of Biotechnology
NIPSONM	National Institute of Preventive and Social Medicine
NOSCOP	National Oil and Chemical Spill Contingency Plan
NSDS	National Sustainable Development Strategy
NTD	Neglected Tropical Diseases
NWP	National Water Plan
NWMP	National Water Management Plan

PA	Protected Area
PC	Planning Commission
PCB	Private Commercial Bank
PDB	Power Development Board
PPP	Public Private Partnership
Ppt	Parts per trillion
PGCB	Power Grid Company of Bangladesh
PPA	Payra Port Authority
PaCT	Partnership for Cleaner Textile
PMO	Prime Minister's Office
RAJUK	Rajdhani Unnayan Katripakkho
REB	Rural Electrification Board
RHD	Roads and Highways Department
RIMS	Resources Information Management System
RRI	River Research Institute
SDC	Sustainable Development Commission
SDGs	Sustainable Development Goals
SID	Statistics and Informatics Division
SKWC	Sheikh Kamal Wildlife Center
SOB	Survey of Bangladesh
SRDI	Soil Resource Development Institute
SREDA	Sustainable and Renewable Energy Development Authority
SUFAL	Sustainable Forest and Livelihoods
STP	Strategic Transport Plan
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
UDD	Urban Development Directorate
UGC	University Grants Commission
VCF	Village Common Forest
WARPO	Water Resources Planning Organization
WASA	Water Supply and Sewerage Authority
WASH	Water, Sanitation and Hygiene
WSS-HRD	Water Supply and Sanitation- Human Resource Development
WZPDCL	West Zone Power Distribution Company Ltd.

EXECUTIVE SUMMARY

Human wellbeing, economic and social development, even our very existence essentially and intricately depends on the Nature. It was, however, not until 1980 when all nations came together to identify a common vision that appreciates the very close relationships between human and the nature and to aim for a balance between economic growth and environmental sustainability through the World Conservation Strategy. The adoption of the Millennium Development Goals (MDGs) in 2000 and the Sustainable Development Goals (SDGs) in 2015 are the two other milestones the world has seen over the last four decades. The SDG Framework talks about resource conservation, efficiency in resource use, and maintaining integrity of the environment particularly for attaining the Goals on eradication of poverty and hunger – two overarching SDGs. All these indicate the fact that the Nature has increasingly been taking a center stage in the development discourse. The Bangladesh National Conservation Strategy(NCS) appreciates these three global events as well as the general development discussions surrounding human kind's relationship with the Nature.

The Bangladesh NCS was formulated as a response to the decisions of the Cabinet of the Government of Bangladesh. The NCS formulation started by preparing reports on 25 sectors which are linked with the corresponding SDGs and targets and are grouped into three clusters. The first cluster is the natural resource sectors, namely land resources, water resources, forest resources, biodiversity, fisheries resources, livestock resources, primary energy and minerals resources, and marine and coastal resources. The second cluster is the natural resource dependent sectors, such as agriculture, industries, power, transport and communications, rural development, and urbanization, housing and settlement planning. The third cluster includes sectors that would support implementation of the NCS. Eleven sectors in this cluster are human resources, gender, health and sanitation, disasters and disasters management, environment and international obligations, environmental education and awareness, information and communication technology, financing strategy, monitoring and coordination mechanism for NCS implementation, institutional framework for NCS implementation, and legal aspects of NCS.

The main thrust of the NCS is to view it within a unified and holistic sustainable development framework rather than stand-alone sectoral issues – because of the dependency of sectors on one another. For preparing this national document, workshops were arranged in all administrative divisional headquarters to collate information and opinion from relevant stakeholders.

The following issues were considered in the NCS formulation:

- Status and analysis of natural resource degradation and depletion;
- Proposals for resource enhancement; and
- Inter-sectoral linkages and their implications for development, conservation of the resources or sectors with attention to synergy or conflicts between or among sectoral policies.

The Bangladesh NCS formulation exercise has clearly established that the SDG and the NCS are intertwined, in many cases, they are indistinguishable. The linkage is such an intricate one that often the implementation of one is a necessary condition for attaining the other targets and conservation in another sector or target. Butterfly effects, which means that a small change in some place may create rather large unintended perturbation in another place, are almost certain in such a situation.

The NCS sectoral reports outlined recommendations for future strategy and action plan. The strategies of each sectors can be summarized as followed-

Natural resources sectors

1. Land Resources: The conservation strategy for land resource should focus on policy and legal instruments, institutional capacities, inter-agency coordination, incentive mechanism, awareness raising, and monitoring elements around land sector towards an integrated land zoning and sustainable management of land resources.
2. Water Resources: Given that water permeates almost any sphere of human action and that preserving ecosystem balance, the basic principle of NCS water sector is Integrated Water Resources Management (IWRM).
3. Forest Resources: The future strategies should give more attention to the full and effective practice of co-management as well as preservation of natural forests. While social forestry should be encouraged, this should not be taken to be a substitute for natural forests.
4. Biodiversity: As a biodiversity rich country, Bangladesh's conservation strategy should be highly focused on halting loss of biodiversity and restoration of degraded ecosystems and its goods and services. For biodiversity conservation, the strategy is to make people aware of the value of biodiversity and mainstreaming the importance of conservation and sustainable use of Biodiversity in the development planning process and integrating the value of biodiversity into national accounting of GDP.
5. Inland Fisheries: The strategy include sustainable use and maintenance of fish habitats and inland wetland ecosystems, such as, Ponds, Haor, Baor, Beels, Canals, Lakes and Riverine areas through legal, technical and ecosystem-based approach, ensuring engagement of resource dependent communities especially fisher folks.

6. Coastal and Marine Resources: Exploratory surveys are essential for stock assessment of all major species of coastal fisheries and other resources. Sustainable utilization of ‘blue resources’ is to be ensured in the context of ‘Blue Economic Growth’ and tie together with the SDG 14.
7. Livestock Resources: The strategy for livestock resources conservation would be doubling production as well as ensuring conservation of genetic resources of local breeds.
8. Primary Energy and Minerals: Regulations, policies and institutions of Bangladesh should be updated/reformed and adequately made functional in line with the Eighth Five Year Plan (2020-2025) and the SDG targets ensuring conservation of ecosystems as well as, rehabilitation and resettlement of the project-affected people of mining of energy and mineral resources.

Natural resources dependent sectors

9. Agriculture: Bangladesh NCS would put emphasis on conservation of agricultural biodiversity, reduction of land degradation, safe use of agro-chemicals and related other issues for the sustainability of agriculture.
10. Industry: Industrial growth taking into consideration of healthy environment, ecosystem and human ecology would be the utmost priority in terms of conservation strategy. It is important to establish a national high-level forum to take coordinated conservation measures across tiers of governance and to ensure high level political guidance for successful implementation of conservation measures in the face of industrial and urban development.
11. Power: To conserve energy, the best way is to improve energy efficiency and control misuse of energy.
12. Rural Development: A vital step is to revise the National Rural Development Policy and make it productivity-oriented along the lines of the SDG targets, adopt programmes and projects accordingly under various natural resource management programmes as well as the sectors which are dependent on the natural resources. As the rural areas have high potential to conserve species and genetic diversity of cultivable and wild variety of crops, livestock, medicinal and as well as wildlife resources, our rural development vision should be living in harmony with nature and community engagement in the conservation would be very important.
13. Transportation and Communication: Towards achieving the goals, the development of fuel-free active transport and energy efficient and affordable public transport system with special attention to the needs of those in vulnerable situations as well as by improving safety are considered to be the best strategies. Conservation focus in construction and installation of infrastructures

of transportation and communication sector should follow a paradigm shift towards ensuring ecosystem friendly and prevention mitigation measures to address obstruction on the flow regime and other impacts on the ecology and environment.

14. Urbanization, Housing and Settlement Planning: Urbanization should be planned in a way that settlements are protected from and be resilient to disasters. To ensure sustainable and ecologically viable settlements, all future growth needs to be strictly monitored. Compact settlement development, densification of existing rural and urban settlements should be a strategic choice.

Natural resources supportive sectors

15. Human Resources: The conservation strategies urge on strengthening human resources by including environmental resource management nationally at secondary and higher secondary level of education, enhance and update of university course curricula, and extensive investment on related research and innovation. Strategies particularly emphasize on public health safety by increased number of trained health professionals on environmental contaminations, creating mass awareness on clinical waste management, making sanitary materials affordable for all and food safety from farm to market level.
16. Gender: The conservation strategy should give recognition of present roles and safeguards of women, and it must go beyond that to increase the role of women as managers of natural resources. Each NCS sector need to explore more in-depth possibility to find the entry points for men and women to contribute in resource management and gender disaggregated/ segregated data should be managed and reflected in all the development initiatives on conservation.
17. Health and Sanitation: Based on the prevailing limitations and opportunities in the health and sanitation sector, for attaining the targets under the SDG 6 it is required to mainstream environmental conservation in this sector.
18. Disaster and Disaster Management: The major approach of NCS in Disaster Risk Reduction (DRR) would be Ecosystem-based DRR or (Eco-DRR) and Ecosystem-based Adaptation (EbA) into strategies, policies, planning, and development programmes at all levels as a part of paradigm shifts in disaster management.
19. Environment and International Obligation: The strategies are- capacity building at individual, organizational and systemic levels, institutionalizing an enabling legal and policy framework and establishing stakeholder partnerships and networks nationally and internationally to mobilize financial, technical and technological resources for implementation of the MEAs.
20. Environmental Education and Awareness: The strategy is to update academic curricula at all levels by giving due emphasis on environment and conservation

issues and undertake specific environmental education and awareness programmes with specific purposes, for specific audience.

21. Information and Communication Technology: The strategy is to fulfill the SDG target 9c to significantly increase access to information and communications technology and affordable access to the internet. The areas that cut across conservation issues include early warning, risk reduction and management of national and global health risks, women's empowerment, and monitor sustainable development. Management of e-waste should also be given priority.
22. Financing Strategy: Allocation, expenditure and impacts of the various conservation-centric programmes and projects, globally best practices of the financing mechanisms, and available funds of the prospective funding sources should be reviewed.
23. Monitoring and Coordination Mechanism for NCS Implementation: Internal and external monitoring mechanism should be in place to monitor the implementation of NCS while and audit should undertake to track the progress of achieving the NCS objectives. Total monitoring system should be well designed and tested with contingency planning. Monitoring results need to regularly be communicated among the concern stakeholders.
24. Institutional Framework: Implementation of NCS should periodically be reviewed by the National Environment Committee and National Executive Committee for necessary policy directions and required actions to be taken towards conservation, sustainable use of natural resources. NCS should be mainstreamed at the institutional and individual level.
25. Legal Aspect: A holistic legal and policy framework covering the institutional and technical aspects of conservation with effective monitoring and compliance mechanism can help to reduce environmental degradation, to promote environmental sustainability, sound natural resource management and sustainable development.

A very important aspect of any particular programme, project, technology or activity must be the resource footprint it may have and examine how in cost-effective manner the least resource-intensive actions might be taken. This implies that the present project documents should be reviewed in line with the Bangladesh NCS.

The Bangladesh NCS has been formulated with an aim to identify environmental problems as well as their solutions. Unplanned use of natural resources, like unplanned use of water and land; forest degradation; unplanned urbanization; excessive use of natural resources; lack of awareness; lack of coordination among departments and agencies; lack of proper enforcement; and limited allocation of financial resources are identified as drivers for environmental degradation. For resolving aforesaid problems, three issues are given importance, namely enhancing institutional capacity, mass

awareness, and enforcement. Moreover, along with conservation, importance has been given on providing incentives or recognition for positive conservation initiatives. At last, the following actions are given importance for proper management of natural resources of Bangladesh.

1. Reducing dependency of agriculture and drinking water supply sector on ground water and ensuring conservation of ground water.
2. Increasing tree cover and conserving forest biodiversity through proper enforcement of laws and promoting participatory management.
3. Documenting information related to biodiversity and taking comprehensive measures to conserve it during implementing development projects.
4. Preventing unplanned use of natural resources through proper enforcement of existing laws.
5. Enhancing institutional capacity and establishing inter-departmental coordination.
6. Planning for necessary infrastructure to supply and use of solar energy.
7. Increasing mixed cropping and use of organic and balanced fertilizer for reducing use of chemical fertilizer and other chemicals.
8. Formulating comprehensive roadmap for implementation of renewable energy programme.
9. Increasing women's access to information and ensuring women's participation in planning, management and overall decision making.
10. Preparing plans for urban and rural development, including waste management.
11. Taking awareness and education programmes for systematic dissemination of information and education regarding environmental pollution, degradation and natural resources management.
12. Preparing plans and programmes for substantive investment for disaster preparedness at all levels (household, community, upazila and national).
13. Placing internal and external monitoring mechanisms for on-going projects along with adequate financial, human and other logistics support.
14. Forming Sustainable Development Commission with sufficient legal power, a broad mandate, and magisterial jurisdiction and clout with adequate finance.
15. Ensuring adequate financial support for NCS implementation.
16. Taking initiatives for raising mass awareness on natural resource conservation and sustainable use.

Chapter 1

Introduction

1.1 SUSTAINABLE DEVELOPMENT PROSPECTS

The Government of Bangladesh is committed to conserve its natural resources guided by policies, laws, strategies, international treaties and conventions, and also as enshrined in its constitution. An amendment to the Constitution was made in 2011 and a new Clause 18A was inserted as “*The State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future generations*”. The Clause 18A echoes the core principle of sustainable development as defined in Brundtland Report. Sustainability is also the foundation for the global framework for international cooperation – the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)-which Bangladesh is highly committed to achieve to continue its success as one of the top global achievers of Millennium Development Goals (MDGs).

Over the past decades Bangladesh has secured a phenomenal development growth. GDP has climbed from less than 4% in the early 1970s to 8.15% in 2019 and per capita GNI rose to US\$ 1,909 in FY2018-19¹. The proportion of population below the national poverty line was as low as 11.3% in 2018². Bangladesh has become a model country on other indicators on human-wellbeing, for example life expectancy has increased to 72³ and child mortality rate has reduced by 82% over the last three decades⁴. Bangladesh is regarded as an example for the empowerment of women in the world as the country has improved gender parity across all sectors ensuring

1 <http://www.bbs.gov.bd/site/news/6c99edb5-3a23-4651-b46a-6b90e17ab782/GDP-of-bd-2018-19p--Growth-rate815-and-per-capita-GNI-1909-in-US>

2 <http://www.sdg.gov.bd/>

3 BBS (2019). *Statistical Year Book Bangladesh 2018 (38th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People’s Republic of Bangladesh, Dhaka, Bangladesh.

4 UNICEF (2019). *Levels and Trends in Child Mortality: Report 2019, Estimates developed by the United Nations, Inter-agency Group for Child Mortality Estimation*, New York: United Nations Children Fund.

greater participation in all aspects of the society. The World Economic Forum recently ranked Bangladesh first in gender equality among South-Asian nations for the second consecutive year.

With all these impressive development, Bangladesh has fulfilled all the eligibility requirement to graduate from a least developed country (LDC) to a developing country. The official recognition of advancement to developing country may take place in 2024. Bangladesh is now aiming higher to become middle income country by 2030. The economy is also fast transforming from an agrarian base towards a modern manufacturing and services economy.

One of the major challenges for future growth of an aspiring middle income country would be to ensure an economic growth which is socially inclusive and environmentally viable. The Clause 18A of the Constitution, and the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) have put nature in the heart of the economic and social development discourse. It is imperative to say that Bangladesh is bestowed with a bounty of nature and at the same time the nature and natural resources are under pressure from anthropogenic sources. The main direct threats are habitat degradation and fragmentation, change in land-use pattern, change in hydrological regime, pollution, over-exploitation of resources, unplanned and uncontrolled tourism, expansion of invasive alien species, and climate change. As a result, species diversity is in the decline. For example, 31 faunal species are categorized as extinct from the country while 390 species are under the Threatened Categories⁵.

Good planning and strategies are necessary to blend development and conservation, and create enabling conditions “to protect and improve the environment and to ensure natural resources, bio-diversity, wetlands, forests and wild life for the present and future generations”. Bangladesh has recently taken a policy leap in developing long-term strategies to match with its long-term development challenges. Bangladesh Delta Plan 2100, Vision 2041, the 20-year perspective plan (2021-2041), and the Eighth Five Year Plan (2020-2025) are all parts of the government’s on-going national development strategies. In view of the special long term challenges presented to environment, the Government aspires to develop a long term National Conservation Strategy (NCS). This NCS will help country to achieve constitutional objective regarding natural resources management.

The impetus to formulation of an NCS, however, began much earlier. After Bangladesh endorsed the 1980’s World Conservation Strategy, the Government started working

5 IUCN Bangladesh (2015). *Red List of Bangladesh: A Brief on Assessment Result 2015*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, 24pp.

on developing the NCS for Bangladesh. An NCS document was drafted in 1993. Recently the Cabinet has directed the Ministry of Environment, Forest and Climate Change (MoEFCC) to revise the NCS to consider the recent pertinent developments in the national and global arenas and also to incorporate some new areas and sectors for analysis and formulation of strategies. The Cabinet also formed a Ministerial Committee headed by the Finance Minister with provision of necessary secretarial services by the MoEFCC. To finalize the Bangladesh NCS, the MoEFCC formed an Expert Committee with the involvement of renowned experts and scientists of the country. According to the guidance of the Cabinet, the final NCS is developed after revision and inclusion of opinions from relevant experts and stakeholders gathered through country-wide consultations.

The NCS (2021 to 2036), a 15-year strategic roadmap, seeks to integrate the short to medium term aspirations of Bangladesh to achieve Upper Middle Income status and eliminate extreme poverty by FY2031 with the longer term challenge of sustainable management of natural resources. Bangladesh Climate Change Trust Fund (BCCTF) has provided financial support to undertake sectoral studies to formulate the NCS. The formulation of NCS involved a large volume of baseline studies as special background papers, large number of stakeholder consultation meetings, and interaction with experts and government officials.

1.2 THE NCS FRAMEWORK

The Bangladesh NCS provides broad directions on the wise use of natural resources for socio-economic development. In the NCS, although sectoral analyses were the starting point, emphasis was given on a unified and holistic sustainable development framework rather than stand-alone sectoral issues – distinguishing between renewables and non-renewables. The NCS was formulated in light with the SDG Framework and it was done mainly due to the following four reasons.

-First, the NCS has the objective of consolidating economic, social and cultural gains and development in a country as natural resources provide a major base and means for attaining them. Indeed, this natural capital, along with man-made capital as well as human capital, are the basic elements behind the progress of any country. The SDG Framework provides a holistic and synergistic view of these interactions.

-The second reason is operational. The SDG Framework and its targets and indicators were developed after long and wide-ranging debates and discussions by all countries and their governments before being unanimously adopted for implementation. Indeed, if we correspond the NCS sectors with SDG Framework, we would find a general correspondence in many cases, directly and indirectly.

-Third, as the linkages are quite close, the SDG targets and indicators thus provide the basic premise from which Bangladesh can develop its own indicators for monitoring.

-Finally, for implementation of the SDGs, support in the form of global finance, technology transfer, and capacity building are expected to be provided. Bangladesh must tap into these resources for which the close synergy between the SDGs and the NCS sectors will provide a basic common platform.

In this light, the NCS details out the characteristics of the configuration of the natural resources in the country along with the sectors that use these resources to create value in the economy and ultimately lead to the attainment of the first two overarching goals under the SDGs, namely the eradication of poverty and vanishing hunger. Time and again the UN resolution calls for the sustainable management of natural resources – essentially the basis of NCS – as the process to attain these overarching goals of economic and social well-being. Thus, the core issues of a development process, which is environmentally sustainable, economically efficient and socially desirable, considered as the base of the SDG and these are given preference in the Bangladesh NCS.

The Bangladesh NCS is formulated based on analyses of 25 sectors which are linked with the corresponding SDGs and targets. These sectors are grouped into three different clusters: 1) Natural Resource Sectors, 2) Natural Resource Dependent Sectors, and 3) Supporting Sectors. The first sector cluster consists of the core natural resources for management under the NCS. These sectors are directly linked with corresponding SDGs and targets dealing with natural resources and their management. Similarly, the sectors that uses the natural resources as identified in the first cluster were also linked with the SGDs and targets. The enabling sectors that are necessary for the implementation of the NCS are clustered into the third cluster as the Supporting Sectors. These sectors can also be subsumed under different Goals and Targets of the SDG Framework for its implementation. The direct and indirect relationships among the Goals and Targets of the SDG Framework and the NCS sectors are illustrated in annex 1.

Analyzing the inter-linkages among NCS sectors, it can be said that the impact of initiatives for conserving a resource or activities regarding that resource may enhance or deplete other natural resources. For example, water as a resource is essential for crop agriculture. Without water of a minimum acceptable quantity, agricultural production is not possible. But, unregulated withdrawal of groundwater in the name of higher crop production and food security would lead to the depletion of this important natural resource reserve which takes hundreds of years to recharge.

In fact, such situation may be even more complex than what is apparent, because such multiple interconnections may lead to a kind of butterfly effect, which means that a small change somewhere may ultimately lead to a major unintended change in the system. In the above crop production (land resource and crop agriculture sectors) example, withdrawal of groundwater (water resource sector) by using fossil fuel (primary energy and mineral resource sector) directly influences cost-benefit calculation of crop production (financing strategy sector) and rural employment opportunity (rural development sector) to name a couple.

The next chapters discuss the three NCS sector clusters and the final chapter binds them together as a coherent strategy.

Chapter 2

Core NCS Sectors

This chapter analyses the current situation of eight natural resources of Bangladesh, namely: land, water, forest, biodiversity, inland fisheries, coastal and marine, livestock and primary energy and minerals. The discussion on the present state of these resources also include prevailing challenges hindering their conservation and major interventions taken so far for sustainable utilization and conservation of these natural resources. Based on the country situation analysis and expectations from the SDGs and other international commitments, conservation strategies and action points are identified for each of these core NCS sectors.

2.1 LAND RESOURCES

2.1.1 Situation Analysis

With a population of 16.17 crore living in 147,570 km², Bangladesh is one of the most densely populated countries of the world with 976 people living in a sq. km area⁶. It has been estimated that by 2051 its population would be around 218.64 million, a net increase of about half million in the next 33 years⁷. The distribution of land is very skewed in Bangladesh: about 7.84% (of the) rural households are absolutely landless⁸, whereas 30% rural households own only 5% of land. Agricultural land is diminishing by about 1% (0.425%) every year due to various land use changes while wetlands and forests are being converted into crop lands and for other purposes⁹.

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6 BBS (2018). *2017 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

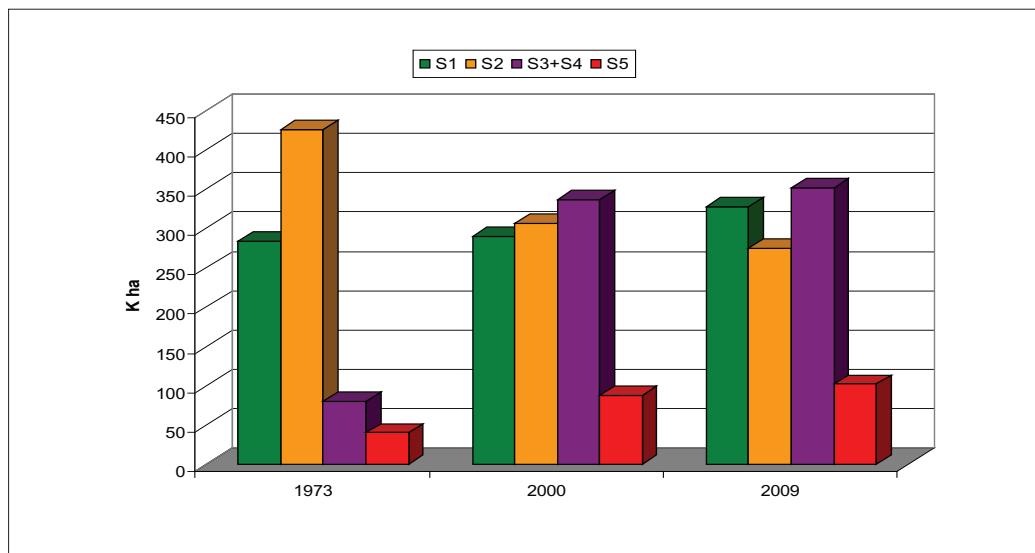
7 BBS (2015). *Population Projection of Bangladesh: Dynamics and Trends 2011- 2061*. Bangladesh Bureau of Statistics, Statistics and Information Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

8 BBS (2019). *Preliminary Report of Agricultural Census, 2019*. Bangladesh Bureau of Statistics, Dhaka, Bangladesh.

9 Planning Commission (2009). *Steps Towards Change National Strategy for Accelerated Poverty Reduction II (Revised), Fiscal year 2009-11*. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Land degradation – the long term loss of ecosystem services centered around land – is a major concern for Bangladesh. Worldwide the total economic value of land degradation was estimated US\$ 231 billion/year or about 0.41% of the global GDP in 2007¹⁰. Using the same percentage for Bangladesh's GDP in 2015, the loss comes to nearly 71 thousand crore taka in a year. This is an underestimate as the actual value includes not simply losses in economic output, but also other intangibles support to various ecosystems.

Figure 2.1: Salinity Changes Over Time¹¹



Note: Salinity classes are - S1 (Very slight): 2-4 ds/M; S2 (Slight): 4.1-8 ds/M; S3+S4 (High): 8.1-16 ds/M; S5 (Severe): 16+ ds/M

Land degradation mainly happens from deficiencies in soil nutritional elements (e.g. phosphorus, potassium, and sulphur), and organic matter. Riverbank erosion, water logging and salinization are other reasons of land degradation. Salinization, for example, in Bangladesh has increased significantly over the last four decades (Figure 2.1). Land depletion, on the other hand, may take place through the process of riverbank erosion and coastal erosion. Recent estimates indicate that 1,56,780 hectares land have been lost along major riverbanks over 1973-2008 with accretions of nearly 45,520 hectares¹².

10 Nkonya, E., Mirzabaev, A. and von Brown, J. (eds.) (2016). *Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development*. Springer International Publishing, Switzerland, V+686 p.

11 Asaduzzaman, M. and Anik, A. (2017). Climatic Influence on Rice Production: A Panel Data Analysis, presented at the BIDS Research Almanac, 6-7 December 2017.

12 CEGIS (2008). *Prediction of river bank erosion along the Jamuna, the Ganges and the Padma Rivers*. UNDP, Dhaka, Bangladesh.

Both natural and anthropogenic factors are responsible for land degradation and land depletion. River erosion and subsequent loss of land is mainly due to river flooding and its severity. The extent of river erosion is also determined by the water regulating and other infrastructures along the river banks and extraction of sand near the river banks. Water control infrastructure had also created drainage congestion and waterlogging in many areas, most notably in the South-West Bangladesh, leading to major land use changes. Agricultural land degradation is related to unsustainable cultivation practices influencing the soil quality. Imbalance in fertilizer use is often cited as a major problem for depletion of soil fertility. The problem of salinization has to do with hydro-climatological dynamics along the coast. Rising sea level influenced by climate change is a major concern here.

Land use changes have many drivers. On the one hand, population growth influences conversion of non-agricultural land, particularly forest land and other common property resources such as wetlands, into agricultural land. On the other hand, the changing structure of population with growth of urbanization as well as demand for commerce, industries, and land-based transport system all combine to transfer agricultural and other land into these uses.

The management of land resources of Bangladesh is promoted through a number of policies, including those on land use, agriculture, forestry, water, coastal zone, environment and fisheries. There are some other policies which are also directly or indirectly relevant to land management, namely Bangladesh Climate Change Strategy and Action Plan (BCCSAP), National Action Programme for Combating Deforestation, and Bangladesh Biological Diversity Act. The recently adopted National Environment Policy provides attention to some important aspects of land management. But a comprehensive Land Management Policy and a consequent plan is an imperative for an integrated management of land.

Eleven ministries and 27 agencies of the Government of Bangladesh directly use land or administer land use, such as Ministries of Land; Agriculture; Environment, Forest and Climate Change; Water Resources; Local Government and Rural Development; Fisheries and Livestock; and Communications. Besides there are a number of other ministries also involved indirectly with the management of land. There are also some specialized organizations, such as Directorate of Land Records and Surveys (DLRS), Space Research and Remote Sensing Organization (SPARRSO), Survey of Bangladesh (SOB), development authorities like Rajdhani Unnayan Katripakkho (RAJUK), Chattogram Development Authority (CDA), Khulna Development Authority (KDA) and city corporations and municipalities, which deal with land.

The Ministry of Land is the custodian of the Government owned lands. On the other hand, district administrations under the Ministry of Public Administration deal with land conversion from one use into another. Detailed mapping of the whole country and from very micro level to macro scale is a good start for land management.

2.1.2 Conservation Strategies and Actions

The SDG target 15.5 calls for restoring degraded land and soil, including land affected by desertification, drought and floods and to strive to achieve a land degradation-neutral world. Burgeoning population which may go up to 250 million by 2050 will put tremendous pressure on land for food, shelter, urbanization and deplete available land for many of the legitimate purposes for livelihood while the innate capacity of the land to produce enough food may fall. To halt the precarious trend of land degradation, explicit policies on land management and its linkages with other sectors with a holistic view are urgently needed. Accurate data are needed on the use of land, their beneficiaries, and the barriers to sustainable land management. Technologies are needed for analyzing and managing some of the major aspects of land degradation, such as declining soil fertility. Bangladesh has formulated the National Action Program (NAP) for combating Desertification, Land Degradation and Drought, 2015-2024. To achieve SDG15.3.1, Land Degradation Neutrality (LDN) by 2030, Bangladesh also has set its voluntary national LDN targets. DoE is implementing projects to reduce land degradation and to mainstream Sustainable Land Management best practices.

The conservation strategy for land resources within the NCS Framework may focus on policy and legal instruments, institutional capacities, inter-agency coordination, science and technology, good practices, incentive mechanism, awareness raising, and monitoring elements around land sector.

To prevent misuse and degradation of land, an appropriate land use policy is required comprising land use zoning to be prepared as per land suitability and its strict adherence. Necessary changes in the prevailing legal system are needed along with their applications, particularly in case of State-owned land. These policy and legal instruments need to be accompanied by necessary institutions and expertise on land conservation and management. Generation of necessary information on land use, its causes and barriers to conservation should be a prerequisite for land use and soil quality management. Ministry of Land needs to take appropriate measures in coordination with other ministries, such as Ministries of Agriculture and Water Resources.

Pertinent agencies should ensure peoples' participation in land resource conservation by creating awareness through mass media and other means. Further, to influence land use changes, economic incentives, through appropriate payment systems for various land services (including ecosystem services) of land should be explored. Climate change induced adverse impacts on land resources need to be addressed through research, knowledge management, technology adoption, monitoring and devising appropriate adaptation strategies.

Based on the above strategies, the following actions may be considered:

1. Conduct an appraisal of land resources and its quality, which will seek to revalidate the existing knowledge and reclassify land by quality and principal causes of degradation. Conduct this through a 'Land Use Survey' and ensure public access to 'Land Information Database' where all data and information will be kept.
2. Formulate a 'National Sustainable Land Management Policy' and all possible necessary legal provisions, including those for management of state-owned land through necessary acts of Parliament and subsequent rules and procedures for implementation.
3. Set up of a 'National Land Use Commission'.
4. Put in place a comprehensive 'Land Management Regulation' (including land zoning and land service charges) to be overseen by the proposed 'National Land Commission'.
5. Take appropriate measures, including economic incentives in coordination with other agencies, such as those under Ministry of Agriculture for influencing fertilizer use, cropping patterns, soil conservation and make investments for increased freshwater flows (in association with Ministry of Water Resources) in saline zones for arresting land degradation.
6. Coordinate with the Ministry of Environment, Forest and Climate Change for all climate change-related adaptation measures.
7. Take appropriate programmes for poor's access to land and its sustainable management by them through provision of technical knowledge, financial support and administrative measures as appropriate.

2.2 WATER RESOURCES

2.2.1 Situation Analysis

The society, culture and economy of Bangladesh have been initiated and flourished around water resource. The endowment comprises three types of resources - rainfall, surface water and ground water. The annual average rainfall in Bangladesh except eastern hill region ranges from 5,500 mm in the north-east to 1,500 mm in the north-west¹³. Annual renewable surface water flow is around 1,226.6 km³ and the groundwater recharge is estimated to be around 21 km³¹⁴. There are about 310 rivers in the country with approximately a total length of 24,000 km¹⁵. Most of the flow in the river system is generated from outside the country and passes over the country through 57 trans-boundary rivers. The country has a large area under wetlands particularly in the north-east (distinct freshwater wetlands known as *haor*), south-west (saline water wetlands), and also seasonal wetlands in the north-west (also freshwater wetlands).

Many consumptive and non-consumptive dependencies of residential and human consumption, agriculture, industry, fisheries and navigation on water resources of the country keep the economy and society running from time immemorial and more importantly now. Although the country is well endowed with water resources in terms of volume in aggregate, its spatial and temporal variation causes shortages of resources for its many uses often inciting conflicts among various users. Conservation of this resource is indispensable for sustainable development of the country.

The water resources situation in Bangladesh has several characteristics which need to be considered while finding ways to conserve them. First, there is a huge seasonal variation of availabilities of water resources between wet (June to October) and dry season (January to May), of the order of around 953 km³ and 168 km³, respectively, with estimated per capita availability of 5,300 m³ and 700 m³¹⁶. Second, much of this availability is actually sourced from the trans-boundary rivers, the availability of which is rather uncertain, despite a treaty, due to various uses in the upper riparian parts.

The third aspect relates to utilisation of water. Not all of the available surface water in any given season can be utilised as much of it has to be in-stream, a part is percolated to the underground, and a part is evaporated while the rest is used for agricultural,

13 Brammer, H. (1996). *Geography of soils of Bangladesh*, 287p. University Press.

14 FAO (2014). Bangladesh - Geography, Climate Change and Population Geography. Food and Agricultural Organization.

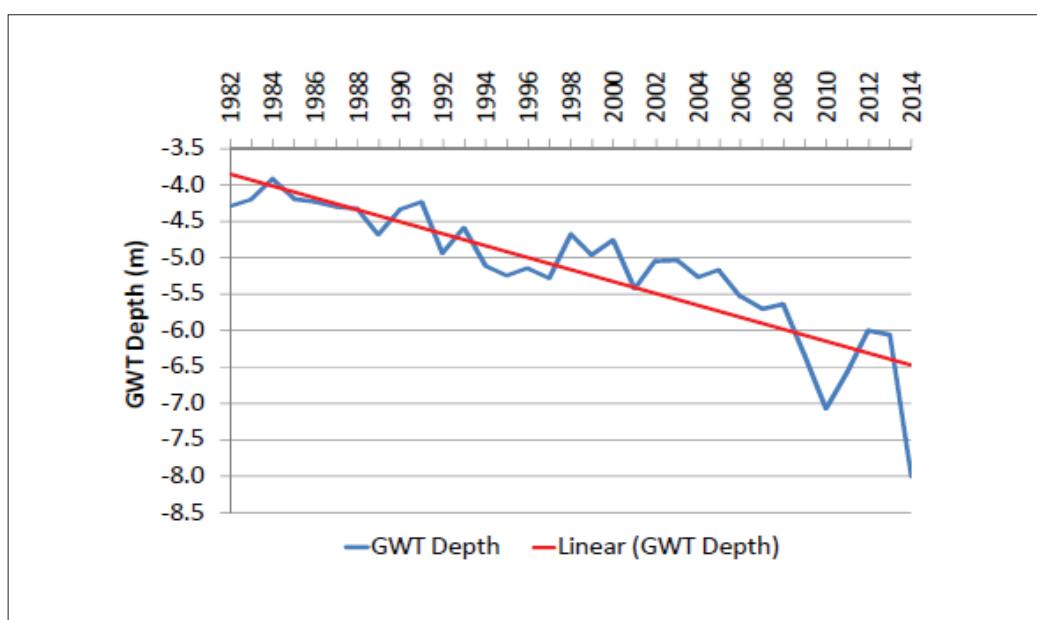
15 FAO (2014). Bangladesh - Geography.

16 FAO (2014). Bangladesh - Geography.

industrial and residential purposes. All these three types of uses are heavily dependent on ground water, which has now become a scarce resource in many places.

The serious water scarcity during dry season is putting pressure on legitimate use of water for agriculture. Rivers and wetlands are dried up due to diminishing upstream flow as well as illegal encroachments. This significantly reduces replenishment of groundwater. Again groundwater table falls because of very high abstraction for irrigation, which becomes a major concern due to an ever-increasing fall in the water table in certain parts, such as the Barind in the country (Figure 2.2).

Figure 2.2: Groundwater Table depth in Northern Bangladesh¹⁷



It is, however, not only an issue of water supply and inefficiency in use, but also most of the irrigation is for the dry period, *boro* rice cultivation – the most water-intensive crop and the mainstay of food security of the country.

The fourth issue is water quality. The arsenic in ground water and salinity in the coastal zone, south-west Bangladesh in particular, are of natural origin. The pollution of river waters is due mainly to untreated industrial waste water discharge, and dumping of solid wastes and sewages. Leaching from agricultural fields laden with residual chemicals, including fertiliser and pesticides, are also polluting fresh water

¹⁷ Ministry of Food (2015). *National Food Policy Plan of Action and Country Investment Plan: Monitoring Report*. Planning Monitoring Unit, Ministry of Food, Government of the People's Republic of Bangladesh.

of the country extensively. The pollution loads of rivers around Dhaka, particularly in the rivers of Buriganga, Shitalkhya and Turag are very high¹⁸. While arsenic still remains a major problem, salinity has also been apparently increasing due to lower freshwater flow through transboundary rivers. Obviously, the rising salinity also limits availability of fresh water for residential, industrial and agricultural purposes, and calls for interventions to adapt to the situation.

Water resources management in Bangladesh thus faces immense challenge for resolving many diverse problems and issues. The most critical of these are alternating abundance and water scarcity during the dry seasons. Ever-expanding water needs of a growing economy and population, massive river sedimentation and riverbank erosion, depletion of wetlands which cater to the needs of the ecological balance and conservation of animate and inanimate aquatic resources and the pollution loads further limiting freshwater availability.

Water supply is also facing obstacles to meet the continuous growing water demand. Eighty percentage of water demand is met by surface water and only 15% of the total surface water is available in the dry season¹⁹. Using more surface water is a considerable challenge at the moment because of lack of infrastructure for abstraction, treatment and distribution. Also, groundwater abstraction is constrained due to salinity intrusion and arsenic contamination. As practically available water now is 36 km³ and total water demand (agriculture, municipal and industrial) is 35.78 km³²⁰. Water demand for agricultural activities, municipality and industrial purposes are 88%, 10% and 2% respectively²¹. In near future, water demand is bound to exceed the practically available resources, especially under climate change scenarios, if no proper remedial intervention is made.

There is a growing need for providing total water quality management (i.e. checking salinity, deterioration of surface water and groundwater quality, and water pollution), and maintenance of the ecosystem. There is also an urgency to satisfy multi-sector water needs with limited resources, promote efficient and socially responsible water use, delineate public and private responsibilities, and decentralize state activities where appropriate. Although several constraints still exist that hamper wise-use of water resources.

18 DoE (2015). *River Water Quality Report 2014*. Department of Environment (DoE), Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka.

19 FAO (2014). Bangladesh- Geography, Climate Change and Population Geography. Food and Agricultural Organization.

20 CSIRO, Research for Development Alliance (2014). Bangladesh Integrated Water Resources Assessment (BIWRA). Water Resource Planning Organization, Dhaka. (<http://warpo.gov.bd/index.php/home/catdetails/19/51> WARPO report).

21 Ministry of Food (2015). *National Food Policy Plan of Action and Country Investment Plan: Monitoring Report*. Planning Monitoring Unit, Ministry of Food, Government of the People's Republic of Bangladesh.

Government invested significantly on water resource infrastructure such as infrastructure for surface water development for irrigation and drainage, flood protection embankments, dykes and polders, dredging, and river training for transportation facilities such as bridges construction. Other interventions are related to formulation for water resources and administrative management and river development. The Ministry of Agriculture has undertaken development projects for improving the efficiency and overall performance of irrigation systems with better on-farm water management practices. Bangladesh has established a regulatory framework for untreated effluent discharge into water bodies. However, the implementation of the regulatory measure is yet a challenge due to lack of online monitoring of ETP operation in industries. Bangladesh is also considered as global leader in water management issue. For a new approach in global water crisis and ensuring sustainable management of water and sanitation for all, the United Nations and World Bank Group convened a High Level Panel on Water (HLPW) in 2016 where Honourable Prime Minister Sheikh Hasina is one of the 12 members of the HLPW²². Water, sanitation and hygiene (WASH) programme is one of the lighthouse initiatives of Bangladesh action which is a model approach for many other countries²³.

A National Water Plan (NWP) project was initiated in 1983 with a view to develop a perspective in water development plan for the period 1985–2005 based on a comprehensive assessment of needs and availability of water resources. To provide further impetus to the effort, the Water Resources Planning Organization (WARPO) was established in 1991. The first environmental impact assessment (EIA) document for the water sector was brought out in 1992 by the Flood Plan Coordination Organization (FPCO) which was later merged with WARPO in 1996. The Flood Action Plan (FAP) studies were summarised in the Bangladesh Water and Flood Management Strategy in 1995 as a preparation of a national water management plan, strengthening of water sector organizations, and allowing the private sector to provide water related services whenever possible. Given the diversity of hydrological settings and unique regional requirements, recommendations have been incorporated into the National Water Policy in 1999, the Development Strategy in 2001, and the National Water Management Plan (NWMP) in 2003.

The government has formulated the Bangladesh Delta Plan 2100 documents the broad development strategies which the country can adopt by the end of the 21st century. It offers long-term strategies and interventions to ensure food and water security, economic progress and environmental sustainability while reducing the threats of natural disasters and developing resilience to climate change. The Government

22 HLPW (2018). Making Every Drop Count: An Agenda for Water Action. High-Level Panel on Water Outcome Document. (https://sustainabledevelopment.un.org/content/documents/17825HLPW_Outcome.pdf).

23 Azad, M.A.K. and Fan, Q. (2017). Towards a cleaner Bangladesh: Safe water, sanitation, and hygiene for all. The Financial Express. Available at: <https://thefinancialexpress.com.bd/views/views/towards-a-cleaner-bangladesh-safe-water-sanitation-and-hygiene-for-all-1505225835> (Accessed: 25 October 2018).

remains committed to improving transnational cooperation for the management of rivers shared with Bangladesh's neighbours. The government has signed a Framework Agreement on Cooperation for Development between Bangladesh and India in 2011 for water resource management and development of cross-border rivers through sub-regional cooperation,

The structural interventions established the view to making the country flood-free have led to environmental changes and degradation²⁴. The environmental performance of small infrastructural interventions, such as rubber dams also should be reviewed. Other problems such as climate change issues should be kept in mind set while designing of projects and their implementation.

2.2.2 Conservation Strategies and Actions

The SDG 6 is directly concerned with water related issues. It has six outcome targets and two process targets. These targets are related to protection of minimum water rights for human welfare, call for ensuring quality of water, focus on water use efficiency in all sectors, urge actions for integrated water resource management while ensuing fair distribution of water between upper and lower riparian countries, and raise the issue of ecosystem protection in all water related physical environments. In addition to the SDG 6, the SDG Targets 12.2 and 13.2 are also indirectly related to water. The SDG 6 encapsulates clearly all the concerns raised or should be raised under the Bangladesh NCS. The strategies under NCS must therefore be properly aligned with the SDG 6.

A full attention to the development of the water sector of Bangladesh is urgently needed for the fulfillment of the SDGs and their targets by 2030. Given that water permeates almost any sphere of human action and that preserving ecosystem balance for future welfare of the country, the basic principle of NCS water sector strategy should be Integrated Water Resources Management (IWRM).

Based on the preceding discussions and the SDGs and its targets, a conservation action-oriented strategy is needed in line with the strategies placed under the National Environment Policy 2018. Concentrating on eight key issues, such as economic development, poverty alleviation, food security, public health and safety, standard of living, and protection of the natural environment, the conservation strategy has given importance on a number of actions. The dependency of agriculture and drinking water supply sector on ground water needs to be reduced by shifting to surface water sources as far as practicable. That, in turn, will require increasing trans-boundary flow especially during dry season through successful treaties with upstream countries. Improvement of efficiency of water use, improvement of irrigation water use efficiency

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24 See the various Flood Action Plan (FAP) reports prepared under the Flood Plan Coordination Organization (FPCO) for graphic descriptions of these changes and their consequences, particularly FAP 12.

in particular, will be a strategy. Reducing water pollution through strict enforcement of existing rules and regulations will be another focus of the action plan. Last but not the least, the demands for the ecosystem balance must be paramount in all cases of water sector intervention with a clear monitoring plan for unintended environmental, livelihood and social adverse effects and prompt remedial measures to minimise the losses.

In the light of these focuses, the detailed action plan is formulated as below.

Table 2.2.1: Actions for Water Resource

Issues	Actions	Implementing agency
Safe and affordable drinking water	<ol style="list-style-type: none"> 1. Ensuring safe water facilities for all through the development of different water supply options 2. The development of different water supply options in affected areas 3. Ensuring safe water facilities in the hydro-geologically difficult and problematic areas 4. Establishment of WSS HRD centre in DPHE to ensure adequate supply of trained and skilled manpower 5. Establishment of the NAWASIC (National Water Supply and Sanitation Information Centre) in DPHE 6. Establishment of water quality examination, monitoring and surveillance systems 7. Update and strengthen “Organizational Setup” of DPHE to orient it to support the LGIs 8. Continue with hydrological and hydro-geological investigation for ground and surface water 9. DPHE has to carry out and look after information management and R&D activities of the WSS sector to support policy making and strategic planning 10. Gradual shift of DPHE from its exclusive role of “Service provider” to the role of “Service provider and Facilitator” 11. Modern water management technology to be promoted to enhance irrigation efficacy and water productivity through optimal use of available water resources 	LGD, Mol, MoPME, DoE, Molnd and SID

Issues	Actions	Implementing agency
Water supply and sanitation	1. Development of water conservation and efficiency focused water supply infrastructure in rural and urban areas	LGIs, DPHE, LGED, DoE, Municipalities, WASA, Universities, Research institutes and Development partners
	2. Building sewage treatment facilities in urban areas	DPHE, WASA, MoLGRD
	3. Establishment of surveillance and water quality monitoring	MoLGRD, WASA
	4. Develop affordable and reliable arsenic mitigation technologies	MoLGRD, LGIs
	5. Explore innovative ways of water conservation including rainwater harvesting.	MoLGRD, DPHE and LGIs
	6. Develop community water supply and sanitation facilities	
	7. Awareness campaign on water conservation and personal hygiene	
	8. Incentive for water conservation and rain water harvesting	
	9. Ensuring sanitation facilities for all through the development of different sanitation options	LGD, MoE, MoInfr, MoPME, MoWCA, PMO, MoF, MoHFW, MoEFCC and SID
	10. Sustaining and replication of Total Sanitation Campaign with a variety of water supply initiatives	
	11. Ensuring sanitation facilities in the hydro-geologically difficult and problematic areas	
	12. Ensuring safe sanitation facilities for all through the development and up-gradation of different sanitation options	
	13. Increase access to sanitation facilities to all rural people	
Water quality	1. Urban areas need integrated water treatment and efficient water supply facilities	MoInd, MoFA, MoTJ, MoF, MoWR and MoS
	2. Shifting the dependence on water supply from groundwater to surface water with improvement in surface water quality	
	3. Construction, operation and maintenance of water treatment plants, water abstraction facilities and water distribution system for providing drinking water to public, industries and commercial organizations	

Issues	Actions	Implementing agency
Water-use Efficiency	<ol style="list-style-type: none"> 1. Monitor, control and prevent environmental pollution and degradation related to water 2. Undertake environmental assessment 3. Implementation of emission, effluent and waste management strategy 4. Expansion of small scale irrigation technology and surface water for irrigation 5. Implement Bangladesh Water Act 2013 and National Environment Policy 2018 6. Implement programmes of BDP 2100 7. Design and implement different Water Management Programme 8. Programme for dry season irrigation coverage 9. Efficient use of irrigation water 10. Increase surface water use for irrigation 11. Limit ground water use for irrigation 	LGD, MoA, Molnd MoS, MoWR, MoFA and DoE
Protect and restore water related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	<ol style="list-style-type: none"> 1. The DoE has to apply its legal authority to recognize and manage any ecosystem as an Ecologically Critical Area (ECA) 2. Maintain the inland river systems and ecosystems for fishery, sediment transport, and inland shipping, protecting dry season water flows, restoration of habitat and fish species 3. Integrated Coastal Fisheries Resource Management 4. Maintenance of ecosystem health and management of pollution 5. Coping with climate changes through Nature based Solutions (Nbs) 6. Conserve and protect forest ecosystems and overall environmental stability 7. Programmes will be taken to protect the threatened and endangered species of flora and fauna and the fragile ecosystems 8. Half/reduce rate of salinity intrusion and mitigate impacts of salinity on human health and agro-ecosystem production 9. Proper ecosystem management is required to ensure the sustainability of natural resources without hampering the livelihood of people dependent on the goods and services 	DoE

Issues	Actions	Implementing agency
	10. Conduct assessment of ecosystem degradation in terms of heavy metal contamination and nutrient loss 11. Identification of wetland ecosystems significant for biodiversity to be declared and managed as ECAs 12. Assessment of ecosystem degradation and mitigate impacts of drought in dry land Barind ecosystem 13. Valuation of goods and services provided by ecosystem and biodiversity will be accomplished towards integration of the values into the national accounting system 14. Polluting the ecosystems from all sources will, wherever possible, be stopped or minimized 15. An appropriate IT/ITeS business ecosystem has to be established 16. An innovation system comprising of required infrastructure, well trained human resources and supportive policy regime need to be established 17. Use of Science and Technology as a means of sustainable use of Environment, Ecosystem and Resources contribute to world pool of knowledge in Science and Technology 18. Support product innovation and creation ecosystem	
Agriculture	1. Raise awareness and popularize irrigation technologies which are less water consuming such as Alternate Drying and Wetting method 2. Put more focus on rain fed <i>Aush</i> and <i>Aman</i> and gradually reduce dependence on irrigation intensive <i>Boro</i> 3. Shifting from mono cultivation of rice to crop alteration with pulses and other high value grains/crops	DAE
Drought	1. Issue drought forecast 2. Seek cooperation from India on real time sharing of data from upstream river gages and weather stations 3. Develop less water consuming appropriate cropping pattern in drought prone area such as Barind area	BWDB, Meteorological Department, LGIs, Disaster Management Bureau, JRC BMDA

Issues	Actions	Implementing agency
Major river development	<ol style="list-style-type: none"> 1. Develop plans for interregional and multi-purpose use of waters of major rivers 2. Feasibility study and construction of the Padma / Ganges Barrage and the Brahmaputra Barrage 3. Ensure environmental flow in all rivers 	WARPO and BWDB
Groundwater development	<ol style="list-style-type: none"> 1. Consider all options including natural and artificial recharge of groundwater 2. Private sector withdrawal for agricultural / industrial use will be permitted subject to necessary regulations 3. Groundwater mining in urban areas for drinking water supply will be discouraged and alternative sources including surface water and rainwater harvesting will be explored 	WARPO, BWDB, WASA, DPHE and LGED WASA and Municipalities
Illegal encroachment into rivers, lakes and canals	<ol style="list-style-type: none"> 1. Strict and regular monitoring and enforcement of laws 2. Ensure natural flow of all rivers and canals 	Municipalities, LGIs, Ministry of Land, WASA and MoWR
Transboundary issues	<ol style="list-style-type: none"> 1. Monitor quantity and quality of trans-boundary inflow to ensure ecological sustainability in Bangladesh 2. Review existing treaties and suggest updating if necessary 3. Resolve any outstanding issue in relation to sharing dry season flow, flood management, sediment management, water quality, adverse location problems etc. 	The Joint Rivers Commission, BWDB, WARPO and MoWR
Environmental assessment and monitoring	<ol style="list-style-type: none"> 1. Develop/update IEE and EIA manuals 2. Conduct environmental screening and post-evaluation during O&M phase 	DoE, WARPO, BWDB, LGED, LGI, DAE, DoF and WASA
Data collection network	<ol style="list-style-type: none"> 1. Maintain, review and upgrade the data collection network (for hydro-meteorological and quality data) 2. Collect surface water and ground water quality data, particularly at pollution hotspots 3. Collect salinity data and monitor movement of the critical salinity front 	BWDB, RRI, WARPO and WASA

Issues	Actions	Implementing agency
Legislation / National Water Code	<ol style="list-style-type: none"> 1. Set up planning zones: water-stress zone, drought-prone zone, four types of flood management zones, and river channels used for navigation 2. Set up regulatory zones: water scarcity zones, industrial zones, fisheries and wildlife zones, water body zones and brackish water zones 3. Define water rights in relation to using surface water and groundwater 4. Specify conflict resolution mechanisms 5. Mainstream climate change in all sectoral policy, strategies and plans 	WARPO, BWDB, DoE, DoF and BIWTA Ministry of Law, WARPO, BWDB and Legal experts WASA and MoWR MoWR GED
Private sector participation	<ol style="list-style-type: none"> 1. Develop appropriate regulatory framework 2. Introduce appropriate incentives and pricing policies 3. Improve provision for credit and access to investment resources 4. Attract domestic and foreign investment in the rural and peri-urban water sectors 5. Promote community-based initiatives and low-cost appropriate technology solutions 	MoWR
Cost recovery	<ol style="list-style-type: none"> 1. Target full or partial (O&M) recovery of cost for irrigation, water supply and sanitation projects 2. Water charge may be linked with crop production, hours of operation of pumps or size of the household etc. 3. In urban areas, full cost recovery should be attempted along with increasing block tariff structure 4. Improve billing and collection system and minimize system loss 	BWDB, LGIs, WASA and Municipalities
Disaster management	<ol style="list-style-type: none"> 1. Adopt emergency preparedness plan in respect to water and sanitation covering the risk assessment, public awareness as well as effective response 	DPHE, DMD and MoLGRD

Issues	Actions	Implementing agency
Natural environment and aquatic resources	<ol style="list-style-type: none"> 1. Develop National Industrial Pollution Control Plan 2. Strict monitoring and enforcement of water quality laws 3. Protect open water fish habitats and migration routes 4. Build fish pass and fish friendly structures 5. Develop conservation action plans for Haor, Baor and large wetlands 6. Re-excavate sediment filled wetlands 7. Develop community-based and sustainable management plans for wetlands 	DoE, DBHWD, BWDB, DoF, Development partners and WASA
Investigative research to address the knowledge gaps	<ol style="list-style-type: none"> 1. Conduct follow up studies on the possible impact of climate change and sea level rise on the water resources of Bangladesh 2. Carry out research on the environmental / ecological / in-stream water requirement 3. Carry out a comprehensive assessment of groundwater resources (quantity and quality) 	MoEFCC, BWDB, UGC, Universities, Research Institutions and MoWR

2.3 FOREST RESOURCES

2.3.1 Situation Analysis

The total area of forest land in Bangladesh is 2.32 million hectares²⁵. On the basis of location and topography forests are classified as hill forests, plain land Sal forests, mangroves, coastal plantation forests, freshwater swamp forests, and village forests. The Bangladesh Forest Department manages about 1.6 million hectares of forests. Unclassed State Forests extending an area of 0.7 million hectares is under the control of the Deputy Commissioners of respective districts and now have been placed under the control of District Councils. Privately-owned village forests outside the purview of state and scattered throughout the country in aggregate amount to 0.27 million hectares²⁶. Over 90% of the state-owned forest land is concentrated mostly in 12 districts in the eastern and south-western regions of the country, while out of 64 districts, 29 districts have no state forest at all. Of the total forest area, 84% has

25 <http://bforest.gov.bd>.

26 DoE (2015). Fifth National Report of Bangladesh to the Convention on Biological Diversity, Biodiversity National Assessment 2015. Department of Environment. Ministry of Environment, Forest and Climate Change. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 147pp.

been classified as natural forest and nearly 16% as plantation forest²⁷. The two most common types of forest, namely Hill forest and Mangrove forest cover more than 80% of total forest area. Sundarbans, the mangrove forest account for 42-45% of Bangladesh Forest Department-managed forests of the country²⁸.

During 2015–2016, the contribution of forest and related services to national gross domestic product (GDP) stood at 1.69%²⁹. Forests contribute to climate change protection through carbon sequestration as well as act as wind breaks at times of cyclonic storms in the coastal areas as the Sundarbans mangrove did during the onslaught of Cyclone Sidr in 2007, Aila in 2009, Bulbul and Fani in 2019, Amphan in 2020 and Yaas in 2021. If the value of forest ecosystem services such as non-timber forest products, value of recreation and carbon locking is considered, the contribution of forestry sector could be higher.

The role of forests in poverty alleviation is also quite substantial. There are at least 19 million of people who are dependent on forests for their livelihoods in Bangladesh. Contribution from village forest to total household income is significant.

Population pressure and conversion of forest land into pastures or crop land often followed in many countries but not necessarily in the same manner³⁰ is a major cause of depletion and degradation of forest land. But there are also other factors related to population and income growth such as inability of normal supply to cope with growing demand for forest products. The consequences of persistent widening gap between demand and supply of forest produces are: (1) un-authorized felling of trees from state forests, (2) over-cutting of village forests, (3) increased use of non-traditional energy sources, and (4) raw material scarcity for wood-based industries.

Natural factors play in the deterioration of quality in forest lands. The ingress of salinity in the Sundarbans is a great threat to the fragile mangrove ecosystem. Movement of oil tanker and commercial vessel through the valued and biodiverse ecosystem of the Sundarbans is posing a serious risk to both the environment and the communities that depend on it for their livelihoods. Forgoing the native plant species few invasive exotic plants with ability to grow in any kind of degraded edaphic qualities and

27 Altrell, D., Saket, M., Lyckeback, L. and Piazza, M. (2007). National Forest and Tree Resources Assessment 2005-2007 Bangladesh. Bangladesh Forest Department, Ministry of Environment, Forest and Climate Change (MoEFCC) and Bangladesh Space Research and Remote Sensing Organization, Ministry of Defence, Dhaka, Bangladesh, 38pp.

28 Agriconsulting Europe S.A. and Sodev Consult International Ltd. (2016). Climate Resilient Participatory Afforestation and Reforestation Project Updating Forestry Master Plan for Bangladesh. Bangladesh Forest Department, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, pp. 73. (<http://pubdocs.worldbank.org/en/703171521827828431/pdf/FMP-Task-1-Sectoral-Studies.pdf>).

29 BBS (2017). *2016 Statistical Year Book of Bangladesh (36th edition)*. Bangladesh Bureau of Statistics (BBS), Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 559pp.

30 Ashraf, J., Pandey, R. and de Jong, W. (2016). Jawaid, Rajiv Pandey and Wil de Jong, Assessment of bio-physical, social and economic drivers for forest transition in Asia-Pacific region. *Forest Policy and Economics*, 76: 35-44.

climatic conditions are preferred for afforestation programmes. Although such fast-growing exotic plant species evidently help improve socioeconomic condition of the local communities within the shortest possible time, but they are aggressively a mediator of change and threat to native plant biodiversity of the country.

There are institutional factors behind the depletion and degradation of forest land. Enforcement of forestry laws in the country remains weak primarily due to the shortfall of adequate and skill manpower and also inadequate financial support to bear the necessary expenditures. The government has reset its vision to increase tree covered area up to 25% by the year 2030 in light of the SDG.

While the diversified duties of protection, exploitation, afforestation, extension, planning and training are assigned to forest professional cadre, the Forest Department lacks sufficient funds, training, infrastructure, logistics and manpower to properly carry out such a diverse array of responsibilities. Adequate manpower and appropriate logistic supports including, modern transport, modern arms and ammunitions, accommodation facilities, provision of ration, risk allowance, hardship allowance etc. are long felt need of the field foresters.

The Government of Bangladesh adopted the first National Forest Policy in 1979 with the objective of providing protection and conservation of the country's forest assets whilst concomitantly developing its rural and industrial economies. Principally, the Forest Department is responsible for the management, planning, protection and strategy development of country's forest resources in accordance with the National Forest Policy (updated in 1994), Forest Act and regulations.

Several steps regarding forest resources development and preservation and assessment of its benefits and utility have been taken in the past in the following areas:

- Increasing forest cover, protection of biodiversity through strict enforcement of laws (such as ban on logging) and participatory management³¹;
- Providing encouragement to communities to preserve small natural forests particularly in the Chittagong Hill Tracts (CHT) through Village Common Forestry (VCF);
- Through implementation of social forestry, Bangladesh Forest Department has so far raised more than 96,705 hectares of participatory block plantation and 71,780 km strip plantation involving local community on the degraded and encroached forest land, thereby the area planted has been brought under tree cover successfully. About 1,68,546 beneficiaries received share

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31 Chowdhury, M.S.H., Koike, M. and Muhammed, N. (2009). Embracing Collaborative Protected Area Management for Conservation: An Analysis of the Development of the Forest Policy of Bangladesh. *International Forestry Review* 11(3): 359-374.

of more than Bangladeshi Taka 356 crores 82 lac from the sale proceeds of matured plantation under the social forestry programme (FD 2019³²). The area harvested has been replanted from the Tree Farming Fund, kept reserved from the 10% of the sale proceeds of the plantation;

- Establishment of more than 2,00,000 hectares of coastal Green Belt along the coast and declaration of about 1,00,000 hectares of land as Reserved Forest is a key initiative of Bangladesh Forest Department;
- Optimizing consumption of fuel wood, timber and bamboo, rehabilitation of shifting cultivators greening the Unclassed State Forest lands in the Chittagong Hill Tracts under participatory community forest programmes, abolishment of traditional villager system through relocation, relocation of forest encroacher subject to policy directives and incentives, constitution of national nature conservation institute and conservation of common property resources;
- Scaling-up of co-management of Protected Areas (PAs), promotion of eco-tourism activities and provision of alternative income generated activities for forest-dependant people residing outside forests through cooperatives have as well been intervened;
- A tiger protection initiative in the Sundarbans is on-going;
- Three areas of the canals in the Sundarbans, covering 32 kilometres, have been declared as “dolphin sanctuaries”. Fishing in the 32-km waterway has been prohibited with a provision of sentence and fine in violation of the ban.
- Government has undertaken initiatives to strengthen conservation efforts through Bangladesh Tiger Action Plan (2009-2017), Bangladesh Elephant Action Plan (2018-2010), Bangladesh Vulture Conservation Action Plan (2016-2025), and Bangladesh Wildlife Conservation Master Plan (2015-2035).
- Gene banks for bamboo for preservation of genetic resources established;
- In 2017, Government approved 15% risk allowance for the field level Bangladesh Forest Department staff of Sundarbans.

A center point of the current strategy is co-management. This is currently practiced only in small patches of forests, not in the major ones. Other strategies in the past included agro-forestry and social forestry in the villages to supplement the supply of tree products (fuel wood and timber). But note that such social forestry while good in itself for providing certain livelihood and income benefits to the community, does not really fulfill the functions of a natural forest, including conservation of biodiversity and other benefits such as prevention of soil erosion or providing other ecosystem services. To address this issue, Forest Department has recently introduced collaborative forest management system through its SUFAL project.

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32 Social Forest Wing, Bangladesh Forest Department.

2.3.2 Conservation Strategies and Actions

The basic guideline behind the conservation strategy of forestry sector within the NCS Framework should be the SDG Target 15.2. Within this framework, the future strategies should give more attention to the full and effective practice of co-management as well as preservation of natural forests. While social forestry should be encouraged, this should not be taken to be a substitute for natural forestry. These issues need to be considered while suggesting any action plan to halt forest depletion and degradation and forest regeneration and afforestation. Furthermore, the strategies for forestry sector should consider forest land management, protected area creation, creation of new forests often with participatory approach, and institutional and financial aspects of the Forest Department.

The provision of restriction of any transfer of forest land to private or public citizens or organizations for non-forestry purposes should be strictly scrutinized. The forest settlement operation should be accomplished through recruiting the settlement officer.

Forest areas that are critical and rich in biodiversity should be declared as protected area for conservation. These national forests and protected areas should be conserved and protected by implementing integrated management plan. As a part of the management approach, buffer zones could be created between core biodiversity rich parts of the forest and regenerating degraded parts. The buffer zones could be transformed for eco-tourism with strictest rules on entry or full ban on development into and around the core areas.

Natural regeneration should be widely encouraged. Plantation programme should be taken on accreted land (char land) in coastal areas and identified deforested and barren lands. In such programmes, site-specific indigenous species should be planted. Any introduction of alien and invasive plant species must be strongly restricted.

Plantation targets need to be achieved through social forestry. Unclassed State Forests should be brought under social forestry programme. Agroforestry could be developed in Unclassed State Forests of the Chittagong Hill Tracts and Madhupur. As a means of rehabilitating shifting cultivators (*jhumia* farmers), the forest and bamboo resources in their surroundings need to be increased.

To implement these strategies, it is crucial to increase manpower and logistics and build the capacity of the Forest Department according to the Forestry Master Plan. Adequate forest financing through domestic and international resource should be ensured.

Following actions may be taken in accordance to the SDG to promote conservation in the forestry sector.

Table 2.3.1: Actions for Forest Resource

Issues	Action	Implementing agency
Degradation and depletion of natural forests. Except Sundarbans, the natural forests of the country, mostly located in CHT, Chattogram, Cox's Bazar and Sylhet, has got depleted, degraded and shrunk.	1. Massive afforestation and reforestation programmes are required	MoEFCC and FD
Structure and function of Sundarbans is under threat due to industrialization in the periphery	1. Enrichment planting programmes are required	MoEFCC and FD
Loss of biodiversity: The Red List of Bangladesh(2015) indicates that at present out of 1,619 species examined in Bangladesh, 31 are regionally extinct, 56 are critically endangered and 181 endangered and 153 are vulnerable.	1. Biodiversity conservation programmes to be undertaken	MoEFCC and FD
Transfer of Forest Land: FD data indicates that till 2019, over 70,000 hectares of forest land have been transferred to other agencies. Out of these about 47,000 hectares have got transferred to Army and law enforcing agencies, which has gone under non-forestry use. This type of transfer is gradually shrinking the forests.	1. Use of forest land in non-forestry sector needs to be prevented	MoEFCC
Encroachment of forest land: According to the FD records about 68,000 hectares of forest land has got encroached. The actual figure will be much high. Such encroachment is constantly reducing the forest land.	1. The encroachment must be stopped 2. Encroached lands must be recovered and reserved 3. Forest land under reservation process are to be fast-tracked 4. Manpower of the FD needs to be significantly strengthened. Recovered land should be declared as reserved forest	MoEFCC and FD

Issues	Action	Implementing agency
<p>Forest Biodiversity conservation: Biodiversity conservation programme needs strengthening in the declared 45 Protected Areas while paucity of fund and lack of manpower remain as the major challenges.</p>	<p>1. Forest biodiversity conservation programmes need to be scaled up through Protected Area Management Plans</p>	FD and MoEFCC
<p>Pure plantations: Forest plantations are mostly monoculture with exotic species. These plantations are poor to support wildlife.</p>	<p>1. Mixed plantations of indigenous species to be encouraged</p>	FD, MoEFCC and Development partners
<p>Demand of wood: In 2018-19 Fiscal year, Forest Department produces about 0.29 million M³ of timber and 0.073 million M³ of fire wood. (FD, 2019). The village homestead area is expected to take this load of firewood and timber demand. Though the demand for total wood in the country may start to decline from 2030, the demand for industrial wood or timber is likely to continue to rise in future.</p>	<p>1. FD may strengthen forest extension offices at every upazila to provide forest extension service for the village communities</p>	FD, MoEFCC and Ministry of Finance
<p>Impact of Climate Change: The climate change and rising temperature may result in large-scale forest die-back, loss of biodiversity and reduced ecological benefits as per IPCC projection. Bangladesh will be one of the worst sufferers.</p>	<p>1. Large scale afforestation and reforestation programmes need to be undertaken 2. Green Belt plantation in the coastal region to be encouraged</p>	FD, MoEFCC and Ministry of Finance
<p>Priority of natural resources in national budget: The Government of Bangladesh has inadequate budget allocation to natural resources compared to other sectors.</p>	<p>1. Adequate importance to the natural resource sectors to be reflected in national budget</p>	MoEFCC and MoP
<p>Research and Development: At present R&D in natural resource sector is inadequate.</p>	<p>1. BFRI, BNH and SKWC need to be properly strengthened in terms of staff and equipment</p>	MoEFCC, MoF and FD

Issues	Action	Implementing agency
Policy, Acts and Rules: Time gap between policy and formation of act and rules sometimes affect proper forest management. Other sectoral policies, acts and rules sometime are contradictory to the conservation objectives.	1. Policy, acts and rules regarding forest conservation needs to be updated on regular basis 2. Sectoral policies to be reviewed in accordance with the priorities of the NCS	FD and MoEFCC
Forest Land Records: The FD has inadequate capacity in maintaining their land records.	1. The forest maps need to be digitized and properly conserved 2. The RIMS unit of the FD should be adequately resourced	FD, MoEFCC and MoF

2.4 BIODIVERSITY AND ECOSYSTEM

Bangladesh is flourished with rich biodiversity. Based on geographic and biogeographic features, ecosystem diversity of Bangladesh are: Hill ranges; Evergreen and semi-evergreen forests; Dry-deciduous and moist deciduous forests; Grasslands; Reed lands; Floodplains; Rivers; Low-lying islands (Char lands); Ox-bow lakes (Baors); River back swamps (Haors); Open woodlands (Village Grove); Low-lying deep depressions (Beels); Ponds/canals/ditches; Estuary; Coastal mudflats, Coastal islands; Mangrove swamp; Coral-associated island; and Marine ecosystems. The ecosystems of Bangladesh can also be divided into broad cluster on the basis of biophysical characteristics-(a) Terrestrial, (b) Inland Water, and (c) Marine and Coastal. The species diversity is endowed with rich flora and fauna. The reason behind this, is the country's unique geo-physical location, tropical climate and fertile landmass. However, the number of species are decreasing gradually because of direct and indirect intervention of human being and the rapid change of climate. The declining trend is higher especially in species diversity and mega fauna in particular³³.

33 DoE (2015). Fifth National Report of Bangladesh to the Convention on Biological Diversity, Biodiversity National Assessment 2015. Department of Environment. Ministry of Environment, Forest and Climate Change. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 147pp.

Box 2.4.1: Bamboo Gene Bank

Bamboo is an important plant resource popularly known as poor men's timber. In Bangladesh, bamboos are represented by 37 species under nine genera. Seven species of bamboo grow naturally in the forest dominated by muli (*Melocanna baccifera*) and 3 species, e.g. dalu (*Schizostachyum dullooaa*), pecha (*Dendrocalamus hamiltonii*), and lata bans (*Melocalamus compactiflorus*) have become endangered. Twenty-seven species grow in the villages dominating by borak (*Bambusa balcooa*) and baijja (*B. vulgaris*). Bangladesh Forest Research Institute (BFRI) established a Bambusetum (1.5 hectares) at its campus, Soloshahar, Chattogram. This arboretum contains 33 bamboo species, including six exotic ones.

2.4.1 Situation Analysis: Flora

The floral diversity of Bangladesh is extraordinary. Considering the country's biogeographic features, the country possesses notable diversity in its ecosystems, for example Sundarbans Mangrove ecosystem, hilly forests of the Chittagong Hill Tracts (CHT), Sal forests, Ratargul wetland ecosystem, agro-ecosystem, and homestead ecosystems denote the variations in the ecosystems. The *Encyclopedia of Flora and Fauna of Bangladesh* (2007-2009; Volumes 5-12) recorded 3,611 angiosperm taxa from the country, whereas the number increases to 3,733 due to recording of many new plants by 2015³⁴. Considering genetic diversity, some agricultural crops possess rich genetic resources, e.g. jute and allied fiber crops (6,012 accessions), and 9,925 accessions of 137 agri-horticultural crops by Bangladesh Agricultural Research Institute (BARI). Forest genetic resources are also rich, e.g. 2,260 plant species are reported from the Chattogram region³⁵ and 1,048 tree species including the gymnosperm, dicot and monocots reported from the country³⁶.

The people of Bangladesh depend on the floral stock for their day-to-day sustenance as well as overall livelihood security. Plant resources provide food, fiber, fuel, medicine, timber and also contribute significantly to national economies and employment of a large population.

The present condition of floral diversity in Bangladesh is at stake. The stress is mainly induced due to population pressure, unchecked pollution of soil and water, habitat destruction through land use change, introduction and rapid spread of invasive alien species along with the recent

34 Ara, H. and Khan, B. (eds.) (2015). Bulletin of the Bangladesh National Herbarium, Vol. 4. Bangladesh National Herbarium, Dhaka, 96pp.

35 Anon (1992). Forestry Master Plan (FMP) of Bangladesh. Ministry of Environment and Forest, Government of Bangladesh.

36 Basak, S.R. and Alam, M.K. (2015). Annotated Checklist of the Tree Flora of Bangladesh. Bangladesh Forest Research Institute, Chittagong, Bangladesh, iv+116pp.

climate change vulnerabilities. Over-exploitation of resources, e.g. unregulated harvesting, illegal felling, encroachment, shifting cultivation in the CHT, indiscriminate harvesting of medicinal plants and non-wood forest products exerts a significant negative impact on the biodiversity of the country. According to the *Encyclopedia of Flora and Fauna of Bangladesh* (2007-2009), 486 vascular plants are identified as threatened in Bangladesh³⁷, and expectation is that more species will be threatened if adequate measures are not taken to halt the destruction of the biodiversity.

2.4.2 Situation Analysis: Fauna

Bangladesh is located in the subtropical belt at the confluence of two major biotic sub-regions of the Oriental Region: Indo-Himalayas and Indo-China. This makes Bangladesh as one of the most ecologically significant and biologically diverse landscapes in terms of migratory species, staging ground, flyways and habitat for diversified wildlife of the region. The hilly area in the south-east of Bangladesh forms part of the Indo-Burma Biodiversity Hotspot which is also a repository of diversified floral and faunal species.

Of the wildlife, there thrive a total of 138 mammal, 650 bird, 167 reptile and 49 amphibian species³⁸. The biodiversity of Bangladesh is important for various reasons, the most important of which is to support the life in general and lives and livelihoods of the people in particular. The biodiversity in crop agriculture, fisheries, livestock, and forestry sectors are essential particularly for food security as well as for livelihood. However, the interspecies interrelationships or symbiosis are understood only in limited sense and many are also only ill-understood. On the other hand, the country has limited institutional capacity, and inadequate education and training facilities for the development of conservation and management of biodiversity. There had been only limited awareness and understanding among policy-makers regarding value of biodiversity.

The main direct threats are habitat degradation and fragmentation, change in land-use pattern, change in hydrological regime, pollution, over-exploitation of resources, unplanned and uncontrolled tourism, expansion of invasive alien species, and climate change. The indirect threats include legal and institutional systems that promote unsustainable exploitation, inequality sharing of benefits of biodiversity, insufficient knowledge and awareness, and erosion in genetic diversity. As a result, according to the 2015's assessment by IUCN, 23% of 1,619 animal species are nationally threatened (Box 2.4.2a). At least 31 species, most of which were charismatic wildlife, became extinct from Bangladesh in the last 100 years or so.

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37 Irfanullah, H. M. (2011). Conserving threatened plants of Bangladesh: Miles to go before we start? *Bangladesh Journal of Plant Taxonomy* 18(1): 81-91.

38 IUCN Bangladesh (2015). *Red List of Bangladesh Volume 1: Summary*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, xvi+122pp.

Despite prevailing threats and recent extinctions, Bangladesh still has many important species of wildlife, like Bengal tiger, Asian elephant, hoolock gibbon, dolphins, vulture, gharial, and batagur. There are also even private individuals who out of love of nature have created impromptu bird sanctuaries.

Box 2.4.2a: Species Red List of Bangladesh

The first step to conserve the animal species in Bangladesh is to identify the level of extinction risk on different species and produce a national Red List. IUCN Bangladesh led the initiative to update the National Red List 2000 under a Forest Department project of the Government of Bangladesh. The updating process took two and half years, involving the leading national experts of the relevant fields, and the result was published in 2015. A total of 1,619 species under seven groups of animals, namely mammals, birds, reptiles, amphibians, freshwater fishes, crustaceans and butterflies, were assessed, and was found that 2% are Regionally Extinct and 23% are threatened (i.e. Critically Endangered, Endangered and Vulnerable). This is indeed very alarming. Without strong and immediate conservation attempts, many more species might extirpate from Bangladesh in the next few decades. Moreover, 17% species were categorized as Data Deficient, which means that sufficient data to assess these species were not available. Field-oriented surveys should be conducted on these species to fill in the data gap. It is, however, feared that once the data are available and the Data Deficient species are assessed against IUCN Red List Criteria, a large proportion will be identified as threatened as well.

As highlighted in the Fifth National Report to the Convention on Biological Diversity (CBD) in 2015, the most notable achievement for Bangladesh is the expansion of protected area network through the declaration of new protected areas. Currently, Bangladesh has a network of 45 protected areas including wildlife sanctuary, national park, eco park, special conservation area and marine protected area³⁹. Moreover, the Government has so far declared 13 wetlands and coastal-marine biodiversity significance areas as Ecologically Critical Areas (ECAs). The Government has declared a number of wild flora and fauna as the nationally protected species. The captive breeding programmes of some important species of wildlife are also going on (Box 2.4.2b). Other than the wild animal diversity, there are some initiatives of the conservation of domestic animal diversity as well. Nijhum Dwip seascape has been declared as a Marine Protected Area (MPA). Declaration of St. Martin Island and surrounding areas as MPA is also under the process.

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39 DoE (2015). Fifth National Report of Bangladesh to the Convention on Biological Diversity, Biodiversity National Assessment 2015. Department of Environment. Ministry of Environment, Forest and Climate Change. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 147pp.

Box 2.4.2b: Return of the River Terrapin

The River Terrapin (*Batagur baska*) is considered as one of the rarest and most threatened wildlife species on earth. According to Red List, the species is globally Critically Endangered, which means that the species is facing extremely high risk of extinction in the wild. Thankfully, however, the successful captive breeding programme in Bhawal National Park of Bangladesh has brought back the species from the brink of extinction. With a few parent animals, the ‘Project Batagur’ was launched in 2010 and by 2015 a total of 146 young was born in captivity. A significant proportion of the world population of this species was born under this breeding programme. In 2016, IUCN-Bangladesh, Turtle Survival Alliance and Forest Department initiated the first step of its reintroduction to the natural habitat, i.e. the Sundarbans, by transferring 92 young in a facility in Karamjal, Sundarbans. Once they are acclimatized in the mangrove environment, they will be released in the wild to reclaim their former range.

2.4.3 Conservation Strategies and Actions

As a signatory to the Convention on Biological Diversity (CBD) and other international conventions and treaties, Bangladesh is committed to conserve and ensure sustainable use of biodiversity. Considering the importance of protection and improvement of the country’s environment and biodiversity, the Government of Bangladesh, in 2011, inserted the Section 18A in the constitution: “the state shall endeavor to protect and improve the environment preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens”.

In line with the global policy guidelines, in 2012, the Government enacted the Bangladesh Wildlife (Conservation and Security) Act for wildlife protection. More recently, the Government has adopted the Ecologically Critical Area Management Rules, 2016; the Protected Area Management Rules, 2017; and the Bangladesh Biological Diversity Act, 2017.

Adopted in 2010, the Aichi Biodiversity Targets 2020 have 5 strategic goals with 20 targets expected to be achieved and/or implemented by 2020. Among the targets, the most immediate need is to make people aware of the value of biodiversity and mainstreaming these issues in development process and planning based on knowledge, science and technology relating to all aspects of biodiversity which must be improved, widely shared, transferred, and applied. Subsequently, the SDGs, particularly Goals 14 and 15, called for certain targets on biodiversity conservation, some of which are basically the same that were to be achieved by 2020 under the Aichi Targets. The post 2020 Biodiversity Framework will be adopted in the Conference of Parties of the Convention on Biological Diversity in 2021.

What these bring to the focus is the necessity of ensuring scientific and socio-economic analytical assessment of the value of biodiversity and its processes and the consequences of its loss prior to any major specific intervention and subsequent mainstreaming. The National Biodiversity Strategy and Action Plan (NBSAP) was first formulated in 2006 has its first Strategy as “Recognize the value and importance of biodiversity for the Bangladesh people and document properly its components, distribution and value”. This became Bangladesh policy even five years prior to the adoption of the Aichi Targets. This strategy and action plan have recently been updated as the National Biodiversity Strategy and Action Plan of Bangladesh (2016–2021) in line with the Aichi Target and the SDGs⁴⁰. Elements of the NBSAP (2016–2021) has also been incorporated in the Eighth Five Year Plan (2020–2025), the most comprehensive national planning instrument of the Government of Bangladesh.

The strategies and targets outlined in the NBSAP (2016–2021) are therefore the guiding principles for conserving Bangladesh’s biodiversity within the NCS framework. The updated NBSAP essentially focuses on mainstreaming biodiversity conservation at individual, institutional and systemic levels as the core strategy. Its 20 targets have been translated the 20 Aichi Biodiversity Targets into Bangladesh context and list of possible activities to be taken under each of them. The important issue now is to undertake long-term, comprehensive programme in achieving implementation of these biodiversity strategies, action plans and targets. It is also important to mainstream biodiversity conservation in development process.

Based on the background above , the following action points are proposed for biodiversity conservation as a the priority needs for Bangladesh in order to strengthen the conservation and management of biodiversity are: i) broad-based awareness and advocacy to mass people, media and policymakers for proper management of biodiversity conservation; ii) formulation and implementation of updated policy and proper implementation of Bangladesh biological diversity act and other relevant laws; iii) regular monitoring and research on different aspects of biodiversity, particularly the population trends, breeding and conservation needs of key species; iv) capacity building for scientific management of protected areas and ecological critical areas; v) strengthening and expanding the processes by which local stakeholders can take part in protected area governance, wildlife conservation and benefits sharing; vi) avoidance, as much as possible, use of the alien/invasive species of animals and plants, and strict control of existing alien/invasive species; and vii) careful development of non-consumptive uses of protected areas and wildlife through controlled ecotourism. viii) effective and well-managed protected area and ecologically critical area network and inclusion of strategically chosen new areas, i.e. representative areas of all ecosystems

40 DoE (2016). National Biodiversity Strategy and Action Plan of Bangladesh (2016–2021). Department of Environment, Ministry of Environment and Forests, Dhaka, Bangladesh, xvi+119pp.

(terrestrial and aquatic), and biodiversity rich and biologically important areas that are not yet in the protected area network.

Considering the priority actions needed in line with the relevant SDGs, the action plan is hereby produced for proper attention and implementation.

Action plan for Flora

Considering the issues and strategies, the following actions may be given priority for implementation through relevant ministries, organizations and institutes. However, private or individual initiatives may be searched all across the country and encouraged for the initiatives.

Table 2.4.1: Actions for flora

Issues	Action	Implementing agency
Review existing laws and policies	1. Review, update and strictly implement laws and policies related to, natural resources, forests and environmental pollution	MoEFCC, DoE , FD, DoF MoEFCC, MoA, MoF and Legal experts
Legislation	1. Implementation of the Biodiversity Act	MoEFCC, MoA, MoF and Legal experts
	2. Enhance the capacity of Environmental Court to handle issues of biodiversity conservation appropriately	DoE, MoEFCC, FD and MoLJPA
Document and monitor biodiversity	1. Develop database of all known species based on published information	MoSICT, BNH and Universities
	2. Inventory marine biodiversity, microorganisms, agro-biodiversity, lower plants etc.	DoE, FD, BNH, BFRI and Universities
	3. Develop a National Policy on Genetic Resources	MoEFCC, MoA, Universities, AF, IUCN, DoE and FD
	4. Updating of inventory on existing and endangered flora and fauna	FD and BNH
	5. Identification of Key Biodiversity Areas (KBAs)	DoE, FD and DoF

Issues	Action	Implementing agency
Evaluate status of Threatened Flora and Fauna	1. Detailed countrywide survey of the plants that have been listed as threatened	MoEFCC, FD, BNH, BFRI and Universities
	2. Prepare a handbook that illustrates and describes the known species of plants and animals in Bangladesh	MoEFCC, MoSICT, FD, BFRI, BNH and Universities
	3. Develop Species Recovery Plan	MoEFCC, FD, DoE, BNH, BFRI and Universities
Ecological Restoration	1. Recolonization of native plants and the gradual re-establishment of ecosystem processes	MoEFCC and FD
Prepare the Management Plan for the PAs, ECAs and Other Important Biodiversity Areas.	1. Prepare management plan for all ecosystems of the country including the Wildlife Sanctuary, National Parks, Ecologically Critical Areas etc.	MoEFCC, DoE, FD, BFRI, BNH BCSIR, BFRI, and Universities
Ensure cross-sectoral integration of biodiversity	1. Integrate biodiversity information and communication protocol in all development projects	MoEFCC, Ministry of Planning, GED, DoE, all development ministries
	2. Network biodiversity information system so that they are accessible across sectors	FD, DoE and MoSICT
Local participation	1. Build capacity in the local government to manage biodiversity locally	MoEFCC, FD, DoE and Development partners
	2. Effective co-management of PAs	
	1. Establish cooperatives and regulated markets locally exclusively for biodiversity trade	MoEFCC, FD, DoE and Development partners
	2. Build capacity in women to run the local level institutions	MoEFCC, MoWCA, MoDMR, FD, DoE and Development partners

Issues	Action	Implementing agency
Replenishment of resources	1. Plant species bearing food and providing shelter to wild animals and bird should be included in tree planting programme in rural and forest area	MoEFCC MoLGRDC, MoA, FD, DAE and Development partners
	2. Restoration and recolonization of native tree species with Assisted Natural Regeneration (ANR)	MoEFCC, BNH and Development partners
	3. Unutilized areas in managed forest and unclassified state forest to be planned with indigenous species and bamboos	MoEFCC, FD, BNH and Development partners
	4. Wild plant survey to be initiated with adequate qualified personnel and equipment in the protected areas. Survey will include study of long term ecological studies, population dynamics and listing of rare, endangered and threatened species	MoEFCC, FD, DoE, BNH and Development partners
	5. Documentation and participatory management of the VCFs in CHT	Headmen/Karbari, CHT Development Board and Development partners
	6. Reclamation and restoration of degraded forest land through natural regeneration	FD, Development partners and Universities
	7. Conservation and restoration of mangroves, e.g. Chakaria Sundarbans 8. Develop models for community participation 9. AIGs for forest dependent groups	FD, DoE, Development partners and Universities

Issues	Action	Implementing agency
Research, Education and Public Awareness	1. Create widespread awareness amongst the general public	FD and Development partners
	2. Sensitise the religious heads at all levels to address the issue of biodiversity conservation	MoEFCC, DoE and FD
	3. Graduate courses on Biodiversity Conservation and management to be introduced in universities for production of professionals on the subject	MoE in collaboration with MoEFCC and University Grants Commission
	4. School curricula to be incorporated with small projects on field visits of 'biodiversity hotspots'	MoEFCC in collaboration with School Text Book Boards, Boards of Secondary and Higher Secondary Education
	5. Establish Village Biodiversity Register for documenting the rural biodiversity resources	DoE and FD
	6. Eco-tourism to be developed in protected areas for public awareness and generating income	MoEFCC, FD and DoF
	7. Research for exploration the climate resilient species	BFRI and Universities
Resource inventory and protection	1. A National Committee for Plant and Animal Genetic Resources should be established. This may be constituted under the auspices of a National Institute, e.g BARC (apex body of the NARS)	MoEFCC and BARC
	2. Physical facilities and expertise of the Universities to conserve germplasm	MoEFCC, UGC, Universities and NARS
	3. Conservation of Forest Genetic Resources (seed, fruit)	BFRI, Universities, FD, BNH, BFRI and Universities
	4. Endangered plants conserved through seed banks/germplasm banks	MOEFCC, NARS institute, FD and BNH
	5. Establishment of: Bangladesh Biodiversity Research Centre (BBRC) OR Bangladesh Biodiversity Research Institute (BBRC)	MOEFCC

Action for Fauna

Table 2.4.2: Actions for fauna

Issues	Action	Implementing agency
Increase effectiveness of protected area network and include strategically chosen new areas (SDG Goal 15)	1. Increase the trained manpower and logistics, and dedicate them for protected area management; make legal arrangements to include the new areas (e.g. biodiversity-rich wetlands and bamboo groves) that are currently not under the MoEFCC	MoEFCC, MoWR, MoL, MoCHTA and MoP
Identify, map and protect all vulnerable ecosystems	1. Develop appropriate methods, standards, criteria, indicators for identifying all such ecosystems; undertake nationwide mapping (by taking advantage of GIS and remote sensing) of all vulnerable ecosystems taking cognizance of land use changes and other emerging threats such as climate change	MoEFCC, MoL, GIS and remote sensing expertise organisations
Zoological survey of fauna from microorganisms, tiny invertebrates (e.g. rotifers, planktons, etc.) to wildlife	1. It involves a lot of tasks – institutional arrangement and funding, time bound action plan, gathering of respective expert scientists especially taxonomists in each area and logistics	All public Universities, Govt research organisations – NIB and Other research institute
Establish terrestrial connectivity/corridors for keystone and flagship species	1. Landscape principles of establishing terrestrial connectivity/corridor should be identified, restored, and protected from development activities; a GIS mapping of all such connectivity along with land use pattern change/trend should be done	MoEFCC and MoL
Initiation of molecular taxonomy/ DNA barcoding	1. Molecular taxonomy is crucial for biodiversity conservation; DNA barcoding is needed to cope with international trend	NIB and Universities
Produce new legislation	1. Formulate a parent or over-riding law dedicated to biodiversity conservation	MoEFCC and legal experts

Issues	Action	Implementing agency
Formulate new policies	1. Formulate policies on biodiversity (particularly wildlife) conservation and genetic resources	MoEFCC, MoA and Legal experts
Review and update the existing laws and policies	1. Update the bio-safety policy/ guidelines of Bangladesh as per the Cartagena Protocol on Biosafety	MoEFCC
Digitalisation of biodiversity data	1. All collected specimens and their attributes – taxonomy, biogeographic locality, ecology, evolution, and genetics must be incorporated in the dataset	MoEFCC, DoE, NARS institute and Universities
Make documentation and inventory of biodiversity	1. Develop a database (archive and online) of all known species based on published and other reliable information; conduct inventory of least known groups like marine biodiversity, lower plants, micro-organisms, etc.	MoEFCC, DoE, MoST, IUCN-Bangladesh, Universities and Research organizations
Conduct a survey and evaluate the status of endangered fauna and flora	1. Conduct a countrywide survey of the fauna and flora to identify the status; prepare books and online resources on threatened fauna and flora	MoEFCC (FD), IUCN-Bangladesh, Universities, BNH and BFRI
Improve conservation and management of the threatened ecosystems and species	1. Prepare management/survival plans for threatened ecosystems and species (or groups of species); take legal and scientific measures for <i>in-situ</i> and <i>ex-situ</i> conservation of the threatened species; take initiatives of reintroducing the extinct species	MoEFCC, FD, DoE, IUCN-Bangladesh, Universities, BNH, BFRI, legal experts
Gather information on natural history and population trends	1. Conduct scientific research (particularly on ecology and behaviour) and monitoring of fauna	MoEFCC, DoE, , FD Universities, Research institutions and Development partners

Issues	Action	Implementing agency
Improve the institutional capacity	1. Strengthen the capacity of institutions to manage and protect biodiversity, and undertake survey and taxonomic work; establish Zoological Survey; enhance the capacity of Environmental Court to properly handle the issues of biodiversity conservation	MoEFCC (all Depts), Wildlife Centre and Environmental Court
Restore degraded ecosystems and combat climate change	1. Plantation programmes should include (at least partially) the indigenous species (e.g. fruiting trees) that can support the local wildlife; natural water cycles and connections of the freshwater wetlands should be maintained/re-established; increase coastal forestation and other climate change mitigation measures	MoEFCC, FD, MoDMR, MoWCA and Development partners
Improve public support and participation	1. Strengthen co-management practices for natural resource conservation and management; conduct mass education and outreach programmes on biodiversity; support AIGs including community-based ecotourism; increase women's involvement; ensure quick disposal of compensation for human casualty and major damage of property by wildlife	MoEFCC, MoFL, MoPME, MoI, MoLGRDC, DoE, media, Development partners and Community organizations
Ensure cross-sectoral integration of biodiversity	1. Integrate biodiversity information and communication protocol in all development projects; network biodiversity information system so that they are accessible across sectors	MoI and MoEFCC

Table 2.4.3: Actions for protected areas

Issues	Action	Implementing Agency
Management of ECAs	1. DoE will develop and implement a project to manage all the ECAs 2. Enhance capacity for proper management of ECAs	MoEFCC and DoE
Management of PAs	1. FD will develop and implement a project to manage all the PAs	MoEFCC and FD
Management of Fish Sanctuaries	1. Fish sanctuary or refuge (seasonal/temporary sanctuary) needs to be established. 2. Unified tool or action plan is required for instant protection of value species in vulnerable period	DoE and DoF

2.5 INLAND FISHERIES

2.5.1 Situation Analysis

Freshwater fisheries resources play a significant role in the economy of Bangladesh. This agriculture sub-sector alone is about 3.6% of GDP and 23.8% of agricultural GDP⁴¹. Straddling on the tropics and blessed by the largest delta of the world, Bangladesh has a total inland water area of 4.7 million hectare of which 27.03% is open water capture fishery and 56.82% for closed water culture fishery⁴². Seasonal floodplain expands over a massive 2.7 million hectares of area for 4–6 months of the year, opening up a vast area where fisheries can thrive⁴³.

In 2016, the Food and Agricultural Organization (FAO) ranked Bangladesh as the 5th in aquaculture⁴⁴ and in 2018, 3rd in open water fishery by output⁴⁵. Fish accounts for

41 BBS (2017). *2016 Statistical Year Book of Bangladesh*. Bangladesh Bureau of Statistics (BBS), Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 559pp.

42 BBS (2018). *2017 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

43 Rahman, M.F., Jalal, K.C.A., Jahan, N., Kamruzzaman, B.Y., Ara, R. and Arshad, A. (2012). Present Status and Approaches for the Sustainable Development of Community Based Fish Culture in Seasonal Floodplains of Bangladesh. *Pakistan Journal of Biological Science* 15(12): 551-567 (https://scialert.net/fulltext/?doi=pjbs.2012.551.567#98470_b).

44 DoF (2017). *Yearbook of Fisheries Statistics of Bangladesh 2016-2017*. Fisheries Resources Survey System, Department of Fisheries Bangladesh, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh.

45 Dhaka Tribune (2018). FAO: Bangladesh ranks 3rd in inland fish production. Dhaka Tribune. Available at: <https://www.dhakatribune.com/feature/food/2018/07/18/fao-bangladesh-ranks-3rd-in-inland-fish-production> (Accessed: 28 July 2018).

about 60% nationwide animal protein intake. In the year of 2016-2017, 1.51% of annual export earning comes from the fisheries sector⁴⁶. This sector provides employment to about 17.80 million full-time and part-time fishermen and workers⁴⁷. Official statistics indicate that the annual fish catch from the rivers of Bangladesh was nearly 271,639 metric tons fishes in 2016-2017 fiscal year, of them, Hilsa (*Tenualoa ilisha*) alone contributes to 80%. Besides, major and minor carps (10.22%), larger catfishes and live percoids (6.07%), shrimps (6.04%) and other inland fishes (14.66%) comprise the remaining catch in the open waters⁴⁸.

Despite exponential growth in fishery production, native fish diversity of Bangladesh is at stake. As of IUCN Bangladesh, out of 253 native species, 64 have been assessed as threatened (3 Critically Endangered, 13 Endangered, 13 Vulnerable)⁴⁹ in comparison to 54 from 266 species assessed back in 2000⁵⁰. Several in-bound and transboundary dams and embankments are playing adverse and crucial role in the decline of the fisheries production. The water resource infrastructure in the 1960s and 1970s and also continuing in many cases now blocked the linkages between the rivers and their floodplains as well as canals, *khals* and open water bodies, like *beels*, *haors* and *baors*, resulting in adverse consequences for the life-cycle of the fishes and lowering their output. In case of Hilsa, the production sharply fell in the Padma river system after the Farakka Barrage construction in the early 1970's.

Grave threats are also caused due to increasing discharge of pollutants and effluents from industrial and agricultural sectors in many cases causing drastic fall in quality of water for aquatic life. Native breeding grounds, like the Halda River is falling victim to effluent-induced pollution, and human interventions that affect river ecosystem. There are also climatic factors that influence the fish and fisheries of Bangladesh so far and have been identified as, rainfall, drought, temperature and siltation. Major changes in these elements of climate cause loss of natural habitat for the fishes. The high temperature causes low survival of spawns. In addition, under-developed and poor techniques work as restraints for the overall progress in hatchery and farming practices.

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- 46 DoF (2017). Yearbook of Fisheries Statistics of Bangladesh 2016-2017. Fisheries Resources Survey System, Department of Fisheries Bangladesh, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh.
- 47 Monowar, H. (2016). Fisheries Statistics in Bangladesh: Issues, Challenges and Plans. Presented in Asia and Pacific Commission on Agricultural Statistics (Twenty-Sixth Session), Thimphu, Bhutan, 15-19 February 2016, Department of Fisheries, Government of People's Republic of Bangladesh.
- 48 DoF (2017). Yearbook of Fisheries Statistics of Bangladesh 2016-2017.
- 49 IUCN Bangladesh (2015). *Red List of Bangladesh Volume 1: Summary*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, pp.xvi+122.
- 50 IUCN Bangladesh (2000). *Red Book of Threatened Fishes of Bangladesh*. IUCN-The World Conservation Union. Xii+116.

2.5.2 Conservation Strategies and Actions

Inland fisheries are not mentioned separately in the SDG Framework. The references to several targets, however, clearly imply that fisheries are targeted along with others as well. The SDG 2 and Target 2.2 call for ending all forms of malnutrition by 2030 while some of the results are to be achieved by 2025. Fishes accounting for around 60% of animal protein in the country are certainly to be targeted well in Bangladesh, if such goals are to be met. The SDG Target 2.3 calls for doubling agricultural productivity and income of small-scale food producers including fishers. But this needs to be done without adversely affecting the ecosystem, particularly aquatic ecosystems. This guides to the strategy for water resources development to be fish-friendly. The Target 15.1 has given importance to conserve freshwater ecosystems by 2020. Additionally, the Target 2.5 calls for maintaining genetic diversity of domesticated animals, which may include aquaculture within fisheries. The environment policy of the Government with respect to fisheries as provided in the recently adopted National Environment Policy 2018 should be followed as a national conservation strategy for the improvement of river-floodplain ecosystems to increase the production and productivity of open water fisheries. The environment policy for fisheries calls for the reestablishment of connectivity between rivers and their floodplains which will improve the river-floodplain ecosystems, and subsequently increase open water fish production and productivity.

The relevant authorities have time to time promulgated various laws, policies, regulations and subsequent interventions. These include the Protection and Conservation of Fish Rule (1985), Bangladesh Fisheries Development Corporation Act (1973), Environmental Policy (2018), National Water Policy (1999), National Fisheries Policy (1998), Reservoir Protection Act (2000), and National Shrimp Policy (2014). But unavailability of adequate information is still an issue. Even reliable information on catch is not available. This is a major issue from the view point of people's livelihoods, food security, and nutrition. Similarly, how far the culture fishery can actually be a substitute of capture, wild and natural fishery remains little investigated and understood. From nutritional and other points of view, culture fishery is only at best a limited substitute. Further, the fisheries biodiversity and genetic diversity cannot be maintained with culture fishery alone. In this connection, it is instructive to refer to one of the Aichi Biodiversity targets which read as "By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits". These concerns are reflected very similarly in the SDG targets discussed above.

Given the above concerns, the conservation strategies for inland fisheries for the future should include conservation and sustainable use of fish habitats and ecosystems through legal, technical and other means. It should focus on regeneration of natural open water, capture fisheries. Efforts should be given on maintaining genetic diversity while regenerating natural fisheries, but also maintain purity of brooding stock in case of culture fisheries. We need to take appropriate technical and other means, including financial and economic, for raising productivity of fisheries, with an aim to enhance the income of those directly and indirectly involved with fisheries, with particular emphasis on adapting to climate change impacts.

Table 2.5.1: Actions for Inland Fisheries

Issues	Actions	Implementing agency
The quantification of population, assessment of the level of habitat degradation and pollution are lacking. This is hampering the making of conservation plans for any 'risk' fisheries resources.	<ol style="list-style-type: none"> 1. Habitat identification and protection 2. Improvement of the understanding of species diversity of different inlands water bodies like Beels, lakes, rivers and streams of Bangladesh 	DoE, DoF, Universities and IUCN
Being an overpopulated country and agricultural country, huge organic and chemical pollutants are drained into the wetland as well as the rivers which undermine the water quality and pose threat to survival of aquatic species.	<ol style="list-style-type: none"> 1. Water pollution: Regular monitoring of the water quality and pollution of different water system 	DoE and DoF
Due to the population expansion and multiple ownerships of land and water, conversion of wetland to house or agricultural land is high. This causes the shrinkage of wetlands of the country. The water area needs to be marked by the government to prevent land grabbing or poaching activities.	<ol style="list-style-type: none"> 1. Allocation of areas for fisheries: Demarcating the land and water use area uses 	MoL along with DoF and DoF

Issues	Actions	Implementing agency
There is a knowledge gap in identifying the target fish/crustaceans habitats and the fishermen communities they support and design effective alternative income generating activities for best protection of the species.	1. Fisheries Governance and livelihood support: Understanding the life patterns and livelihoods of the fisheries dependent people	DoF, NGOs, Universities and BFRI
There are no quarantine laws and laboratories for fish importation in Bangladesh. A weak protocol for importation of selected exotic fishes is in place. This resulted in introduction of mislabeled fish species in Bangladesh in many ways. More than 19 species is introduced in the aquaculture sector by the government and private sectors. Though banning was made effective for piranha and African cat (<i>magur</i>) fish, full eradication and illegal production in hatchery and culture system is not possible yet.	1. Alien species: Control of exotic/alien fish/crustacean/predator species import in the country	DoF, Research in universities and BFRI, Customs (Revenue department), land, air and water port authorities
Natural disaster and water flow management cause habitat loss for aquatic organisms. No protocol has developed to save animals in such state. Impact on climate changes on fish and fisheries sector also need to assessed. .	1. Natural, Human and trans boundary attributes: Develop management plans based on research on impacts of climate change and disaster on aquatic fauna. Transboundary issues on river flow and fauna need to be assessed	DoF, Disaster Management Dept, BFRI and Universities
More coordination and collaboration and partnerships are needed among natural resource managers, agencies, organizations, academics, and individuals in order to improve the conservation status of aquatic habitats and species.	Institutional management: Adopting partnerships and collaboration among various agencies, organizations, academia and related industries to conserve the target fisheries	DoF, DoE, Universities, BIWTC, EPB, WDB, PDB, PDB and MoL

Issues	Actions	Implementing agency
The knowledge on the fish status, conservation and prevention of aquatic habitat destruction among the general public is limited. There is a need to educate and engage local governments, planning commission, and both rural and urban populace about the importance of fish and wildlife conservation as a key component of successful land use planning.	1. Improvement of knowledge base and Research: Improvement of educational and extension efforts to advance the understanding of fish and fisheries resources among the general public and various stakeholders.	NCTB, MoEdu, MoEFCC, colleges and schools, extension department, Media and newspapers
Degradation of river-floodplain ecosystems because of disconnection of rivers from their floodplains due to flood control, drainage and irrigation infrastructures such as polders and embankments with water controlling structures	1. Improvement of river-floodplain ecosystems by the reestablishment of connectivity between rivers and their floodplains to increase production and productivity of aquatic ecosystem goods and services, fish production in particular	MoWR, BWDB, WARPO, MoA, DAE, BADC, MoFL, DoF, BFRI, MoEFCC and DoE

2.6 COASTAL AND MARINE RESOURCES

2.6.1 Situation Analysis

With the Bay of Bengal in the south, the coastal and marine resource sector broadly comprise with two major systems: the marine system consists of the waters and associated resources from the low water mark (50 m depth) to the high seas; and the coastal system made up of up to < 50 m depth to the coastline and inland from the coastline to a maximum of 100 km or 50-metre elevation. However, by the UN Convention on the Law of the Sea (UNCLOS), Bangladesh also has legal rights over the resources in the high seas and responsibilities for their sustainable utilization and management.

Huge volume of river runoff from the upstream rivers and in-country river networks of the Ganges-Brahmaputra-Meghna basin along with monsoon precipitation has differentiated coastal and marine ecosystems in various saline zone with sharp contrast, ranging from almost ‘zero’ in the estuarine and near-coast areas⁵¹ to below 30 ppt⁵²,

51 Chowdhury, S. R., Hossain, M. S., Shamsuddoha, M. and Khan, S.M.M.H. (2012). Coastal Fishers' Livelihood in Peril: Sea Surface Temperature and Tropical Cyclones in Bangladesh, CPRD, Dhaka, Bangladesh, 54pp.

52 Benshila, R., Durand, F., Masson, S., Bourdallé-Badie, R., Montégut, C.B., Papa, P. and Madec, G. (2014). The upper Bay of Bengal salinity structure in a high-resolution model. *Ocean Modelling*, 74: 36-52. DOI: 10.1016/j.ocemod.2013.12.001.

compared to 35 ppt and above for the world average⁵³. Such a unique geo-physical setting along with diverse bio-chemical parameters support formation of diverse habitat nurturing wide range of flora and fauna, especially in the shallow and well oxygenated area. The intertidal coastal zone helped natural growth of the world largest mangrove forest, the Sundarbans, on 10,000 km² areas, 60% of which is in the southern part of Bangladesh, providing a unique set of goods and services to the society.

The off-shore areas of the Bay of Bengal also serve as a potential reserve of organic sediments, estimated around annually 2.4 billion tons, representing about 10 to 20% of the total terrestrial organic carbon⁵⁴. The high erosion rates in the Himalayas generate high sedimentation rates and low oxygen availability in the Bay of Bengal that sustain the observed extreme organic carbon burial efficiency.

In both coastal and marine systems, Bangladesh endows a wealthy reserve of both living and non-living resources in its long and extended coastal and maritime jurisdiction. Country's 710 km long coast line extending from the tip of St. Martin's Island in the south-east to the west coast of Satkhira and Exclusive Economic Zone (EEZ) are characterized by uniquely differentiated ecosystems having significant ecological and economic importance and potential.

The coastal and marine environment of Bangladesh is subject to a number of threats and stressors. The near-shore fisheries areas of the Bay of Bengal is over-exploited as catch per unit fishing effort is falling and several species of marine shrimp and fish stocks are in decline⁵⁵. Marine and inland fish catches in Bangladesh have doubled since 2003 reaching 4.1 million metric tons in the year 2017, of which Hilsa has contributed 496,417 metric tons⁵⁶. Over the same period, the number of marine fishing trawlers/boats and gears/nets has increased 3times and 2 times respectively resulting in tremendous pressure on Hilsa populations⁵⁷.

A number of laws, rules and policies are in place for fisheries management, but their implementation are often met by conflicts and non-compliance by the stakeholders. In Hilsa sanctuaries, fishers often violet ban season prohibitions and continue using banned *current jal* (a type of net). Pressure on fisheries resources also increases from

53 Sverdrup, H.U., Johnson, M.W. and Fleming, R.H. (1942). *The Oceans: Their Physics, Chemistry, and General Biology*. Prentice-Hall, NY. 1087pp.

54 Anwar, J. (1988). Geology of coastal area of Bangladesh and recommendation for resource development and management. In: *National workshop on coastal area resource development and management, part II*. Organized by CARDMA, Dhaka, Bangladesh, pp 36–56.

55 Hussain, M.G. and Hoq, M.E. (2010). Marine and coastal resources of Bangladesh: BOBLME project implication. In: Hussain, M.G. and Hoq, M.E. (eds.) *Sustainable Management of Fisheries Resources of the Bay of Bengal*, pp. 107–120. Support to Sustainable Management of the BOBLME Project, Bangladesh Fisheries Research Institute.

56 DoF (2017). Yearbook of Fisheries Statistics of Bangladesh 2016-2017. Fisheries Resources Survey System, Department of Fisheries Bangladesh, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh.

57 Sverdrup et. al. (1942). *The Oceans: Their Physics, Chemistry, and General Biology*.

fishing larvae and juveniles whatever is available⁵⁸.

The impacts of climate change are likely to reduce the potential fish production in the Bangladesh EEZ by 10%⁵⁹. If over-exploitation continues, catches are projected to fall by almost 95% by 2060, compared with the Business as Usual scenario for the start of the 21st century⁶⁰. Ocean acidification is another global problem that can affect coastal and marine living resources of Bangladesh⁶¹.

Pollutants from point and non-point sources often find their ways in the Bay of Bengal. Some point sources are ship-breaking activities in Chattogram, and municipal wastes and industrial wastes from Khulna city⁶² and Chattogram city through the adjacent rivers. Scrapping activities in particular release loads of pollutants, including toxic waste and harmful chemicals to the coastal and marine environments.

The coastal population of Bangladesh has doubled since the 1980s, now reaching more than 16 million, which is approximately 10% of the total population, where most of them experiencing both poverty and vulnerable to rapid environmental changes⁶³. The population pressure alone is posing ever-increasing pressures on biodiversity resulting in high level of exploitation and destruction of habitats and disrupting integrities of the coastal ecosystems⁶⁴.

The Government of Bangladesh has declared four different areas covering 204 square nautical miles of the fishing ground of the south patches and the middle ground as marine reserve to provide safe breeding ground for fisheries and shrimps inside Bangladesh territory to conserve and develop marine fisheries resources⁶⁵. To protect the single largest Hilsa fishery from recruitment overfishing and growth overfishing,

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- 58 Jahan, K. M. Belton, B. and Viswanathan, K. K. (2014). Communication strategies for managing coastal fisheries conflicts in Bangladesh. *Ocean & Coastal Management* 92: 65-73.
- 59 Miah, M. S. (2015). Climatic and anthropogenic factors changing spawning pattern and production zone of Hilsa fishery in the Bay of Bengal. *Weather and Climate Extremes* 7: 109–115.
- 60 Fernandes, J. A., Kay, S., Hossain, M. A., Ahmed, M., Cheung, W. W., Lazar, A. N., and Barange, M. (2015). Projecting marine fish production and catch potential in Bangladesh in the 21st century under long-term environmental change and management scenarios. *ICES Journal of Marine Science* 73(5): 1357-1369. <https://doi.org/10.1093/icesjms/fsv217>.
- 61 Hossain, M.S., Chowdhury, S.R., Sharifuzzaman, S.M. and Sarker, S. (2015). *Vulnerability of the Bay of Bengal to Ocean Acidification*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, vi+55pp.
- 62 Hossain, M.M. (2004). National Report of Bangladesh. On Sustainable Management of the Bay of Bengal Large Marine Ecosystem (BOBLME), GCP/RAS/179WBC, FAO, BOBLME Programme in Bangladesh, 4-9pp.
- 63 Fernandes et. al. (2015). Projecting marine fish production and catch potential in Bangladesh.
- 64 DoE (2015). Fifth National Report of Bangladesh to the Convention on Biological Diversity, Biodiversity National Assessment 2015. Department of Environment. Ministry of Environment, Forest and Climate Change. Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 147pp.
- 65 Hossain, M.M. (2004). National Report of Bangladesh.

the Government has declared five fish sanctuaries in the Meghna and the Padma Rivers, its tributaries and inshore waters. The five Hilsa sanctuaries in Bangladesh are 100 km of the lower Meghna estuary, 90 km area of the Shahbajpur River, nearly 100 km of the Tetulia River, whole 40 km of the Andharmanik River, and 20 km stretch of the lower Padma (Box 2.6.1).

Box 2.6.1: Hilsa conservation

Hilsa (*Tenuelosa ilisha*) is one of the important fisheries of Bangladesh which is about 11% of the country's total fish production and more than 1% of the GDP (Dhaka Tribune 2018). The production of Hilsa was 387,211 mt in 2014–15 compare to 183,501 mt in 1987–88, shows an increasing trend in the fisheries due to a conservation plan implemented by the Government of Bangladesh. The adult Hilsa fish lives in the sea and migrate to the estuary and freshwater rivers to breed. The water flow, depth, availability of planktonic-food and sediment loads of the rivers are the major factors for the onset of migration. The spawning migration initiated with the early rain and maximize to the full moon of Bengali month Ashwin (mid-September–mid-October) in the Meghna estuary of Bangladesh. The lesser water flow in the river due to Farraka Barrage on the Ganges is also identified for preventing the migration fish in the River Padma in Bangladesh. In early monsoon, the fish migration to the Padma is prevented due to the *chars* (sandbars or riverine islands) emerge as barriers. However, the fish starts to migrate to the upper river catchment areas in the late monsoon after heavy rainfall and with higher water level.

The Hilsa management plan of Bangladesh is unique. A ban on catching the brood fishes for 21 days in breeding season and prohibition of catching under 10-inch-sized juvenile Hilsa or *Jatka* for six months are the major conservation strategies for the fish. Hilsa catch of West Bengal, India is declining although they spawn in the Bay of Bengal and breed in the Hoogly-Bhagirathi estuary. A joint study of University of Dhaka and Jadavpur University commenced by IUCN along with different governmental agencies resulted an exemplary initiative. The West Bengal Government in 2013 adopted laws on preventing fishing of Hilsa brood at the same period with Bangladesh. The conservation plan for Hilsa taken by Bangladesh and India is a historical event for a trans-boundary fish management. This will benefit in developing a good understanding and conservation of the Hilsa fishery in future. This initiative is an exemplary edge for the world to conserve a flagship fish like Hilsa.

On 27 October 2014, the Government of Bangladesh declared 1,738 square kilometers of the Swatch of No Ground as country's first Marine Protected Area (MPA) for the long-term protection of dolphins, whales, sharks and turtles that inhabit waters offshore of Bangladesh. With a view to conserve the nature in sustainable manner, control and mitigate pollution, the Government has declared a total of four coastal sites of the country as Ecologically Critical Areas (ECAs). There are nine wildlife sanctuaries

and two national parks in the coastal zone. In 1992, the entire Sundarbans Mangrove forest was declared as a Ramsar Site; 3 Wildlife Sanctuaries were declared as the World Heritage Site in 1997. Nijhum Dwip MPA has been declared recently. Initiatives are ongoing to declare new MPAs. In relation to open ocean fishing, Department of Fisheries (DoF) has declared 65-days ban period (from May to July) for trawl fishing and shrimping in the Bay of Bengal.

2.6.2 Conservation Strategies and Actions

Bangladesh does not have sufficient, updated data on the standing stock and maximum sustainable yield values of coastal and marine fisheries which are important to make policy decisions and manage the fisheries. Exploratory surveys need to be conducted for stock assessment of all major species of coastal fisheries resources. Identification of other coastal resources also needs to be done along with establishing maximum sustainable yield estimates, emphasizing conservation of marine resources.

High Seas represent about 60% of the ocean and deep seabed beyond the State's jurisdiction. It is under worrying situation not only for fast degradation of its common resources, but also for increasing illicit activities. Since the enforcement of the UNCLOS, much has been achieved in resource conservation and management through different regional initiatives, like Large Marine Ecosystems (LMEs) projects. Proper initiatives are needed for combating illicit activities, e.g. illegal fishing and sea piracy.

Government of Bangladesh has developed action plan for the wise management of marine resources and developed Blue Economy Action Plan. With the increase of country's EEZ, Blue Economy offers enormous potentials to Bangladesh towards ensuring sustainable use of untapped marine resources within the national jurisdiction and beyond. Beside resource exploration and utilization, blue economy refers to other potentials of coastal and marine sector, including shipping, marine construction, energy development, mariculture, coastal aquaculture, and tourism that can increasingly contribute to economic growth, development, and poverty alleviation. Bangladesh should develop a long-term action plan and strategies for sustainable utilization of 'blue resources' in the context of 'Blue Economic Growth' and tie together with the SDG 14 and SDG 15. This must be coordinated with relevant regional partners and organizations since oceanic resources and dynamics are essentially a transboundary issue.

Based on these strategic directions, the following action points are suggested for the coastal and marine sector within the Bangladesh NCS framework.

Table 2.6.1: Actions needed for Coastal and Marine Resources

Issues	Actions	Implementing agency
Fisheries Stock Assessment	<ol style="list-style-type: none"> 1. Conduct exploratory survey for stock assessment of all major species of commercial importance 2. Assess stock of untapped/less explored pelagic fishery resources, like tuna and other non-traditional fishery resources, such as squid, cuttlefish, octopus, oysters, mussels, lobsters, crabs, sea cucumbers and seaweeds with a view to their sustainable exploitation within the EEZ of Bangladesh 3. Undertake appropriate legal framework to prevent over-exploitation 4. Establish MSY (maximum sustainable yield) emphasizing conservation of over exploited resources 5. Introduce catch monitoring system at landing centers to assess the status and trends of resources in catch for efficient management decisions 6. Develop capacity of a dedicated institution to conduct assessment at regular intervals, monitor catch and fishing efforts and generate research-based data/ information with a view to conserve and manage fishery resources on a sustainable basis 	MoFL, DOF, Academic/ Research institutions, Marine Fisheries Academy, National Institute of Oceanographic Research and Bangladesh Navy
Legal measures and social safeguards for resource conservation and management	<ol style="list-style-type: none"> 1. Bring the small-scale artisanal fishery under monitoring, control and surveillance (MCS). The ESBN operations should be ban in less than 10m deep and mesh size should also control strictly 2. Undertake stock recovery plan for the overexploited fishery by adopting comprehensive measures including reduction of fishing effort, conservation of fishing grounds and actively monitoring of the compliance measures 3. Ensure proper implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the SSF Guidelines) adopted in 2015 	MoFL, MoEFCC, DoF, Civil Administration, Academic/ Research institutions and Bangladesh Navy

Issues	Actions	Implementing agency
	<p>4. Ban shrimp post-larvae collection from certain ecologically sensitive areas near the Sundarbans and other ecologically sensitive areas since the complete ban on shrimp post-larvae collected hasn't implemented in an effective manner</p> <p>5. Ensure necessary technical and financial support for establishing high-tech shrimp hatchery to ensure supply of pathogen free (SPF) shrimp post-larvae</p> <p>6. Upscale post-harvest technology with appropriate infrastructure facilities, such as cold storage, ice plants, insulated and refrigerated systems etc. to prevent spoilage and quality deterioration during different stages of handling, transportation, processing and preservation</p> <p>7. Introduce seasonal closure of fishing in selected estuarine and coastal nursery</p> <p>8. Adopt economically viable alternative fishing methods such as crab-fattening, hook-and-line fishing and other non-farm occupations such as small cash crops, tree crops, and livestock rearing</p> <p>9. Introduce appropriate social policies such as job retraining and relocation assistance to support fishery-dependent communities. The poorest section of the communities should be supported by subsidy and existing welfare schemes for vulnerable groups</p>	
Establishment of Marine Protected Areas (MPAs)	<p>1. As per Target 11 of the Strategic Plan for Biodiversity 2011–2020 (Aichi Targets), conserve at least 10% of coastal and marine areas as protected areas</p> <p>2. Develop a long-term plan and institutional capacity to achieve 10 percent target with proper compliance monitoring in place</p> <p>3. Social policies such as job retraining and relocation assistance may be required to support formerly fishery-dependent communities. The poorest section of the communities should be supported by subsidy and existing welfare schemes for vulnerable groups</p>	DoE, DoF, FD, Academic/Research institutions, Marine Fisheries Academy, National Oceanographic Research Institute and Bangladesh Navy

Issues	Actions	Implementing agency
Co-management approach in Hilsa Sanctuaries	<ol style="list-style-type: none"> 1. Introduce participatory and co-management approach in decision making and management of Hilsa Sanctuaries 2. Develop institutional capacity for monitoring of <i>Hilsa</i> spawning behavior, and breeding and nursing areas to undertake management decisions regarding boundary of <i>Hilsa</i> sanctuaries, and temporal and spatial shifting of ban period 3. Effective surveillance to prohibit production, transport and use of all destructive gears use for catching <i>jatka</i> and brood <i>Hilsa</i> 4. Build a <i>Hilsa</i> conservation fund to meet the increased cost incentive programme and develop alternative income generating activities for the coastal fishers 5. Increase existing support (e.g. 40 kg rice) on the basis of household size. To avoid leakage, rice support could be provided in a pre-packed sac. Cash support also could be provided through mobile banking to meet the cost of non-food expenses 6. Facilitate access of the coastal fishing communities to formal credit with a view to reduce dependency of fishers on informal credit system e.g. <i>dodon</i> which cause long term debt bondage to money lender who push fishers to continue fishing during ban period 7. Undertake regional initiative for research data sharing on <i>Hilsa</i> fishery 	DoF, Academic/Research institutions, Marine Fisheries Academy, National Institute of Oceanographic Research and Bangladesh Navy

Issues	Actions	Implementing agency
Conservation of Mangrove Ecosystems	<ol style="list-style-type: none"> 1. Undertake an economic valuation of the ecosystem services of Sunderbans and establish an optimum limit of sustainable yield while revising revenue-oriented management system currently in place 2. Develop a special joint force to monitor as well to take legal actions for any undue interventions for resource harvesting, illegal activities such as setting fire, tree felling poaching etc. 3. Capacity building in terms of personnel and logistic support for the Forest Department to enforce conservation regulations in the Sundarbans 4. Introduce resource/forest co-management approach 5. Assess the areas with thin canopy and brought them under mangrove rehabilitation programmes 6. Undertake long term plan and strategies to protect the Sundarbans from the predicted impacts of climate change especially form sea level rise and intrusion of saline water 7. Undertake immediate measures to clean-up pollutions close to ecologically sensitive areas, particularly in ship breaking yards in Chattogram coast 8. Strict enforcement of the Environmental Impact Assessment (EIA) rule while undertaking development activities in the coast 	MoEFCC, MoL, MoWR, MoS, MoCAT, MoCA, DoE, DoF, FD, and Academic/Research institutions

Issues	Actions	Implementing agency
Land Reclaiming and Coastal Land Management	<ol style="list-style-type: none"> 1. Develop a land use planning for the coastal areas to protect coastal lands from other uses like agriculture shrimp culture, industries etc. 2. Undertake appropriate legal measures to protect newly formed coastal lands from illegal grabbing and bring them under mangrove plantation and resettlement of landless people. In this regard, the Ministry of Land should follow the guidelines prescribed in the Coastal Zone Policy through strict enforcement of existing laws 3. Take special measures to protect the Sundarbans by ensuring adequate water flow through dredging of accreted rivers and canals, necessary institutional support and appropriate management regime 4. Undertake long term strategies to trap silt deposition for land reclamation 	MoL, MoWR, MoEFCC, MoFL, DoF and FD
Green Coastal and Marine Tourism	<ol style="list-style-type: none"> 1. Develop eco-friendly tourism policy from the coastal tourism hot-spots e.g. the Sundarbans, Cox's bazar, Teknaf, Saint Martin, Kuakata etc. Adequate facilities in terms of accommodation transport and personal security should be developed in those areas 2. Develop infrastructure along with proper security measures for beach and cruise tourism 3. Pro-poor tourism (PPT) intervention should be adopted to increase net benefits to the poor and ensure that tourism growth contribute to poverty reduction in the coastal zone 4. Private-public partnership could be adopted in the process PPT development 	MoEFCC, DoF, MoCAT, FD, MoWR, MoFL, BTB and Parjaton Corporation

Issues	Actions	Implementing agency
Climate Resilient Coastal and Marine Environment	<ol style="list-style-type: none"> 1. Institutional and human resource capacity building to undertake research on the impacts of climate change (ocean acidification, changes in salinity, sea surface temperature, PH and oceanic parameters etc.) on the coastal and marine systems and associated resources 2. Promote eco-system based adaptation measures through resource conservation and reducing anthropogenic stress to the climate change exposed ecosystems 3. Undertake measures to limit marine pollution and curtail over fishing which might have positive effect on the ability of marine ecosystems to adapt to climate change impacts 4. Policy instruments to reduce pressure on fisheries include limit on license or vessel buyouts and regional fishery closures to make fishery system more resilient against climate change 	MoP, MoWR, MoDMR, MoEFCC, MoL, DoF, DoE and FD
Conservation of Marine Biodiversity	<ol style="list-style-type: none"> 1. Develop marine floral and faunal biodiversity database 2. Implement effective regulatory framework for controlling illegal, unreported and unregulated fishing (IUU) 3. Marine areas important for Biodiversity and ecosystem will be conserved as protected areas in line with SDGs targets NBSAP targets and Post 2020 biodiversity framework 	MoFL, MoEFCC, DoF, DOE and FD
Control Marine Pollution	<ol style="list-style-type: none"> 1. Identification of sources of land-based pollution and control them 2. Implementation of NOSCOP and Environmental Actions under Blue Economy Action Plan 	MoFL, MoEFCC, DoF, DOE and FD

Issues	Actions	Implementing agency
High Seas Governance	<ol style="list-style-type: none"> 1. Develop a comprehensive policy framework by revising the constraints of the existing laws and regulations (i.e. The Marine Fisheries Ordinance 1983; The Territorial Waters and Maritime Zones Act, 1974 etc. for improved governance of ‘High Seas’ of the Bay of Bengal 2. The high seas are governed by an international Convention called UN Convention on the Law of the Sea (UNCLOS), hence steps should be taken to enhanced cooperation with the regional countries and international organization 3. Enhance institutional capacity and establish coordination among institutions of to control illegal and illicit activities in the high seas 4. Establish effective regional cooperation for strengthening, monitoring, and controlling and surveillance mechanisms to prevent illegal fishing 5. Undertake coordinated research both national and regionally on selected resources and other trans-boundary issues like pollution, habitat degradation and fish migration 6. Undertake strict measures and vigilance to prevent foreign vessels to use Bay of Bengal as dumping place of hazardous wastes 7. Develop mechanisms to inspect pollutant free status of ships in the open seas before beached in Chattogram Ship breaking yards for scrapping 8. Ensure rights based and equitable implementation of UNCLOS to tackle illegal transportation of migrants from Bangladesh and inhuman violence on the migrant on board 9. The potentiality of BOBLME should be fully explored for improving regional management of fisheries resources and the environment of the Bay of Bengal towards establishing governance of the “High Seas” at regional level 	MoFA, MoEFCC, MoP, MoS, DoFL, MoPEMR and Bangladesh Shipping Corporation

Issues	Actions	Implementing agency
Blue Economy	<ol style="list-style-type: none"> 1. Develop a spatial mapping of the marine resources of the Bay of Bengal with possible projections for future resource extraction in a sustainable manner 2. Invest in research to assess vast potential “blue energy” generation from wind, wave, tidal, thermal and biomass sources from the BoB 3. Undertake measures to harvest export oriented large pelagic species particularly tuna within the EEZ of Bangladesh and higher seas, as Bangladesh recently become member to the Indian Ocean Tuna Commission (IOTC) 4. Provide incentives for developing fishing fleet for demersal and open ocean fish harvesting. Similarly undertake artisanal fishery with efficient technology 5. Undertake measures and technological innovation for mariculture and sea ranching in the continental shelf of the Bay of Bengal. The potentially of such practice would release pressure of over-exploitation on fisheries and improved well-being of the population 6. Export oriented mariculture of non-conventional species such mollusk could be introduced 7. Invest in human resource capacity building in diverse fields of marine economic activities as well as environmental and biodiversity issues which needs to address through appropriate training and skill development 8. Mobilize resources for exploration of oil, gas and methane hydrates in the deep seas and valuable minerals deposited in beach sands 9. Mobilize investment for ports and ship building to become pioneer in emerging global market 	MoP, MoFA, MoPEMR, MoEFCC, MoS, DoF, Bangladesh Shipping Corporation, Academic and Research Institutions

2.7 LIVESTOCK RESOURCES

2.7.1 Situational Analysis

Livestock is an integral part of the farming system of Bangladesh. In 2017–18, livestock sub-sector of agriculture sector contributed 1.54% to the national GDP. The sector grew at the rate of 3.40% per annum (2017–18). Livestock provides nutritious food (milk, meat and eggs) for human consumption and good health and contributes to the national economy in many other ways; draught power is important for tillage of land in many cases despite the present trend towards mechanized tillage. Bullock carts still remain a major means for transport in many rural areas. Cow dung is a source of biogas and organic fuel for cooking, particularly in the area where electricity and natural gas is not present. Cow dung manure is an excellent source of organic fertilizer for the conservation of soil while offal, blood and feathers are sources of protein concentrate for animal feeds. Hides and skin of cattle, buffalo and goats are one of the biggest foreign exchange earners. Besides, bone and bone grist, gelatin, horn and hoof from cattle, and recently beef, are being exported to different countries.

Over 60% of the population in Bangladesh keep livestock for economic benefits. This sector has enormous contribution to women empowerment, income generation and employment opportunity for landless, unemployed youths, and destitute women. Since last decade, poultry sub-sector has emerged as a big industry and becoming even larger every year and employ over 2 million people. Since livestock is a natural resource, it is also required for our sustainability. Livestock has enormous contribution in food security and livelihood, thus has already been considered directly or indirectly in achieving the SDG 9.

The major livestock species in Bangladesh are cattle, buffalo, goat, sheep, chickens and ducks. Livestock population in Bangladesh is currently estimated to comprise 23.79 million cattle, 1.47 million buffaloes, 25.78 million goats, 3.34 million sheep, 268.93 million chickens, and 52.24 million ducks. The milk, meat and egg production from livestock were 7.28 million metric ton, 6.15 million metric ton and 11912.4 million⁶⁶, respectively, in FY2015 against a national demand of 14.69 million metric ton, 7.05 million metric ton and 16,744 million, respectively. Rising population, growth of per capita income and public awareness on health and nutrition are likely to bring a further increase in the demand for meat, milk and eggs. The growth rate of livestock is already comparatively slower than other sub-sectors of agriculture.

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66 DLS (2018). Livestock Economy at a Glance. Livestock Economy Section, Department of Livestock, Government of People's Republic of Bangladesh. (<http://www.dls.gov.bd/site/page/22b1143b-9323-44f8-FD8647087828c9b/Livestock-Economy>).

One of the main constraints of livestock sector is poor genetic makeup of the local cattle. The indigenous zebu (*Bos indicus*) cattle dominates the country's cattle population. The zebu cattle are smaller in size with low productivity. For the improvement of its productivity, cross breeding with exotic breed (*Bos taurus*) was introduced in the country in 1974. However, in absence of appropriate breeding policy, inadequate infrastructure of Department of Livestock Services (DLS), and use of inappropriate breed and technical know-how have constrained the development of appropriate breed. The genetic pool of cattle is being changed by the present crossbreeding programme of the Department of Livestock Services (DLS), which, while improving the productivity of animal, is also resulting in gradual degradation of indigenous genetic pools. There are about six native chicken germplasms in the country, of which three, namely Aseel, Native dwarf type and Yasmine, are at the risk of extinction. Due to the emergence of new transboundary animal diseases, the domestic stocks are under threat, especially the poultry due to avian influenza.

There is an acute shortage of quality feeds and fodder for livestock in the country. Due to increased cultivation of agriculture crops, natural pasture land is decreasing every year ultimately resulting in degradation of genetic potentials of farm animals due to lack of feeds. Inadequate health care and disease control are serious constraints, not only for the growth of livestock, but also for the public health. Only a small number of livestock keepers around the Upazila Centre can get access to the veterinary services. This constrains the development of healthy livestock herds as well as safe human food production of animal origin. This in turn increases the environmental load of microorganism and encourages the emergence of new strains of human pathogens, and antibiotic resistance in them. Since Bangladesh is very much vulnerable to climate change, the scarcity of drinking water, particularly in the coastal area, may be a critical issue in future for livestock.

With increase in livestock number and its productivity, waste becomes a burden on the environment; poultry litter production in Bangladesh 4.52 million tons⁶⁷. However, this can be valuable product, if it is managed and used properly, for example for biogas production or even electricity generation.

There are several policies, guidelines, acts and rules have been developed or passed for the growth of the livestock sector. Enforcement of these policies and regulatory guidelines has been limited due to insufficient human capacity, infrastructure, and regulatory power of the sector. While properly trained persons are needed very much, hierarchy in the training of graduates has not helped much. The other important constraint of this sector includes insufficient access of the farmers to credit and also limited or absence of risk coverage scheme for them.

67 MoFL (2015). Draft National Integrated Livestock Manure Management (ILMM) Policy. Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, 1pp.

More than 14 national policies, acts, rules and guidelines are either in place or in process. Of these instruments, Slaughter Act (2011), Animal Feed Act (2010), National Poultry Development Policy (2008), Animal Welfare Act (2019), Animal Disease Act (2005), Animal Disease Rule (2008), Bangladesh Animal and Animal Product Quarantine Act (2005), Avian Influenza Compensation Strategy and Guidelines (2008), National Livestock Development Policy (2007), and few others are in operation. These policies aim to improve disease control and feed supplies, genetic potential of stocks, quality control of livestock inputs, drugs, vaccine and biologics, market of livestock products and to support strategies and action plan in the context of NCS.

For fodder development, for example, steps have been taken to introduce cultivation of local and some imported high yielding fodder. In 1958, artificial insemination had been introduced in the country to improve the genetic makeup of the cattle. Exotic breeds, semen and embryo have been imported from abroad and used to improve the local breeds. However, due to lack of proper breeding policy and insight, the steps are not fully adopted or been effective.

The Bangladesh Livestock Research Institute (BLRI) was established in 1984 for basic and need based researches in animal production and health. However, despite of good infrastructure, its success is constrained by its limited manpower. In 1990s, the Government established several veterinary colleges, at this moment adopted as university, to produce need based quality graduates.

2.7.2 Conservation Strategies and Actions

The SDG Targets 2.2 to 2.5 apply to formulate conservation strategies for livestock sector as part of larger agriculture sector. The salient features of these targets call for the following strategies.

1. Doubling agricultural (read livestock) productivity and incomes of small farmers including women and other marginalised groups by 2030;
2. Ensure sustainable production and implement resilient agricultural practices including adaptive capability under climate change;
3. Maintain genetic diversity of domesticated animals; and
4. Measures for research and development of technology with international cooperation and to establish appropriate gene banks for maintaining biodiversity as well as the resources for future productivity growth.

Doubling productivity by 2030 means that between now and 2030 productivity must rise by on an average by at least 5% per annum, whereas historically the growth in livestock sector had been at the rate of around 3%. This means major investments are needed in the areas where problems have already been identified.

For conservation of livestock, a long-term action plan is necessary for acquiring the following milestones.

Table 2.7.1: Actions for Livestock Resources

Issue	Action	Implementing Agency
Policy / guidelines / Acts /Rules	<ol style="list-style-type: none"> 1. Swift development, analysis, updating and approval of Breeding, Dairy and Poultry Development Policy to boost up dairy and poultry farming 2. Development of National policy for conservation and improvement of potential farm animal and poultry genetics resources 3. Long-term linkage with international and regional organization should be established to upgrade national capacities for managing and economic exploration of livestock resources 4. Animal Feed Act and Rules, Bangladesh Animal Product and Quarantine Act, Disease, Feed rule and Act should be translated into action 5. Encouragement of private sector participation in research and livestock enterprise development 	MoFL
Institution	<p>Capacity build-up of Department of Livestock Services (DLS) to provide effective services for:</p> <ol style="list-style-type: none"> 1. Preventive and curative veterinary services and AI services up to village level 2. Secondary and tertiary health care and disease response, epidemiology, public health and surveillance 3. Strengthen extension services 4. Supply of fodder seeds and cuttings to the farmer 5. Conservation and improvement of potential farm animal and poultry genetics resources 6. Capacity build of BLRI for researches on animal production, disease control, emerging and re-emerging infectious diseases, vaccine and biologics development using local pathogens 7. Establishing a separate national institute for animal health and biologics research and production 8. Establishing linkage with different Universities, private companies and NGOs 	MoFL, DLS, BLRI, BAU and Universities, Private companies and NGOs

Issue	Action	Implementing Agency
Education	1. Proper attention to remove the conflicts among the veterinary and animal husbandry graduates	DLS, MoFL, MoE, University Grants Commission, BAU and other universities
Allocation of land to dairy development	1. Bathan land to be protected for cattle and milk production by all kinds of dairy farmers	MOFL in collaboration with MoL
Statistical data updating	1. Collection of livestock data to be streamlined under the wing/unit for agriculture in the BBS	MOFL in collaboration with BBS
Census and survey	1. Updated data bases on livestock farms, inputs etc. Census to be done at 10 years' interval 2. A survey on the identification of domestic animal diversity and their habitats shall be conducted for developing Farm Animal Genetic Resource Management Plan	MOFL in collaboration with DLS, BBS and BLRI
Marketing of livestock and products	1. Development of organized marketing channel	MOFL, DLS and Ministry of Commerce
Risk coverage	1. Establishment of Livestock insurance system for risk coverage	MOFL, DLS and private sector
Feed resources	1. Fodder seed multiplication farms to be set up at each region	MOFL and DLS
	2. Maize, Sorghum, Khesari (Grass pea), black bean (Matikali), cowpea to be cultivated as fodder	Private sectors, DLS and DAE
	3. High-yielding perennial fodder crops like Napier grass, fodder tree to be cultivated on embankment slopes, roadside etc. with people's participation on benefit sharing basis	MOFL and DLS in collaboration with Ministry of Communications, Roads and High Ways, Local government and NGOs
	4. Preservation and storage practice for seasonally surplus green and dry feedstuff including paddy straw to be introduced	MOFL in collaboration with DLS and BLRI
	5. Small and medium-scale feed mills to be set up	MOFL in collaboration with DLS and relevant departments
	6. Small industries to be set up for processing slaughterhouse waste as concentrate protein feeds	MOFL in collaboration with DLS

Issue	Action	Implementing Agency
Health and disease control	<p>1. Providing doorstep/one-stop veterinary services and establishing laboratories for the diagnosis of diseases, safety and quality assessment of inputs</p> <p>2. Supply of quality inputs like fishmeal, vitamin-mineral premix</p> <p>3. Institutionalization of regulatory state veterinary services to ensure livestock disease control and safety of the human food of animal origin</p> <p>4. Proper, effective and well-monitored biosecurity in livestock and poultry farms, usages of antibiotics under veterinary control</p> <p>5. Vaccination campaign for animal for few economically important diseases</p> <p>6. Development of community based veterinary service in village level</p> <p>7. Ensured quarantine measures during movement of animals and birds</p> <p>8. Development of capacity to for disease surveillance, epidemiology, early warning and response and public health activities</p> <p>9. Capacity build-up of DLS, BLRI and other relevant institutes for the production of vaccine, biologics, epidemiology, public health, regulatory veterinary service, food safety and climate resilient livestock production</p>	MoFL and DLS MoFL in collaboration with DLS, BSCIC and NGOs MoFL and DLS MoFL and DLS MoFL and DLS DLS and LGED DLS and LGED MoFL and DLS MoFL, DLS, BLRI and Universities
Use of modern information technology, e.g. Apps	1. Development of apps to provide services to farmers for disease control, health management and other information	MoFL and DLS
Waste management	1. Proper, effective and well-monitored managements of livestock wastes	MoFL, DLS and LGED

Issue	Action	Implementing Agency
Cattle and buffalo development	1. Strengthen capacity for cryopreservation, including the development of human and technical resources	MoFL and DLS
	2. Set up nucleus cattle breeding farm in each region for development of crossbred and purebred bulls for distribution in the AI centres and in the inaccessible rural areas	MoFL and DLS
	3. Proper delivery of AI services of the DLS to the Union and village level	MoFL and DLS
	4. Development and promoting area-specific livestock practice e.g., buffalo and sheep farming along the coastally raised lands	MoFL and DLS
Draught cattle and beef production	1. Development of draught cattle, local varieties of cattle to be crossed with purebred or crossbred draught breed like Hariana cattle 2. Special breeding programme for conservation of local breeds of cattle for beef and Eid-ul-Azha 3. Enacted Animal Slaughter Act for meatless day	MoFL in collaboration with DLS and BLRI
Poultry development	1. Set up of commercial Poultry Breeding Farm with an international poultry breeding company for production of parent stock chicks for broilers and layers	Private companies, MoFL and DLS
	2. Local stock improvement programme of DLS to be strengthened and expanded	MoFL, DLS and NGOs
Establishment of a new genetic resource centre	1. Establishment of National Centre for Genetic Evaluation and conservation of Farm Animal germplasm	MoFL and DLS
Research: Genetic diversity survey	1. Nationwide survey for the molecular genetic diversity of the major livestock species and infectious agents	MoFL, BLRI and Universities
Climate change research	1. Researches on adaptability of livestock to climate change and emerging diseases	MoFL, BLRI and Universities
Role of NGO	1. NGO should be encouraged for capacity building and carry out socio-economic study to develop this sector	NGO Bureau and MoFL in collaboration with NGOs

2.8 PRIMARY ENERGY AND MINERALS

2.8.1 Situation Analysis

The extraction of minerals and primary energy resources in the present time continues to be considered as an input to productions and development. The extraction of these resources continues to earn revenue, support economic growth and advancement of material welfare. The growing demands for energy and mineral resources in Bangladesh have significantly been increased with the growth of population, urbanization and with industrial developments, and generate pressures for rapid extraction of mineral resources. At the same time, extraction of mineral resources contributes to many of the problems, like environmental degradation, carbon emissions, displacement of populations, economic and social inequality and conflicts, and increased risk for many health problems, that the SDGs are trying to address.

Bangladesh is not very rich in minerals and primary energy sources. Major commercial deposits of minerals discovered in the country include, among others, natural gas, coal, peat, construction rocks, sand, limestone, heavy mineral sand, and white clay. Natural gas dominates as primary commercial energy source in the country and has been extracted at a rate of approximately 2,750 million cubic feet per day from the existing 20 gas field reserves⁶⁸. The gas exploration efforts have been limited and the present production cannot fully meet the existing demands. The country must look for more ways and means for extending the gas reserves in the country. And one way is reservoir management and the other is further exploration both of which are expensive activities. Then again one should also look for other upcoming sources and their feasibility in the areas under Bangladesh jurisdiction.

More specifically there is a need for off-shore exploration of gas hydrates for which there may be a good possibility of discovery in the Bay of Bengal. There is a desperate necessity for diversifying primary energy sources. Apart from natural gas resources of 28 trillion cubic feet *in situ*, our country has five discovered coal fields with good quality coal resource measuring approximately 3 billion tones⁶⁹. The peat resources are deposited in the scattered marshy lands having no major commercially attractive deposits as per present day valuations. Only a small underground coal mine at Barapukuria, Dinajpur produces nearly one million tonnes of coal annually. There is urgent need for coal resource development from existing coal deposits to supplement energy resources from domestic sources and to maximize local natural resources use

68 Petrobangla (2016). Annual Report 2016. PETROBANGLA Bangladesh Oil, Gas and Mineral Corporation, Dhaka, Bangladesh, pp. 5. (https://petrobangla.org.bd/admin/attachment/webtable/596_upload_0.pdf)

69 For a global assessment of the issues involved, see Beaudoin, Y. C., Waite, W., Boswell, R. and Dallimore, S. R. (eds.) (2014). Frozen Heat: A Global Outlook on Methane Gas Hydrates, Volume One, United Nations Environment Programme, GRID-Arendal.

with the objectives to supply sustainable and affordable energy to fuel economic development of the country.

Bangladesh needs to secure rational and sustainable use and diversify its primary energy sources in line with the SDG targets to improve efficiency in energy consumption at an affordable cost and to increase use of renewable energy. At the same time the energy intensive mining of primary energy commodities and other minerals should improve energy use by introducing energy efficient technology and waste reduction measures.

2.8.2 Conservation Strategies and Actions

Many mining related laws prevailing in our country are old. Also, there exist several laws and regulations having environmental implications. There are different organizations and government agencies, directly or indirectly, involved in mineral resources, land, environment, and water resources management. Regulations, policies and institutions related to rehabilitation and resettlement of project-affected people due to mining of energy and mineral resources should be updated/reformed and adequately made functional in line with the Eight Five Year Plans and the SDG targets.

The SDG 7 is wholly devoted to development of modern energy. Its targets call for

1. Universal access to energy, particularly modern energy;
2. Substantially raise the proportion of energy from renewable sources;
3. Raise energy efficiency improvement;
4. International cooperation for energy development;
5. Expand necessary infrastructure for supply of modern energy; and
6. Rationalize fossil fuel subsidies.

Among these the first three are most relevant for Bangladesh and are broadly within the technical capability in the country. The fourth one depends on various financial, technical and political factors and also diplomacy. It may be difficult to practice straightaway although there had been various cases of international private sector participation, but there had been little evaluation of how far these have been of net benefit to the country. Infrastructure development is more a function of long-range planning, while subsidies are as much a political as an economic issue. While one must plan for the future, it needs to review the earlier plans, master plans and programmes. But it is important for the country to go wholly at least for the first three strategies.

In relation to primary energy and minerals sector, major environmental problems have already been identified, though not necessarily adequately quantified in terms of loss of ecosystem services. These adverse impacts substantially affect the poor and the marginalized groups in the society. The preservation of ecosystem services, therefore, becomes a major concern for the future and should therefore be an important strategy.

Based on the above strategies, the following action points are proposed to mainstream conservation into primary energy and mineral resource sector.

Table 2.8.1: Actions for Primary Energy and Minerals

Issues	Actions	Implementing agency
<p>Mining of minerals such as sand, stone, and white clay have been carried out without effective control for rational resource use and environment conservations.</p> <p>As a result, resources are depleting fast and negatively impacting local ecosystems.</p>	<ol style="list-style-type: none"> 1. Prevent negative impacts to soil, water and air resources in and near mined areas 2. Restore the quality of soils to their pre-mining level 3. Maintain or improve landscape visual and functional quality 4. Feasibility and Environment and Social Impact Assessment report and impact management programmes should be a precondition set for approval of mining project scheme (irrespective of public or private sector mining initiatives) 5. Mining project cycle exploration, assessment of economic resource and ESIA study, project approval, opening of resources and mining, transportation, reclamation and restoration of land for after use, rehabilitation of project affected people; environmental and social impact for mining shall be adequately managed and systematically monitored to minimize adverse impacts and to sustainable resource extraction 6. Ensure establishment of a special authority to oversee the recommendations of ESIA for each of the mining and resource extraction projects and their mitigation measures 7. Environmental audits required to be introduced and maintained on a regular basis to ensure environmentally sound practices in mining operations 	<p>MoPEMR, MoLJPA, MoEFCC, BMD Petrobangla and DoE</p>

Issues	Actions	Implementing agency
<p>Absence of adequate legal instruments and institutions including 'the mines inspector's office' for securing safe mining practices, conservation and rational utilization of resources and for securing mine resettlement and rehabilitation of mine affected activities</p>	<ol style="list-style-type: none"> 1. Update Mines and Minerals Rules, 2012 2. Update Environmental Conservation Rules, 1997 3. Adopt Coal Development Policy 4. Adopt and apply land use/zoning map for the country 5. Adopt appropriate legal instruments to address the resettlement and rehabilitation of project affected people due to mining of minerals in particular and for large footprint project in general 6. Establish effective coordination among the departments like Department of Environment, Bangladesh Water Development Board, Bureau of Mineral Development, Forest Department, Deputy Commissioner's office 	MoLJPA, MoPEMR, BMD and MoL
<p>Conflicts of interest among the businesses for extracting minerals (stone, sand, clay etc.,) and conservation of land, water, biodiversity, scenic value have been increasing.</p> <p>Sand and stone extraction activities from riverbeds and floodplains follow limited or ignore the prior BIWTA survey resulting erosion of river, loss of firm land, livelihood and damage to environment and bio-diversity.</p>	<ol style="list-style-type: none"> 1. Inter-departmental coordination among the land administration, law enforcement, mining and quarry lease authority, water, environment management and conservation/ protection authorities 2. Legal compliance irrespective of socio-political belongings 3. Make compulsory prior survey by BIWTA, Geological Survey of Bangladesh to identify suitable sites for sand extraction from riverbeds and floodplains 4. Ensure no harm to natural flow of water courses by sand and other mineral activities; 5. Maintain applicable distances for sand and stone extraction activities from the roads, bridges, rails, communication towers and other important installations strictly to avoid threats. The quarry lease authority (Bureau of Mineral Development, District land administration) needs to ensure that the sand and quarry lease and permission for class II sand cause no harm to adjacent firm land, water bodies and environment 6. Review the existing quarry lease regulations for two years with prior payment of royalty for extracted stone and sand and its monitoring systems to facilitate resource conservation, protection of land and water courses and avoid threats to livelihood of the people 7. Intensify the monitoring at local level to prevent unauthorized and unplanned sand extraction from riverbeds and floodplain 	MoL, MoWR, MoHA, MoS, MoPEMR, BIWTA, BMD and DoE

Issues	Actions	Implementing agency
Many of the mineral resource extraction and environment conservation related legislation and policies need updating in line with the SDGs	<p>1. Adopt an Energy Sector Master Plan. Such a Master Plan should delineate among others the following items:</p> <ul style="list-style-type: none"> i) Gas Allocation Policy ii) Domestic gas exploration policy iii) Domestic coal utilization iv) Energy import (demand side management and energy conservation) v) Strategies for energy use for domestic consumers including for cooking (such as Improved Cooking Stove); and vi) Energy subsidy and pricing <p>2. Adopt advanced technology and better management for mineral extraction and processing to enable waste reduction, reuse and recycling of resource for its sustainable consumption; Use advance coal power generation technology; Effective environmental monitoring and control can reduce waste and their handling and disposal</p>	Mining authority (public and private) BMD, BPDB, SREDA and DoE
Conservation of primary energy	<p>1. Necessary reforms are to be done in the legislations and for their implementation. Careful assessment is required for interlinked regulations and policies having relations to resource extraction, especially for primary energy resource extraction and use</p> <p>2. Institutional reforms and capacity building are required to reflect new technology use, resource conservation and effective use of resources</p> <p>3. Use advance technology for power generation, Urea fertilizer and other industries</p>	MoPEMR, MoLJPA, MoL, MoEFCC, MoS and DoE
Encourage renewable energy use in mining and resource industries; Conservation of resource and improvement of environment.	<p>1. Introduce incentive instruments (financial and others) for energy conservation and effective operational indicators for environment conservations</p> <p>2. Development of skilled manpower improvement of training and target based operational practices with rewards</p> <p>3. Allocate funds and improve fund management</p>	MoPEMR, MoEFCC, MoF, DoE and SREDA

Issues	Actions	Implementing agency
Securing quality of environmental impact assessment and monitoring.	<ol style="list-style-type: none"> 1. Improve quality of Feasibility Study and Environment and Social Impact Assessment Studies for energy and mineral resources sector projects 2. Make necessary fund and logistics facilities available for environmental performance quality monitoring for energy and mineral sector projects 3. Improve inter departmental coordination for rational use of resource and for effective assessment and monitoring of environment, resource conservation and development works 	MoPEMR, MoEFCC, MoF and DoE Local Administration of concerned areas and Departments having relations to implement energy and mineral resource sector
Lack of awareness in the community on natural resource inadequacy, sustainable energy and resource use; Institutional capacity development and fund allocations for target oriented activities of the regulatory organizations in mineral and primary energy resources sector for improving environment conservation and development.	<ol style="list-style-type: none"> 1. Education syllabus should include sustainable resource use, conservation of resources; media can play important role in community awareness building for efficient and sustainable energy and resource conservation; SDG targets and their importance for social development and community welfare 	MoE, MoI and DoE Television networks Community radio services Electrical and Print media

Chapter 3

Natural Resource Dependent Sectors

This chapter analyses the use of natural resources by six resource-dependent sectors, namely agriculture, industry (large and small & cottage), power, rural development, transport and communication, and urbanization, housing and settlement planning. The sectors discussed here are in general economic development sectors. Therefore, some of the general issues of development are also discussed in Bangladesh context. The main emphasis, however, is on how such development impinges on resource use and impacts on resource quality and the ecosystems of Bangladesh.

3.1 AGRICULTURE

3.1.1 Situation Analysis

Agriculture plays a vital role in economic development of Bangladesh. It has critical roles in food security, livelihoods, and income and nutrition of the people. Yet, it faces many challenges, like climate change, loss of biological diversity, loss of soil fertility, and water shortage. Quality of land is deteriorating due to degradation of soil fertility, soil erosion, soil and water pollution, depletion of soil organic matter, water logging, increased soil salinity, pan formation, acidification and deforestation⁷⁰. Apart from issues specific to crop agriculture, most other major issues in relation to the Bangladesh NCS involve direct or indirect relationship and dependence of agricultural activities on natural resources, including particularly, land, water, and energy.

Apart from these dependencies, agriculture sector causes pollution depending on the intensity of use of chemicals (i.e. fertilizer, pesticides and insecticides). It is important to facilitate environmentally sound development in crop sub-sector within agriculture through appropriate changes in production management, and production

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70 The cost of some of these environmental problems has been estimated to be about 2 percent from crop agriculture due to soil erosion alone. See Shamin, S. and Haque, A. K. E. (2012). An Input-Output Analysis with an Environmentally Adjusted Agricultural and Forestry Sector in Bangladesh. *Journal of Sustainable Development* 5(3): 84-94.

organization for protection and conservation of the environment and encouraging sustainable use of resources.

Agriculture sector comprises crops, fisheries, livestock, and forestry sub-sectors with crop sub-sector being the predominant contributing about 8.89% of national GDP in 2016-17, where agriculture sector's total contribution to GDP was around 14.17%⁷¹. About 40.6% of the total labour force is engaged in agriculture⁷². The cropping intensity in 2011–12 was 195%⁷³. The crop sub-sector provides staple food and other food items, raises rural income and creates jobs for rural poor people. Since the independence of Bangladesh, rice production has tripled from 1.5 tones per hectares in 1972 to about 4.42 tones per hectares in 2014, i.e. increased more than three times⁷⁴.

Crop agriculture has seen some major and revolutionary changes since the late 1970s and early 1980s. Rice has dominated all along the overall cropping pattern with only limited crop diversification so far. Simultaneously there had been the switch over from local low-yielding varieties to high-yielding varieties of rice, and now for many other crops as well, which at least in case of rice is heavily dependent on fertilizer application under controlled water management as well as on use of pesticides and other chemicals. While Bangladesh is very rich in genetic plant resources, including for crops, farmers have relied mainly on only few due to higher profits leading to losses in biodiversity. Elaborate on local agricultural biodiversity. The use of chemical fertilizer is also not well-balanced with excessive dependence on nitrogenous fertilizer largely procured from the domestic production based on natural gas.

While agriculture has used the land for production and has been able to produce much more than before, this has been possible due to increasing reliance on ground water. Dry season irrigation system is heavily using ground water and energy resources. Due to high use of ground water, the water table has gone down dangerously.

Disruption of ecosystem services caused by leaching of agro-chemicals as well as some time high use of pesticides and other chemicals along with unsustainable use of resources. Other naturally occurring problems of increased salinity in parts of the country, as discussed in Chapter 2, arsenic in ground water finding its way into the food chain, acidic soil, and soil erosion in hilly areas due to deforestation have also

71 BBS (2018). *2017 Statistical Year Book of Bangladesh*. Bangladesh Bureau of Statistics (BBS), Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 114pp.

72 BBS (2018). *2017 Statistical Year Book of Bangladesh*.

73 BBS (2019). *Year Book of Agriculture Statistics 2018*. Bangladesh Bureau of Statistics (BBS), Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, 361pp.

74 CGIAR. Bangladesh. Ricepedia - The online authority on rice, A research program on rice by CGIAR. Available at: <http://ricepedia.org/bangladesh> (Accessed: 30 September 2018).

arisen. On the whole, the issue of sustainable crop agricultural production has been threatened for quite some time.

The problems therefore are two-fold, but intertwined. First, there is tremendous pressure on some of the resources, which as either non-renewable and has other competing demands (land and energy, for example) or almost non-renewable (such as ground water). Second, the agricultural practices, as well as certain naturally occurring phenomena, do create problems for crop agricultural production and threaten food security which exacerbate the first group of problems.

Various policies and programmes have been taken over time to address some of these problems, the most recent being the National Agricultural Policy (NAP) 2018 and directives for moves to Aush rice in the south-west to shift dependence on ground water to surface water. The Government has also raised relative prices of nitrogenous fertilizer, which may have helped lowering use of such chemicals. Pesticides use has also fallen in recent years, although it may perhaps be lowered further⁷⁵. These policies and their implementation had, however, not been conducive enough towards conservation mainly because the focus had always been on increased food production. It is necessary to promote nature-friendly and sustainable technology. There are two major redirections that are needed: i) preservation of agricultural gene pool, species and ecosystem biodiversity and ii) lowering of resource use footprint.

Bangladesh's crop agriculture is generally inefficient and there are substantial rooms for improving resource use efficiency. This relates to water use, raising land productivity through various means and lowering energy use, directly and indirectly. Increase in average productivity of rice would immediately release lands for other crops that would immediately lower demand for water.

3.1.2 Conservation Strategies and Actions

The SDG targets against crop agriculture states which are important for future crop agricultural development from the view point of conservation. The SDG Targets 2.3 and 2.4 charts the direction for agriculture to take in terms of raising agricultural productivity, conserving genetic diversity, raising irrigation efficiency, and use natural resources more efficiently. The national strategy for conservation should be built upon them and the actions plan should take the cue from them.

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75 The pesticides (of various types) consumption in 2008 was 48.9 thousand metric tons which has fallen with some year to year fluctuation to 35.8 thousand metric tons i.e., by nearly 25%. See <http://www.bcpabd.com/pesticide-consumption>. (Accessed: September 30 2018).

Therefore, the Bangladesh NCS would put emphasis on the sustainability of crop production, conserve biodiversity, preventive measures to crops and environment, sustained and provide adequate supply of irrigation water, reduce land degradation, safe use of agro-chemicals and related other issues.

Based on the above considerations as well as other problems faced by crop agriculture and taking cue from the Eighth Five Year Plan (2020-2025) and the National Environment Policy 2018, the following may be adopted as the minimum action points for consideration under the Bangladesh NCS.

Table 3.1.1: Actions for Agriculture

Issues	Action	Implementing agency
Protect Land/ Soil Fertility and reduce land/Soil degradation	<ol style="list-style-type: none"> 1. Use of organic fertilizer 2. Increase mixed crop cultivation 3. Use of balanced fertilizer 4. Follow crop rotation incorporating legume crop 5. Introduce no-tillage /minimum tillage for crop production. 6. Mechanization in seed sowing and transplanting of crops for minimizing disturbance of soil 	DAE, BADC, SRDI and BRRI
Management, development and conservation of agricultural land resource base	<ol style="list-style-type: none"> 1. Popularize the use of organic fertilizers, green manure and microbe/bio-fertilizer among the farmers 2. Inclusion of legume varieties of crops in cropping pattern 3. Identification of soil and land resources through soil survey and classification of land and soil resources on the basis of their productivity 	AIS, BINA, SRDI, BRRI, BAR and DAE
Genetic diversity	<ol style="list-style-type: none"> 1. Preserve indigenous crop varieties in gene bank 2. improvement and conservation of plant genetic resources through collection and conservation of germplasm 	MOA and BARC including other NARS institutes

Issues	Action	Implementing agency
Improved water resource management and irrigation	<ol style="list-style-type: none"> 1. Augmentation of surface water for irrigation through development of water reservoir 2. Promote Alternate Wetting and Drying (AWD) irrigation method 3. Re-excavate canal, pond, <i>beels</i> for rain water harvesting 4. Reduces use of ground water to avoid hazard of arsenic contamination 5. Use water saving technology for improving efficiency of water and install facilities to reduce distribution losses 6. Use pipe, underground pipe for efficient use of irrigation water 7. Encourage to cultivate crop which require less water 	BADC, BARI, DAE and BMDA
Loss of agricultural Soil/land fertility and soil pollution due to indiscriminate use of Agro-chemicals.	<ol style="list-style-type: none"> 1. Promote Integrated Pest Management (IPM) 2. Appropriate regulation for the use of Agrochemicals 	DAE, DoE, MoEFCC, SRDI and NGOs
Integrated Plant Nutrient Management (IPNS)	<ol style="list-style-type: none"> 1. Encourage farmers to increase the balanced use of chemical fertilizer, farmyard manure and green manure 2. Facilitating application of fertilizers on the basis of soil tests, as well as strengthening of soil testing laboratories 3. Promotion of improved soil health management practices 	DAE, BADC and SRDI
Loss of Crop production and land degradation due to Natural hazard and Climate change impact	<ol style="list-style-type: none"> 1. Overall disaster and climate risk management activities in the agriculture sector 	Research Organizations (NARS), DAE, BMD, DoE and NGOs

Issues	Action	Implementing agency
Soil Erosion	<ol style="list-style-type: none"> 1. Soil erosion intensities to be quantified by rapid survey and preventive measures be adopted by controlling shifting cultivation 2. Effective planned land use to sustain its productivity 3. Promote cultivation of cover crop for reducing soil erosion 	DAE and SRDI
Non availability of irrigation water during drought or dry season due to reduction of river flow and abstraction on ground water	<ol style="list-style-type: none"> 1. Sustainable use of ground water 2. Augmentation of surface water use for irrigation through development of water reservoir 3. Re-excavate canal, pond, <i>beels</i> for rain water harvesting 4. Reduces use of ground water to avoid hazard of arsenic contamination 5. Promote use water saving technology (AWD, fita pipe, drip irrigation for improving efficiency of water and install facilities to reduce distribution losses 6. Use pipe, underground pipe for efficient use of irrigation water 7. Encourage to cultivate crop which require less water 	BADC, BARI/BRRI, IRRI, DAE, BMDA and NGOs
Water pollution	<ol style="list-style-type: none"> 1. Implement Environmental Conservation Rules of 1997 2. Promote Integrated Pest Management (IPM) through DAE 3. Promote and encourage farmers for applying balanced fertilizers 4. Monitor water bodies 	DAE, DoE, DoF,BWDB and DPHE
Institution	<ol style="list-style-type: none"> 1. Effective steps to be taken to ensure that present extension work with farmers emphasizing: crops selection, using improved locally adapted seeds, irrigation efficiency, balanced dose of fertilizers, using more organic fertilizer, crop rotation and diversification, topsoil conservation 	DAE and AIS

Issues	Action	Implementing agency
Agricultural Research Programme	1. Innovation of different varieties of crops friendly for different vulnerable areas	BRRI,BARI, BSRI,BJRI,BINACDB and NARS
Awareness of Agricultural biodiversity	1. Farmers and other stakeholders are to be educated on the laws for protecting biodiversity, species richness, ecosystems and environment 2. Aware the policy makers on the need to balance development with conservation and management regimes of different types of Protected Areas	MoEFCC, DAE and MoA
Incorporation of Agriculture conservation in policy	1. Review National Agriculture Policy, NAEP, Seed Policy and other relevant policy to incorporate agriculture conservation (e.g. Conservation, preservation of seed in gene bank, multiplication of seed, encourage farmers for cultivation etc.)	MoA, DAE and BADC
Capacity building of professionals and farmers	1. Review curriculum of Agricultural Universities/ institutes and incorporate agriculture conservation 2. Organize capacity building initiatives for the DAE personnel's 3. Organize capacity building initiatives for the farmers 4. Incorporate a demonstration on "Conservation of Agriculture" in Agricultural Fair of DAE (at upazila, district and national level) for awareness raising	MoA, DAE, Agricultural Universities/Institutes, NARS, BARC, NATA and Donors

3.2 INDUSTRY

3.2.1 Situation Analysis

The importance of industries cannot be overestimated in a country, like Bangladesh, where land is extremely limited for agricultural expansion and realistic employment opportunities predominantly exist in industries and its allied service sector. Like many development activities, industrial activities, however, result in environmental externalities – even if conservation measures are imposed and implemented. Certain industrial activities release pollutants. There exist potential risks of degradation of certain resources, which might diminish potential of such resources to be used as industrial raw materials. However, the adverse impacts of environmental pollution can also be far reaching – it may simultaneously affect human health, diminish ecological integrity, and may severely restrict future use potential by means of over-extraction.

Although industrialization in Bangladesh has yet to graduate from its rudimentary stage, two issues have already arisen. One is that of materials intensity of industries, inefficiency of resource use, and consequent low productivity, wages and livelihood of industrial labour. This problem is directly related to the conservation of various resources including land, water, raw materials (which may include both renewables and non-renewables depending on industry), and energy that directly is a concern for conservation of resources. The other issue is the impact on environment and resource degradation, which is an externality imposed on the society. This arises mainly due to release of untreated industrial effluents as well as toxic solid waste into the rivers and water ways or simply left somewhere. There are definitive evidences that all the adverse effects of such waste management behavior have already been observed on local environment and various resources. Aquatic and forest resources, including biodiversity, have so far suffered the heaviest damages. Since Bangladesh is set to rather rapid industrialization in the next decade, it appears imperative that adequate conservation strategies are formulated and measures are implemented for enjoying industrial goods and services in decades to come.

The National Industrial Policy 2016 has strongly appreciated environment-friendly industrialization in the clauses of the Section 14⁷⁶. It speaks of several measures such incentives for setting up Effluent Treatment Plant (ETP) and Common Effluent Treatment Plant (CETP), among others. It also calls for providing incentives for setting up waste treatment industries as well as for those which will be more environment and climate-friendly. One must also take note of the examples that some of the industrial sub-sectors has set. For example, of the 10 best resource-saving building designs of factories world-wide, 7 are in Bangladesh.

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76 Ministry of Industries, National Industrial Policy 2016.

3.2.2 Conservation Strategies and Actions

The two problems of resource use – inefficiency and degrading surrounding resources through discharge of effluents and polluting them – can be thought of separately, but these are also interconnected, since excessive and inefficient use of resources and raw materials may actually increase the resultant pollution load of a firm.

On resource use inefficiency, the key to raise efficiency is technology. Technology meant not simply the technique of the production process, but also the management of it. But whether or not an appropriate efficient technology is used depends on a host of factors, including costs, profitability, and availability of technology and of course awareness. Proper policies need to be undertaken and instruments used for facilitating the adoption of the technology. Without such policies and instruments, firms may be unwilling because their market competitiveness may be eroded. On discharge of untreated effluents and pollution of land and water, there are again issues of technology, but also barriers against their adoption. Cost is one issue and erosion of competition is the other fear among entrepreneurs. The advantage is that the technology is available off-the shelf which could be adopted along with proper policies.

As a part of the Bangladesh NCS, the following elements, some of which are already part of present policy regime, need to be considered in relation to establish a healthy industrial environment in Bangladesh. By keeping MoEFCC and Ministry of Industry at the core, it is important to establish a national high-level forum to take coordinated conservation measures across tiers of governance and to ensure high level political guidance for successful implementation of conservation measures. Involvement of research, academia, non-state actors and media is necessary towards ensuring good governance in implementing conservation measures.

An action plan has to be time bound and needs to be updated in every five years. The following activities are listed, which need to be implemented within the next five years in order for the strategies to contribute to national conservation.

Table 3.2.1: Actions for Industry

Issues	Actions	Implementing Agency
Policy	<ol style="list-style-type: none"> 1. Review of industrial policy to incorporate environmental issues 2. Bring a paradigm shift from conventional industry to “green industry” with a policy shift towards promoting cleaner technology applications with adequate incentive structures 3. Involve media towards a green industrialization campaign, launch the campaign 	MoI MOI in association with FBCCI, MCCIs and BGMEA etc. MoEFCC with MoI
Institution	<ol style="list-style-type: none"> 1. DoE should be re-organized and strengthened to provide both regulatory and supportive services for effective control of environmental pollution including industrial pollution. Under new setup, DoE will act both as a regulatory body and a promotional agency for pollution control 2. Create budgetary provisions to increase DoE's capacity (both human resource and technical, including equipment and laboratory facilities) 	MoEFCC MoEFCC and NEC
Environmental Assessment	<ol style="list-style-type: none"> 1. Review and update Environmental Conservation Rules – 1997 2. Review and amend the Environmental Conservation Act accordingly 3. Implement the Environmental Conservation Act Rule and Environmental Conservation Act by means of detailed environmental assessment of all major projects and activities and development of mitigation plans for reducing adverse environmental impacts 	MoEFCC and DoE MoEFCC in association with NEC and National parliament DoE
Augmentation of renewable natural resource by industries	<ol style="list-style-type: none"> 1. Proposal for setting up industries based on renewable natural resources to accompany proposal for augmentation of raw materials required from agriculture, forest, fishery or livestock. Proper incentive to be given to industries for their efforts and expenditure for renewal and augmentation of resources 	MoI in coordination with Planning Commission, MoA, MoEFCC and MoFL
Natural resource depletion premium	<ol style="list-style-type: none"> 1. Feasibility of natural resource depletion premium, to be added to the cost of raw materials of the industrial units based on non-renewable natural resources, should be considered and the projects should be appraised accordingly 	MoI in consultation with DoE, FBCCI, BGMEA and MCCIs etc.

Issues	Actions	Implementing Agency
	2. Proposal for industries based on non-renewable raw material to be based on raw material conserving technologies	Mol
Raw material conservation technologies	1. The current incentives towards acquisition of conservation-friendly technologies must be continued and further enhanced	Bangladesh Bank, National Board of Revenue
Waste management in industries	1. Ensure proper treatment and disposal of industrial liquid wastes/effluents and solid wastes. Monitoring and reporting to be ensured with adequate public disclosure	Mol in collaboration with MoEFCC, DoE, BCSIR, BCIC, BSFIC and BSEC
	2. Ensure proper control of industrial emissions	
	3. Develop protocols for identification, handling, transport, and disposal of hazardous and toxic wastes. Discourage the import and subsequent use of toxic substances as input materials for industrial productions	MoEFCC and Department of Customs
	4. Promote research activities for development of low-cost waste treatment technologies. Involve academic institutions in collaborative research towards developing conservation friendly mechanisms and methods	DoE in association with universities and Research organizations
	5. Ensure safe working environment at all workplaces, especially in industries	MoEFCC, DoE in association with Mol
	6. Promote concept of waste minimization (e.g., through provision of appropriate incentives) in the choice of technology and raw materials	MoEFCC and DoE in association with Mol
Land Zoning	1. Identify and demarcate areas for the planned relocation of similar industries (as in the cases of tanneries and pharmaceuticals) in newly designated ‘industrial parks’, each to be served under centrally operated treatment plants	Mol in association with MoEFCC and MoF
Agricultural top soil conservation	1. Agricultural top soils must be conserved by promoting and incentivizing alternative bricks such as hollow bricks	DoE with Brick Makers’ Association
Water conservation in textile and dyeing	1. Promote and incentivize water conservation technologies in textile and particularly in dyeing industries	IFC (PaCT) and BGMEA

Issues	Actions	Implementing Agency
Energy conservation technologies and processes	<ol style="list-style-type: none"> 1. Promote energy efficiency starting from secondary energy (i.e. power) production up to end-use efficiency in boilers and various processes in a variety of industries 2. Increased monitoring to ensure that energy wasting leakages are controlled 	Power Cell, Min of Energy and Mineral Resources and MoI Ministry of Energy and Mineral Resources
New technology Research	<ol style="list-style-type: none"> 1. Research to be initiated to develop local technology for waste treatment and retrieval of by-products 	MoI in collaboration with MoST, BCSIR, BUET, MoEFCC, BAEC and DoE

3.3 POWER

3.3.1 Situation Analysis

Power is vital for economic growth in any country and a key ingredient in improving the socio-economic conditions. In Bangladesh, over the past two decades, the power consumption has been rising rapidly. To cope with the increasing demand, maintaining uninterrupted power supply is must in order to sustain the country's growth momentum. It is estimated that electricity demand of Bangladesh will be more than 33,000 MW by 2030⁷⁷. Adequate generation capacity in future will help in achieving targets under the SDG 7.

To provide electricity to the customers at an affordable price, low cost primary fuel availability is a precondition. In the perspective of present depleting scenario of domestic gas reserve, indigenous coal reserve of 3.2 billion ton⁷⁸ in the north-western part of the country is the only option for low cost fuel for power generation from domestic primary energy resources. The Power System Master Plan 2010 and 2016 suggested that future fuel mix for power generation should be coal and nuclear for base load duty. In future, renewable energy, cross-border power trade, and next-generation nuclear technology will play an important role in power sector development and will help building low carbon society.

77 MoF (2017). Chapter 10 - Power and Energy. Bangladesh Economic Review (2017). Finance Division, Ministry of Finance, Government of the Peoples' Republic of Bangladesh, 142pp. (<https://mof.portal.gov.bd/site/page/44e399b3-d378-41aa-86ff-8c4277eb0990/Bangladesh-Economic-Review>).

78 Rahman, M. (2014). Status of Bangladesh Cross Border Inter connections with India and Expected Benefits. Bangladesh Power Development Board, Dhaka, Bangladesh, 9pp.

A significant progress has been made in the power sector of Bangladesh over the last decade. Installed generation capacity (grid) has tripled from 4,942 MW in 2009 to 15,755 MW of 2017⁷⁹. Number of consumer's increases from 12 million to 18 million. Population with direct access to grid electricity has increased from 47% in 2009 to 80% in 2017. By this time, 66,900 villages were brought under electrification programme. Electricity consumption, which is an important indicator for overall socioeconomic development, has increased from 32,740 MKWH in FY2012- 2013 to 50,264 MKWH in FY2016- 2017⁸⁰. Though installed capacity was 15,755 MW, actual maximum peak generation of 9,479 MW in 2017 against the demand of about 9,500 MW⁸² indicates that system is facing some bottlenecks exist in transmission and distribution system. Power sector is also struggling with increasing per unit supply cost due to increasing oil-based electricity generation. In the meantime, there had been great advances in lighting the dark areas through the introduction and large scale diffusion of solar homes.

Considering the fuel need of the power plants, the Government of Bangladesh has planned to establish a deep-sea port at Moheshkhali and Matarbari area for coal and Liquefied Natural Gas (LNG) import and movement. Bangladesh and India have agreed to install high capacity extra high voltage regional grid inter-connections in the northern side of Bangladesh to import hydropower from north-eastern region of India. Bangladesh and Russia have signed an Inter-Governmental Agreement (IGA) in 2011 to install two units of 1,200 MW each Water-Water Energetic Reactor (WWER) at Rooppur, Pabna. Government already prepared Energy Efficiency and Conservation Master Plan (EECMP) to address this very important issue. It is now mandatory to keep options of solar energy along with normal electricity line during construction of any new building.

3.3.2 Conservation Strategies and Actions

In order to conserve energy in the context of depleting fossil fuel reserve, primary fuel supply constraint from indigenous sources, and global warming and climate change, the best way is to improve energy efficiency and control misuse of energy. In this connection, the 'Energy Efficiency and Conservation Master Plan' of Bangladesh suggests, for example, in the Scenario 1, 20% reduction of energy demand by 2030 over the baseline projection of demand.

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79 Power Division (2017). Annual Report (Fiscal Year 2016-17). Power Division, Government of Peoples' Republic of Bangladesh, 16pp.

80 BBS (2018). *2019 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

This national target is quite in conformity qualitatively with the SDG Target 12.2, but not with the SDG Target 7.3 for doubling energy efficiency (i.e. lowering primary energy consumption by 50%) by 2030. Importance needs to be given on setting national targets so that the efficiency in generation and transmission and distribution of electricity may be increased at the same time.

Considering the installation and life-cycle costs of available non-renewable and renewable power generation options, indigenous or imported coal appears to be the near-term option for low-cost source of electricity. On the other hand, coal is the most pollutant among all fossil fuel. So, optimum balance between fossil fuel and non-fossil fuel (i.e. nuclear, hydro-power import and renewable energy) will be the key approach for future power generation. The resource use implications have been slowly falling over the last few years and is expected to remain roughly the same (around 4,700 GWH/mtoe), but would jump to nearly 5100 GWH/mtoe by 2030. This is of course only a small improvement of 11.7% only in resource use in 15 years' time⁸¹ when a much larger improvement is called for to achieve the SDG Target 7.3.

Generation is one aspect of supply of electricity. Transmission and distribution are two other aspects which necessitate equal attention because a substantial part of the wastage also occur in these activities. Such losses accounted for 25–30% up to 1990. Due to investments and taking other measures it began falling. It was mainly due to distribution losses, as transmission losses accounted for 2.5–3% at most⁸². While transmission problems are largely technical and can be in principle comparatively easily solved, distribution wastage may have both technical and social dimensions.

Much of the discussion in Bangladesh related to power revolves around supply side issues; rather paid limited attention to the demand side management. There may be various ways in which demand may be curtailed. Pricing of electricity is one way to do so. There may be other ways of encouraging people to save electricity. One may be to tax more heavily on electricity using devices. Lower taxes on those with smart devices to lower electricity consumption.

81 The GWH for the past few years had been 4251 (2012), 4210 (2013), 4437 (2014) and 4547 (2015). The projected efficiencies are 4735 (2021) and 5081 (2030).

82 MoF (2017). Chapter 10- Power and Energy. Bangladesh Economic Review (2017). Finance Division, Ministry of Finance, Government of the Peoples' Republic of Bangladesh, pp. 142. (<https://mof.portal.gov.bd/site/page/44e399b3-d378-41aa-86ff-8c4277eb0990/Bangladesh-Economic-Review>).

Key actions related to power sector development, efficiency improvement and conservation are as follows:

Table 3.3.1: Actions for Power

Issue	Action	Implementing Agency
Generation	1. Integrated approach required for the development of deep sea port for multiple use including coal handling terminal, commercial container terminal, LNG terminal, oil terminal for refinery at north Moheshkhali, Cox's Bazar	Power Division, Energy and Mineral Resource Division and Ministry of Shipping
	2. Implement least cost generation expansion plan (PSMP 2016)	Power Division, BPDB and PGCB
	3. Complete and start operation of Rooppur Nuclear Power Plant on time	Ministry of Science and Technology, BAEC and Bangladesh Nuclear Power Company Ltd.
	4. Establish a regional power market for cross-border power trade	Power Division and MoFA
	5. Retire very old and inefficient power plants as scheduled	Power Division and BPDB
	6. Introduce time/condition based maintenance of power plants as recommended in PSMP Study	Power Division and BPDB
Renewable Energy	1. Prepare a comprehensive roadmap for implementation of Renewable Energy programme (Solar, Wind, Bio fuel etc.)	Power Division, SREDA, NGOs and Universities
Transmission	1. Modernize and upgrade NLDC for efficient operation, frequency control and merit order dispatch	Power Division, PGCB and BPDB
	2. Take necessary measures for reactive power compensation for quality power supply and transmission loss reduction	PGCB
	3. Implement planned 400 kV backbone transmission lines including NG 3, NG 4	PGCB
Distribution	1. Prepare time bound distribution network expansion plan for remote area electrification of remaining villages by REB	Power Division and REB
	2. Provide uninterrupted power supply to the special economic zones, export processing zones and clustered industrial areas through dedicated line	BPDB, REB, DPDC, DESCO, WZPDCL and Power Division

Issue	Action	Implementing Agency
	3. Take necessary measures to curb technical and non-technical distribution losses	BPDB, REB, DPDC, DESCO, WZPDCL and Power Division
	4. Introduce 'smart grid' for loss reduction and better customer services	BPDB, REB, DPDC, DESCO, WZPDCL and Power Division
Regulation and Pricing	1. Implement and practice 'Grid Code' and 'Distribution Code'	BERC, BPDB, PGCB, all generation (including IPP's) and distribution companies
	2. Regular tariff adjustment to ensure cost reflective tariff in both bulk and retail level	BERC, Power Division, BPDB and all distribution companies
Energy Efficiency Improvement and Conservation	1. Speedy expansion of pre-paid metering scheme	Power Division and all distribution companies
	2. Develop mechanism for energy auditing and efficiency improvement measures in the industrial units including power plants	Power Division, SREDA, BPDB and all generation companies including IPP's
	3. Replace inefficient lights by energy efficient lights/ LED bulbs	SREDA and all distribution companies
	4. Assess and find mechanism to replace old and inefficient irrigation motors and pumps by efficient one	SREDA, Ministry of Agriculture, BMDA and REB
	5. Implementation of Energy Efficiency and Conservation Master Plan (Energy Management Programme, EE Labeling Programme, EE Building Programme etc.)	SREDA, Power Division, Energy and Mineral Resource Division, Ministry of Industries and Ministry of Commerce
Institutional Development	1. Ensure good governance in the sector entities	Power Division
	2. Introduce corporate culture in the sector entities	Power Division
R&D	1. R&D activities through newly established 'Energy Research Council' to select and adapt new and alternate technology. To harness the potential of bio-fuel and other non-conventional energies, research programmes need to be initiated at universities and government laboratories especially at BCSIR and BAEC. An integrated renewable research and development policy and implementation mechanism with earmarked funding need to be arranged. An inter-ministerial technical committee may be formed	Power Division, BEPRC, MPEMR, MOST, BCSIR, BAEC and Universities

3.4 RURAL DEVELOPMENT

3.4.1 Situation Analysis

Rural development effort of the government is generally targeted towards poverty alleviation through employment, income generating activities, cooperatives, and increasing access to finance. A review of the key national policies of the Government of Bangladesh regarding rural development indicates need to be given more emphasis on the conservation of natural resources as a means of addressing the challenges in rural development. The fact that degradation of environment hurt the poor most. The policies may be given more attention to how the poor can make use of natural resources in the most efficient and cost-effective manner. An approach that aims to alleviate poverty through judicious utilization of land, water, forestry, livestock, fisheries and other natural resources and ecosystem in general maybe a key strategy for the conservation of natural resources as well as poverty alleviation.

Making an effort to radically change the national policy priorities is a time and resource-consuming process. In this context, leveraging the existing national policy priority of poverty alleviation through proper utilization of land, water, forestry, livestock, fisheries and other natural resources seems to be the most pragmatic course of action for furthering the agenda of natural resource conservation.

Rural development being a multi-sectoral issue is difficult to be pinned down to one or other specific policy or strategy. The bulk of the rural people of Bangladesh still earn their livelihood essentially from agricultural activities (i.e. crop cultivation, fisheries and livestock). But in most cases the rural peoples' access to the necessary productive resources, viz. land, water, fisheries, livestock and related services are limited. The SDG Target 1.4 clearly takes cognizance of this problem when it calls for ensuring equal access of the poor men and women to economic resources. Then again, the SDG Targets 2.3 and 2.4 clearly spells out the need to raise the productivity of small scale farmers in a resilient manner. In fact, all the NCS sectors may accommodate objective towards the fulfillment of the needs of the poor.

In order to achieve the rural development goals, the agricultural sector maybe prioritized. Its vulnerability particularly at times of disasters and in the face of severe ecosystem degradation maybe given special attention. Furthermore, financial allocations for public sector investment maybe geared as far as possible towards the poor either directly or indirectly. It may be noted that, although the allocations for agriculture and rural development have increased over time.

Over the years, diverse interventions have been made for rural development, which has to be addressed with the natural resource utilization. This challenges the policy-makers to comprehensively understand the need for conservation-oriented interventions, their types and impacts on sustainable livelihoods, and production and consumption by the poor and marginalized men and women. Nevertheless, the Government has been making tremendous effort to uplift the lives and livelihoods of the poor through numerous poverty alleviation and vulnerable group support programmes with own funding and with assistance from development partners.

The micro-credit system began with the overall objective of increased welfare for the poor. Over time other interventions have come and gone. But hardly ever these were related to resource management in one way or the other. Some of the more recent programmes, such as those related to social forestry; and the projects like *Ekti Bari Ekti Kamar* (One Home, One Farm), Comprehensive Village Development Programme 2nd Phase, Economic Empowerment of the Poorest in Bangladesh Projects, and Chars Livelihoods Programme 2nd Phase, were related to natural resource management.

3.4.2 Conservation Strategies and Actions

Regarding rural development within the framework of NCS, the productivity of people in the rural areas, particularly of the poor men and women and the disadvantaged, has to be raised to increase their material welfare and their access to food and nutrition. For this to happen, as the SDG has pointed out, they must have equal access to productive assets as all others. This is possible for some resources that are common property resources. However, the forests, wetlands, and rivers are generally owned by the State and the poor can be given limited access to those resources through an accountable system.

The other avenue is to ensure access of the poor to education and health services to make them better productive in the labour market. Third is the issue of financial services. Complete financial inclusion of the poor and the marginalized to such services will allow them to take better advantage for their development by accessing production system.

To get all these done, a vital step is to revise the National Rural Development Policy and make it productivity-oriented along the lines of the SDG targets, adopt programmes and projects accordingly under various natural resource management programmes as well as those in sectors, which are dependent on the natural resources. In fact, the traditional knowledge of the people in some programmes, such as establishing gene banks, may be immensely valuable. Creation of social capital, through capacity building of the people in general and the poor in particular, in resource and ecosystem

management is also important. The actual contents of many of these interventions, however, will vary by specific ecological regions of the country.

Rural development is a major endeavour and cannot be the sole responsibility of the Government. In fact, if millions of private citizens need to be involved, community participation is essential. The civil society and NGOs may be the change agents. However, the Government has the major role in charting the whole course of action. Local government institutions in particular must have a major role to play. They may draw individual rural development programmes within a general planning framework drawn by the central authorities, like the Planning Commission, along with the Ministry of Local Government, Rural Development and Cooperatives.

Given the above conservation strategies, many of the actions outlined under other NCS sectors are generally applicable to the issues of rural development. Here, therefore, only those issues that have not been raised elsewhere are discussed here.

Table 3.4.1: Actions for Rural Development

Action	Institutions
Update the National Rural Development Policy 2001 so that it can put special emphasis on the use of natural resources as a mean of poverty reduction	MoLGRDC
Include fisheries sub sector in the Development Result Framework (DRF) under the national priority outcome goal of promoting sustainable agriculture to ensure self-sufficiency and reduced disparities in food safety and security	MoLGRDC, GED of MoP, BBS, MoFL
Allocate more budget for technical research on developing supply chain linkages between rural raw material production for manufacturing sub sector	MoLGRDC
Allocate for budget for project based research in order to form empirical evidence on how sustainable utilization of natural resource can induce the goal of achieving rural development	MoLGRDC
Allocate more budget for advertisements and campaign to popularize social forestry	MoLGRDC and MoF
Increase the share of national development allocation in agricultural and rural development sector	MoLGRDC and MoF
Allocate more budget for agricultural research from the agricultural sector allocation	MoLGRDC and MoF

3.5 TRANSPORT AND COMMUNICATION

3.5.1 Situation Analysis

The Padma Multipurpose Bridge, a landmark achievement in transport sector in Bangladesh, has connected the two sides of river Padma as the installation of all the steel spans has completed in 2020. In the August, 2021, by installing the last roadway concrete slab, the bridge has connected the approach roads in the both sides of the Padma river. The length of the Padma bride (the river part) is 6.15 km. The length of the viaduct is 3.48 km. The total length from Mawa in Munshiganj to Jajira in Shariyatpur, therefore, is about 10 km and ready to be opened for communication.

In August 2021, another milestone was achieved, when then Metro Rail started experimental operation. The total length, from Uttara to Motijheel, is 20.1 km. There are 16 stations. The line will be inaugurated from Uttara station.

Between June and December of 2022, three mega-projects has been inaugurated. The first inaugurated is the Padma Multipurpose Bridge. Then the Karnafuli tunnel will start operating, and then the Merto Rail was inaugurated by end the end of 2022.

Among all modes of transport, roads and highways are considered as the economic backbone of Bangladesh, carrying more than 80% of freights and 88% of passenger traffic⁸³. Expansion of railway and inland water transport system is also taking place, so is that of seaports, maritime shipping and civil aviation. The main objective of the Bangladesh NCS is to establish a safe, low-cost, modern and technically dependable and environment-friendly transport system with a view to conserve resources in the transport sector.

The water transport network of the country not only caters the inland movement of freight and passengers, but also plays an important role in transportation of import and export items. During 2016–2017 fiscal year, Chittagong port handled about 73,173 cargo, whereas Mongla port handled about 7515 cargo⁸⁴. The aviation activities are being carried out from 3 international and 12 domestic airports⁸⁵, about 38 airlines are now operating in and out of the country; 52 states signed bilateral agreements with Bangladesh for air transport facilities⁸⁶.

⁸³ Economic Division (2015). Sustainable Transportation and Infrastructure Volume 1 Roads & Highways. Bangladesh Delta Plan 2100 Formulation Project, General Economics Division, Planning Commission, Government of Bangladesh.

⁸⁴ BBS (2018). *2017 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

⁸⁵ CAAB (2018). Airports in Bangladesh. Civil Aviation Authority of Bangladesh. (Accessed: October 1 2018).

⁸⁶ CAAB (2017). Annual Report (2016- 2017). Civil Aviation Authority of Bangladesh, Dhaka, Bangladesh. 14pp.

The Government of Bangladesh prioritized road transport system for the last four decades and consequently more than 80% of transport sector investment was routed to improvement of road network⁸⁹. Currently, about 2% of GDP is spent for importing fuel required in transport sector. If the fuel price increases to US\$ 120/bbl by 2030, almost 14% of national GDP will have to be spent to sustain country's transport system. One estimate suggests that 30% diversion of modal share from road to rail, in addition to increased use of Compressed Natural Gas (CNG) in road vehicles, may reduce transport energy import demand to about 4 Mtoe in 2030 and result in cost reduction by almost 10% of GDP.

3.5.2 Conservation Strategies and Actions

Investment focus of Bangladesh should be shifted from roads and highways to more resource conserving and sustainable mode of transport, like railways and waterways. In this regard, the topmost priority may be the development of a balanced 3R (Rail, River and Road) based integrated multimodal transport infrastructure where all modes of transport would act as a complement to each other.

Bangladesh is fundamentally constrained by land scarcity. The growth rate of our vehicle pool should be restricted as road building opportunities will be more limited in the future. Highway construction in Bangladesh is very capital and land intensive and environment intrusive. Furthermore, more than 80% of the country is floodplain with unconsolidated alluvial deposits forcing highways to be built on high embankment. Considering all these facts, the road maybe built on an elevated frame. This innovative infrastructure development initiative will preserve biodiversity, prevent social divide, and most importantly, will conserve land and construction materials.

Towards conservation of nature, the best strategies would be to implement the '*reduce, reuse, recycling*' based 3-R concept in pavement system development. Innovative pavement design and maintenance practices, such as perpetual pavement design, performance-based maintenance practice, recycling of existing pavement, use of green bricks, concrete pavement, and high performance polymer modified bituminous (PMB) binder to endure water submergence and hot weather are found to be very relevant for a tropical country like Bangladesh. These resource-efficient, new road design and maintenance ventures may be explored with a view to develop less maintenance intensive as well as resource conserving pavement system for Bangladesh.

Given acute land scarcity and transport supply constraints, it is important efficient use of road space by encouraging mass transit system. It would be more practicable to adopt restrictive travel demand management strategies, like numeric control and

road pricing policies, to discourage big polluters as well as private vehicles, both in number and usage. Vehicles also should be encouraged to use cleaner or alternative fuels to reduce emissions and air pollution.

Lack of adequate road safety has already reached an alarming level; conflict-free faster and smooth movement along the highways is not possible due to the presence of large number of temporary markets and ribbon development right on the edge of roads. Road safety auditing (RSA) based preventive measure in tandem with integrated transport and road side landuse development plan should be adopted by the highway authorities to ensure speed potential of highways as well as to reduce the level of risk exposure in a systematic way. Moreover, in order to achieve SDG target 3.6 on reducing fatalities 50% by 2020, a well-established 3-E approach, i.e. engineering, education and enforcement, should be adopted for reducing both number and severity of accidents and thereby to save people's miseries and lives.

Impressive development in energy sector and its continued improvement essentially implies that it will stimulate the economic activities significantly in the form of increased industrial productivity in a way that eventually would be translated into increased movements of commercial vehicles. It suggests that the real benefits of highly subsidized energy initiative in power sector would not be harnessed without matching investment in the transport infrastructures.

To reduce the need for travel as well as to generate mass transit enabled trips, there is a strong need to adhere transit-oriented integrated landuse and transport development strategies. The ICT-based digital transport system, which is the safest, quickest and least cost mode of communication, has an enormous resource conservational potential. It should be the backbone infrastructure of any future multi-media cyber smart city with compact footprint and thereby achieving ultimate goals of having city with paperless administration, currency-less economy and placeless jobs. For addressing captive physical trips, indeed policy should be directed towards the environmental sustainability and affordability; thus, need to promote fuel-free active modes of transport viz. walking and cycling along with fuel and space efficient organized inclusive mass transit system, like BRT/LRT/MRT.

Bangladesh is blessed with a network of natural streams which has huge potential to cater for passenger and freight transportation demand and thereby making a balanced transportation system by reducing huge pressure on road network. Particularly, this mode could be a viable alternative for presently unsustainable road transport system.

Railway communication has inherent threat from the road transport system. The smaller geographical footprint of Bangladesh along with flat terrain and most importantly the capital city is located at the center of the country are very favorable for road transport with door-to-door connection facility. But considering that it is cheaper, safer, fuel-efficient and most importantly, a more demand responsive mode of transport, presently the government has placed special emphasis on railway communication and for sustainability this policy should continue in future.

The SDGs aiming at planet, people and prosperity, which are directly related to transport and communication sub-sector and for that there is a need to provide access to safe, affordable and sustainable transport system for all by 2030. Towards achieving the goals, the development of fuel-free active transport and energy efficient and affordable public transport system with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older citizens as well as by improving safety are considered to be the best strategies. Moreover, to enhance people to people contact as well as to provide better opportunities for equitable prosperity of all the peoples of land-lock regions around Bangladesh, opening up of its inland and on-shore transport infrastructures could play a vital role and thereby could harmonize regional development.

Towards conservation of nature, minimizing transport-induced pollution, saving human lives and fostering sub-regional trade, a comprehensive list of actions has been proposed in this sector. The sub-sectors included in the action plan are: Roadway, Railway, Inland Waterways, Ports and Shipping, and also included Climate Adaptation and Quasi-Transport issues.

Table 3.5.1: Actions for Transport and Communication

Issue	Action	Implementing Agency
Roadway		
Pollution Control:		
CNG Conversion	<ol style="list-style-type: none"> 1. The country is already suffering from shortage of natural gas supply and contemplating gas import from neighboring countries. In line with this, CNG conversion policy should be revised 2. The subsidized fuel currently encourages both number and usage of vehicular traffic particularly smaller sized autos, which have negative externalities in the form of congestion, higher rates of accidents, road damage and environmental pollution. The underpricing also reduces incentives for importing energy efficient vehicles. To restrict the use of private cars as well as to reduce gas demand, the CNG conversion policy particularly for private cars and smaller sized vehicles need to be addressed in line with the level of congestion and resulting induced pollution 3. To restrict the use of private cars as well as to reduce gas demand, the CNG conversion policy, particularly for private cars and smaller sized vehicles, need to be addressed in line with the level of congestion and resulting induced pollution 4. Steps should be taken to popularize the use of LPG powered vehicles in cities and in intercity transportation 	BRTA and DTCA in association with MoEP and BPC
Smaller Sized Vehicle	<ol style="list-style-type: none"> 1. Smaller sized modes of transport should be replaced by space and energy efficient mass transit as well as fuel free mode of transport. To take measures for promoting an inclusive integrated mass transit system 	BRTA and DTCA in association with MoRTB
Older Fleet	<ol style="list-style-type: none"> 1. Improving vehicle inspection and fitness system as well as phasing out of the 20-year-old buses and minibuses and 25-year-old trucks from urban centers through strict enforcement to make the city streets safe and pollution compliant 2. In the longer run, to improve vehicle maintenance practices, mandatory emission testing facilities should be introduced as a part of the auto vehicle inspection center (VIC) based vehicle fitness test and will create expert manpower by providing appropriate training 	BRTA in association with BP and HP

Issue	Action	Implementing Agency
New and Reconditioned Vehicles	<ol style="list-style-type: none"> 1. Import duty frame structure needs rationalization to promote low-emission friendly vehicle import and to make the market more hybrid car import-friendly and thereby to control emissions at source level 2. To encourage the use of greener vehicles, it is required to introduce the mandatory Fuel Economy Labeling Scheme (FELS). Under FELS, all cars and light goods vehicles that are displayed for sale must be affixed with the fuel economy labels that provide more information on their fuel consumption. Also, there is a need to introduce Carbon Emissions based Vehicle Scheme (CEVS) to get rebate for replacing older vehicle with 'Green Vehicle' as well as to encourage consumers to buy more fuel-efficient vehicles 3. Need to implement the proposed Emission Standards for the New Registration Vehicles i.e. Euro 3 for Dhaka and Chattogram and Euro 2 for rest of Bangladesh 	BRTA in association with MoRTB in association with NBR and BC
Battery-Operated Hybrid Vehicles	<ol style="list-style-type: none"> 1. Today alternatives exist to replace motor vehicles operating with fossil fuel to a much cleaner vehicle. Of them, battery-operated hybrid vehicle is one. Such hybrid vehicles should be encouraged particularly in city areas to minimize pollution and to economize imported fuel consumption 	BRTA, City corporations and Municipalities
Fuel and Lubricant	<ol style="list-style-type: none"> 1. Use of clean fuels needs to be encouraged to control air pollution 2. The Government will strengthen enforcement to stop adulterated fuel 3. Monitor and control sources of emission through establishing air shed management plan all over the country 4. To check the quality of petroleum and thereby to ensure the integrity of the entire fuel and lubricant supply chain, safeguards need to be implemented into every phase of the process and a mechanism to test and monitor the quality of petroleum sold at the city's filling stations needs to be developed 	DoE and BPC

Issue	Action	Implementing Agency
Congestion	<ol style="list-style-type: none"> 1. Congestion induced by smaller sized auto/motorcycle/para-transit etc. vehicles need to be tackled by controlling both their number and usages adopting strict registration and road pricing policies 2. Reduce congestion at toll plazas by adopting electronic road pricing (ERP) system and thereby ensure free flow traffic movements 	BRTA, DTCA, RHD and BBA RHD, LGED, City corporations and Municipalities in association with DoE
Dust control	<ol style="list-style-type: none"> 1. Dust control measures should be made mandatory in all construction and road maintenance works and strict compliance should be ensured 	
Construction (to minimize pollution and also to conserve resources)		
Green Bricks	<ol style="list-style-type: none"> 1. Traditional gross polluting brick kilns should be replaced by energy efficient brick kilns 2. Gradually, ordinary brick based construction should be replaced by gas burned green auto bricks or cement concrete (CC) blocks to overcome traditional brick industries induced social and environmental consequences 3. Based on incentive and penalty, a strong policy guideline is necessary to promote the use of green bricks by discouraging the resource intensive traditional bricks 4. Brick making by using top soil and wood burning should be prohibited completely 	RHD, LGED, City corporations and Municipalities in association with DoE
Modified Binder	<ol style="list-style-type: none"> 1. In place of traditional virgin bitumen, it is required to adopt the use of high performance polymer modified binder (PMB) to enhance longevity of pavement in tropical weather and rampant overloading condition prevailing in Bangladesh and thereby to conserve materials required for frequent road maintenance 	RHD, LGED, City corporations, Municipalities and CAAB
Pavement Type	<ol style="list-style-type: none"> 1. Concrete pavement has better life cycle cost advantage over traditionally built bituminous flexible pavement. As such, to reduce maintenance frequency of highways, focus should be shifted from bituminous pavement, which is inherently water sensitive, to maintenance insensitive ‘fit and forget’ and ‘perpetual in nature’ type concrete pavement 2. Concrete pavement should be the preferred type for building submersible road particularly in low laying areas with inundation potential 	RHD, LGED, City corporations, Municipalities and CAAB

Issue	Action	Implementing Agency
Community Participation	1. It is needed to make rural infrastructure building and maintenance using Labor Contracting Society (LCS) an official policy to involve poor women in village road development based income generating activities and thereby making them economically empowered	LGED in association with PCB
Recycling	1. As alternative to natural raw materials, we should adopt the use of recycled materials for road construction works and thereby, conserve nature 2. In pavement rehabilitation, in line with 3-R (Reduce, Reuse and Recycle) principle we need to adopt recycling of weathered pavement in place of traditional overlay practice and thereby, conserve materials as well as prevent ancillary problems associated with continuous rising of road level	RHD, LGED, City corporations and Municipalities and CAAB
PPP initiative	1. To ensure high quality road infrastructure with the best possible level of service, there is a strong need to increase private participation through the PPP framework	Government of Bangladesh (PPP Cell, PMO office)
Maintenance (to minimize pollution and as well as to conserve resources)		
Timely maintenance	1. Maintenance of roads should form part of the road network development to affect longevity to vehicles and economy in fuel	RHD, LGED, City Corporations and Municipalities
Performance based maintenance	1. Introduction of performance based preventive and timely road maintenance practice instead of delayed reactive road rehabilitation system or 'build, neglect and rebuild' culture	
Maintenance fund	1. Need to increase RHD's ability to maintain and develop road infrastructure by full implementation of recently proposed 'Road Fund' initiative 2. To reduce maintenance frequency and thereby recurring cost of road, utmost attention should be given to make road infrastructure durable. In this regard, strategic measures could be the adoption of: <ul style="list-style-type: none">■ Concrete pavement in place of traditional bituminous pavement which is inherently water sensitive■ Controlled landuse planning policy integrating with the drainage infrastructure for the road adjacent areas	RHD in association with MoF RHD, LGED, City Corporations and Municipalities in association with MoL

Issue	Action	Implementing Agency
Operational (to conserve resources)		
Overloading	<ol style="list-style-type: none"> 1. To reduce the cost of road construction and thereby, conserve the nature, infrastructures should be built by better design, adhering good construction practices, providing proper drainage system and enforcing vehicle overloading 2. Strict axle load control policy should be adopted to reduce road damages caused by overloading 3. As vehicle modification, in the form of increasing length, height and width beyond manufacturer's recommended dimension, is one of the root causes of overloading and consequent premature pavement damage, the vehicle fitness process needs to be made more effective and accountable so that no oversized truck gets fitness certificate. Side by side, random road side inspection and strict enforcement should be in placed to arrest drivers' over loading tendency 	BRTA, RHD and LGED in association with BP and HP
Road Furniture	<ol style="list-style-type: none"> 1. Street lights and traffic signal system should be replaced with light emitting diode (LED) lamps preferably powered by solar system to reduce energy wastage. Moreover, to conserve resources, in application of traffic control devices, the road marking should be given preference over traffic sign 	BRTA, RHD, LGED, Metropolitan Cities, City Corporations and Municipalities
Urban Transport		
Transit Oriented Development (TOD)	<ol style="list-style-type: none"> 1. Transit oriented development (ToD) is considered as one of the best travel demand management measures in reducing reliance on private transport and the need for travel by better landuse planning 2. Adhering mass transit oriented landuse and transport development policies. Along with improving pedestrian facilities and integrating it to form a well-articulated multimodal public transport network could be a lucrative solution to reduce the carbon emission in urban areas and make the city inclusive and livable 	DTCA and RAJUK in association with BR

Issue	Action	Implementing Agency
Travel Demand Management	<p>1. Considering that the demand driven strict landuse and trip generation and distribution control measures have the potential to provide long lasting transport solution, for sustainable development the following demand management measures are proposed</p> <p>2. Enhancing public transport and active mobility and maintaining affordable public transport</p> <p>3. Active fuel free transport like walking and bicycling as well as fuel efficient mass rapid transit should be given priority in the urban landuse planning and in all new satellite town development initiatives. This is the key strategy to meet the increasing travel demand and to reduce emission from transport sector</p>	DTCA, RAJUK, DNCC and DSCC
	4. To discourage private and smaller sized vehicles, registration policy should be reviewed along with introduction of measures like auto free zone, congestion pricing, strict car parking, car-pooling/ ride sharing, odd-even number car driving schemes etc.	BRTA in association with MORTB, DTCA, RAJUK, DNCC, DSCC and MoC
Multi-modal transport (To conserve resources)	<p>1. Adhering National Transport Policy to integrate different modes of transport considering inter-modal interactions and allocation of resource according to priority of development. Priority should be given on development of water and rail transportation system</p> <p>2. Bridges and level crossings should be built complying proper navigational headroom and following approved guidelines of Bangladesh Inland Water Transport Authority and Bangladesh Railway Authority respectively. In this regards planning commission could play a vital role in ensuring development of conflict free integrated 3R (river, rail and road) infrastructures</p> <p>3. Reinforcing the above by developing a rural road transport system integrating with inland water</p>	DTCA, RAJUK, PCB, in association with MORTB, MoLGRD, MoR and MoSIWT

Issue	Action	Implementing Agency
Regional connectivity (to foster sub-regional trade)	<ol style="list-style-type: none"> 1. Improving connectivity with neighboring countries through development of inter-modal transport network 2. Modernizing existing port infrastructures and developing deep sea port facilities for providing services to hinterland countries and thereby making dividend of geographical location of Bangladesh 	PCB in association with Port authorities (CPA, MPA, PPA), LPB, MoRTB, MoLGRD, MoR and MoSIWT
Rural Transport (To conserve resources)	<ol style="list-style-type: none"> 1. Make rural sinusoidal roads accessible to bus/truck by straightening alignment and curve widening and thereby to support the sustainable development of rural economy as well as to provide public transport facilities 2. Towards land conservation there is strong need for pursuing integrated rural transport and densified growth center/market as well as rural housing development policies 	LGED in association with PCB and MoHPW
Railway (To conserve resources, lives and facilitate regional trade)		
Safety	<ol style="list-style-type: none"> 1. Need to segregate rail and road ways as well as to compartmentalize side frictions for harnessing speed potential of railway as well as to reduce degree of exposure and accidents at level crossings 2. Maintain railway track effectively to reduce derailment potential 3. Need to enhance on-board seating capacity and thereby, promote safety by prohibiting passengers travel using roof-top and locomotive sides 	Bangladesh Railway in association with DTCA, MoLGRD and MoRTB
Land Assets	<ol style="list-style-type: none"> 1. Ensure full utilization of land assets to generate non-operational revenue stream as well as to prevent illegal landuse by authorized and unauthorized quarters 2. One of the best ways of utilizing the unused railway land could be making transit oriented landuse development (ToD) under public private partnership (PPP) framework and thereby ensuring both regular financial support as well as sustainable densified compact urban development with significantly reduced travel demands 	Bangladesh Railway in association with DTCA, RAJUK and PCB

Issue	Action	Implementing Agency
Inland Waterways (To conserve resources, facilitate sub-regional trade, save waterways, and lives)		
Operational Efficiency	<ol style="list-style-type: none"> <li data-bbox="417 357 991 507">1. To maintain high level of operating condition and thereby to ensure uninterrupted high speed journey, there is a need for strict enforcement and monitoring on river encroachment and illegal plying of unregistered boats/vessels <li data-bbox="417 549 991 749">2. To increase its urban modal share, which is now less than 1% of the total daily trips of Dhaka City, restoration and excavation of canal development initiatives should be undertaken and thereby solving cities acute drainage problem as well as making circular water-bus service a destination bound popular mode of self-content transport <li data-bbox="417 755 991 822">3. To develop transit infrastructures and intermodal connectivity to facilitate sub-regional trade 	BIWTC, BIWTA, DoS in collaboration with MoEFCC and MoL
Dredging	<ol style="list-style-type: none"> <li data-bbox="417 963 991 1090">1. Navigability of waterways should be maintained for efficient water transportation network through both capital and maintenance dredging initiatives to ensure flow of passenger and goods traffic <li data-bbox="417 1096 991 1296">2. As dredge materials is a large source of sand and land filling materials, it needs to be addressed in line with the river channel stability and should be integrated with the governmental planned dredging programme. Most importantly this informal massive dredging activity should be regulated by issuing permit 	BIWTA in association with DC
Encroachment and Pollution	<ol style="list-style-type: none"> <li data-bbox="417 1333 911 1400">1. There is a need for strict enforcement and monitoring on river encroachment <li data-bbox="417 1406 991 1473">2. Control of water pollution by marine vessels should be enforced effectively <li data-bbox="417 1479 991 1546">3. Designation of focal point for monitoring and preventing pollution of navigable channels <li data-bbox="417 1552 991 1619">4. Strict procedures for licensing of vessels including vessels in the maritime areas 	BIWTA in association DoS, DoE and BIWTC

Issue	Action	Implementing Agency
	<p>5. Arrangement of contingency plan to check environmental pollution due to spillage of oil and chemicals during accident and thereby conserving fragile echo sensitive coast belt</p> <p>6. Arrangement of training for officers and staff of water transport vessels on environmental pollution and its control measures</p> <p>7. Ratification and monitoring of international convention and protocol regarding water pollution by sea going vessels</p> <p>8. Municipalities, City corporations, Market/Hat-bazar committee along with all land development regulatory bodies should ensure proper place for solid waste dumping for all the neighborhoods and thereby, minimize encroachment of canal/river/wet land</p>	BIWTA in collaboration with Municipalities, City corporations and DCL and MoL

Ports and Shipping (To conserve resources, foster regional connectivity, and boost economy)

Operational Efficiency	<p>1. Developing deep sea port integrating with the intermodal connecting facilities to harness the geographical potential of Bangladesh for boosting and fostering regional and sub-regional trades and thereby ensuring best utilization of this capital intensive facility</p>	Port Authorities (CPA, MPA, PPA) in association with MoSIWT, MoRTB, MoR
Intermodal Connectivity	<p>1. Reducing port induced semi-trailer and covered-van traffic by developing wider intermodal rail and river connectivity and thereby to conserve resources</p>	Port Authorities (CPA, MPA, PPA) in association with BIWTA, BR, MoR
Climate Change	<p>1. To ensure sustainable use of sea front gateway port infrastructures, there is a need to redevelop Chittagong Port as “Climate resilient” against sea level rise (SLR) and land subsidence potential</p>	Port Authorities (CPA)

Issue	Action	Implementing Agency
Climate Adaption (To conserve resources and ensure sustainable infrastructures)		
Climate resilient Infrastructures	<ol style="list-style-type: none"> 1. All the coastal transport infrastructures like road, culvert/bridge, sea and airport, terminal etc. should be developed by making them climate adaptive to make these infrastructures long lasting and, thereby, ensure sustainable use 2. Side by side instead of raising the height of road infrastructures in coastal districts against impending sea level rise (SLR), better strategy would be developing coastal embankment/polder infrastructures as “Climate resilient” to save all sorts of assets including the agricultural lands within the protection area. It would essentially conserve resources required for raising road individually 3. Considering the inherent weaknesses of bituminous pavement under submerged condition as well as the overall performance and special submersible attribute of the concrete pavement roads, this type of road should also be gainfully used in the coastal regions as an adaptation measure against rising sea levels and frequent flooding due to climate change 	Port Authorities (CPA, MPA, PPA), CAAB, RHD, LGED in association with BWDB Municipalities, City Corporations, LGED and RHD
Plantation on Road and Railway Verges	<p>To conserve forest, to ensure renewable energy, to mitigate climate change</p> <ol style="list-style-type: none"> 1. Under social participatory forestry programme, the vegetative plantation should be promoted along roads, highways and railways verges as per LGED, RHD and BR's guidelines 2. Plantation must not be made around the junction and level crossing influence areas and also the areas inside horizontal road curve 	RHD, LGED and BRA in association with MoEFCC
Quasi-Transport and Smart Transport System (STS) (To conserve resources and save lives)		
Use of ICT	<ol style="list-style-type: none"> 1. Adopting transit oriented urban development strategies and ICT enabled densified compact smart city development configuration towards reducing travel demand significantly by innovative planning 	DTCA in association with RAJUK and BR

3.6 URBANIZATION, HOUSING AND SETTLEMENT PLANNING

3.6.1 Situation Analysis

Bangladesh is fast transforming into an urban society. The country is experiencing the growth of metro-cities as well as the socioeconomic and physical changes in the rural villages. The level of urbanization in Bangladesh was 28% in 2014, which is expected to be 56% in 2050, when urban population size will rise to over 112.44 million⁸⁷. Although it covers less than 10% of the land of the country, the urban sector contributes more than 50% (2005) of the national GDP⁸⁸. The rapid transformation has however caused multifarious problems, such as spatial and economic inequity, persisting poverty, housing crisis, transportation problem, stress on natural resources environmental degradation, and poor governance. In order to ensure sustainable development and conservation of nature, it is necessary to design proper conservation strategies and action plans in urban development, housing and settlements.

Rapid urban expansion negatively impacts on the quality of environmental elements, such as air and water, which may adversely influence human health. Rapid and disproportionate growth of Dhaka, for example, has created disparity in economic and social development in the country. Structurally, quality of housing in the country has improved since the independence. But this has significant negative impact on the environment since this has necessitated rampant collection of sand from river beds and massive depletion of top soil for brick-making. Both urban and rural settlements have expanded without proper planning or development control. The National Housing Policy was approved in 1993 and it has been revised and approved in 2016.

Some of the major issues in urbanization, housing and settlement planning are as follows.

1. Substantial rural-urban disparity is observed in the level of development. There also exist urban-urban (metropolitan and small-town disparity) as well as intra-urban inequities.
2. Massive rural-urban migration and much rapid growth of the capital city of Dhaka creating various environmental problems, including solid and waste water disposal.

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87 BBS (2015). *Changing Patterns of Urbanization in Bangladesh: An Analysis of Census Data*. Population Monograph of Bangladesh, Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, ISBN- 978-984-33-9953-3. (http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopMonographs/Volume-12_UM.pdf).

88 MoHPW (2016). *Bangladesh Country Report Habitat III*. Urban Development Directorate, Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. 58pp.

3. Lack of proper planning and designing in construction of necessary infrastructure, such as roads, housing and commercial buildings without much regard to the existing water bodies, their natural flows and gradients ultimately leading to drainage congestion, water-logging, and urban flooding.
4. Extreme traffic congestion in Dhaka as well as in other major cities due mainly to unregulated car based transportation system bypassing mass transit projects resulting sound, and air pollution.
5. Shortage in supply of affordable housing leading to proliferation of slums without much civic amenities.
6. Degradation of overall environment, including depletion of forests, conversion of water bodies and loss of agricultural lands due to limited regulations and their enforcement and lack of coordination.
7. Inadequacy of human resources for urban planning and implementation.
8. Resource consumption, in raw or processed form, appears to be much higher in urban areas than the rest of the country. This apparent correspondence between urbanization and natural resource consumption needs to be rigorously assessed to allocate the costs of resource extraction and processing between the township and country side for a more equitable resource distribution.
9. Similarly, while the present physical planning framework is deficient in handling current ecological problems in the towns, some of them are likely to be affected adversely and the present environmental problems will be exacerbated when disasters strike in future which becomes more of a possibility under climate change.

3.6.2 Conservation Strategies and Actions

Considering the present regional imbalance in urbanization and urban development, particularly the disproportionate growth of Dhaka, strategy for future urban development in the country would be to discourage further growth of Dhaka and encourage decentralized polycentric development. Both political-administrative and economic decentralizations, through establishment of special economic zones, are needed.

Considering the deterioration of urban environmental elements, strategy of implementation of participatory urban governance is suggested. Strategy is needed to improve coordination among urban service providing agencies. All urban development authorities and agencies should be turned into smart, efficient, digital-modern institutions. Financial and human resource strengths of urban institutions need to be enhanced as well.

Urbanization should be planned in a way that these areas, including other settlements, are protected from and be resilient to disasters, including those related to climate change, as called for under the SDG Target 11b. Furthermore, sustainable urbanization is necessary in disaster-prone areas, like coast, flood-prone and drought-prone areas to combat climate change.

The strategy in the housing sector is to transform the Government into an agency for facilitation and enabling to help the private sector and household sector to be more productive. Urban master plans should be prepared to ensure access to land and housing for all socio-economic groups in cities and towns and rural areas.

In the transportation sector, implementation of Strategic Transport Plan (STP) is needed to be given more priority of public transports, like Metro-rail, Bus Rapid Transit etc., like the ones given in the STP of Dhaka. Strict enforcement of legal measures should be ensured in urban transportation. The Government needs to facilitate public-private participation in transportation provisions. ‘Pedestrian first’ policy should be a strategy.

To ensure sustainable and ecologically viable settlements, all future growth needs to be strictly monitored. Compact settlement development, densification of existing rural and urban settlements should be a strategic choice. The adoption of the proposed Town and Country Planning Act should be a strategic priority.

Based on the above strategic guidance, a list of priority action points is suggested below for the urbanization, housing and settlement planning sector. The following Action Plan matrix covers most of these issues, which belong to SDG 11. As an over-arching approach, participatory governance should be ensured in all urban development, housing and settlement related problem solving and implementation. Good governance is a minimum requirement.

Table 3.6.1: Actions for Urbanization, Housing and Settlement Planning

Issues	Actions	Implementing Agency
A. Urbanization		
Rapid Urbanization (Growth rate of urban population still over 4%)	<ol style="list-style-type: none"> 1. Facilitate overall population control 2. Encourage rural development 3. Reduce rural-urban migration 	MoHFW, MoHPW and UDD
Primary City Growth (rapid growth of Dhaka City)	<ol style="list-style-type: none"> 1. Discouraging Dhaka ward migration 2. Decentralized / dispersed urbanization 3. Deconcentrating Dhaka 4. Build satellite towns 	PC, MoHPW UDD, RAJUK and MoLGRDC
High Rural-Urban Migration	<ol style="list-style-type: none"> 1. Facilitate small town development 2. Rural Development 3. Greater opportunity for non-farm employment 	MoLGRD/ MoHW and PC
Regional/ Spatial Disparity (by Division/ District)	<ol style="list-style-type: none"> 1. Map development levels by district/ upazila 2. Initiate development of lagging regions 	PC and MPFP
Intra urban disparity of development	<ol style="list-style-type: none"> 1. Equity based urban development planning 	UDD, RAJUK and CDA etc.
Development problems of secondary cities and small town	<ol style="list-style-type: none"> 1. Facilitate Planned development of secondary cities and small towns through Master Plans and their proper implementation 2. Set up proper urban planning units in such cities 	PC, UDD, MoLGRD and MoHW

Issues	Actions	Implementing Agency
Environmental problems in urban areas. Encroachment on and filling up of rivers, khals, water bodies and wetlands.	1. Undertake Urban Master Plans and ensure protection of wetlands and water bodies	MoHW, UDD, RAJUK, CDA and KDA
Energy scarcity	1. Alternative renewable energy resources	MoPEMR
Water pollution	1. Enforce water pollution control	MoEFCC
Air Pollution	1. Ensure Air Pollution control, through proper monitoring, control measures 2. Strictly control brickfield generated air quality degradation 3. Enforce improved technology; look for alternative to burnt bricks as construction material	MoEFCC, DoE and NGOs
Noise Pollution (caused by transports and other means)	1. Strictly enforce noise from transport, loudspeakers and workshops 2. Acceptable decibel levels showed be regularly monitored and enforced	MoEFCC, DoE and NGOs
Undisposed solid waste	1. Proper measures be taken for collection, transportation, deposition and scientific processing of solid wastes 2. Adequate arrangement be made for intermediate collection and final disposal. The three 'R', ('Reduce, Recycle and Reuse'), approach should be applied by concerned agencies and public	MoEFCC, City Corporations, Paurashavas, DoE and NGOs
Medical waste (is of very serious nature)	1. Special arrangement be made to handle and process hazardous medical waste	MoEFCC City Corporations, Paurashavas and MoHFW

Issues	Actions	Implementing Agency
Electronic wastes (an emergent serious urban issue)	1. Urgent measures be taken for planning collection, processing and disposal of electronic waste	
Public open space scarcity	1. Adequate open space, parks and play grounds must be allocated in urban master plan and these should be properly maintained	City Development Authorities like RAJUK, CDA etc. and Pourashavas Civil society activists
Transportation (congestion, anarchy) mismanagement	1. Adopt mass transit systems MRT, BRT 2. Implement sound traffic management system	MoRTB and Dhaka Transport Coordination Authority
B. Housing		
Shortage of housing stock and supply, specially housing for the low income groups.	1. Ensure adequate, safe and affordable housing and basic services for all by 2030 2. Housing Policy, 2014 has been approved by the Government. Take serious steps to implement the housing policy, specially measures to increase housing supply for the middle and lower income groups	MoHPW/ NHA, City Development Authorities, NGOs and Private Sector (REHAB)
Problems of slums and squatter settlements	1. Take action to improve/ upgrade conditions in slums and squatter settlements as suggested in the National Housing Policy 2. Ensure provision of land and housing for the poor in Urban Master Plans and Detail Area Plans	MoHPW/ NHA, RAJUK and CDA etc.
Land Supply and Land Tenure	1. Ensure policy measures for proper proportionate/ judicious allocation of land for housing and economic activities for all income groups 2. Conduct land ownership/ land use mapping in urban area	MoL and UDD

Issues	Actions	Implementing Agency
Ecological Sustainability of Housing	1. New urban housing development must adopt both disaster risk resilient measures, as well as maintain ecological and cultural traditions	MoHPW/ NHA and MoF
C. Settlement Planning		
Unplanned countrywide settlement development	1. A national settlement development plan (or physical plan) should be prepared to guide, implement and control, ecologically sustainable settlement system in the country	MoHPW/NHA and UDD
Rural Settlement-expansion eating up valuable agricultural land	1. Various models of higher density compact rural settlements should be developed to ensure both land conservation and ecological sustainability and cultural continuity. <i>Guchchagram</i> is a partial model. More creatively designed models should be developed	MoHPW/NHA, UDD and MoL
D. Urban Settlements Planning		
Absence of properly formulated urban (Master/ Detail Area) Plans	1. Make Master Plan adoption by all urban local authorities obligatory	MoHPW/NHA, UDD and MoLGRD
Lack of implementation of available Master Plans	1. Make Plan implementation obligatory	MoHPW/ NHA, UDD and MoLGRDC
Poor Management/ Governance of Urban Centers (Cities and Towns)	1. Ensure good urban governance by enabling greater citizen's participation and democratic representation	MoHW, MoLGRD, NGOs, Civil Society and Political parties

Issues	Actions	Implementing Agency
Poor or no participation of urban stakeholders and citizens	1. Activate Town Level Coordination Committees etc.	MoLGRD
Inadequate/ weak municipal financial resource	1. Develop methods of generating greater financial resource such as by sharing central government revenue 2. Carvings for urban areas, issuing, bond or running income generating projects	MoF and MoLGRD
Cultural and natural heritage threatened by social aggression and natural hazards	1. Identify and maintain structures and places threatened by social/ human action or natural hazards	Ministry of Cultural Affairs, MoHW, MoEFCC and Civil Society
Economic/ Employment loss due to natural or manmade disasters	1. Provide insurance against natural disasters like river erosion, flood, cyclone etc.	MoDMR and MoF

Chapter 4

Supporting sectors for NCS

This chapter discusses 11 sectors which are important for effective implementation of the NCS of Bangladesh. These supporting sectors are human resources, gender, health and sanitation, disaster and disaster management, environment and international obligations, environmental education and awareness, information and communication technology, financing strategy, monitoring and coordination mechanism for NCS implementation, institutional framework for NCS implementation, and legal aspects of NCS. Some elements of these sectors are discussed in the preceding two chapters under specific natural resource sectors. Here the discussions mainly highlight the opportunities these supporting sectors offer and how actively considering these sectoral strategies and action points can ensure efficient, effective, sustainable conservation of natural resources under the SDG-era, within the overall Bangladesh NCS Framework.

4.1 HUMAN RESOURCES

4.1.1 Situation Analysis

For attaining sustainable development, improvement is needed in education and healthcare systems as well as in food security to build human resources capable enough to take up the challenges such paradigm shift offers. Skilled manpower is a pre-requisite of proper implementation of laws, policies and programmes, to build institutions with due efficiency. As Bangladesh is advancing towards graduating to Middle Income Country (MDC), NCS and SDG implementation require knowledgeable, skillful, proficient human resources.

Both quantitative and qualitative aspects of human resources are important. The quantitative aspects have received much attention because of the imperatives of food security. On this aspect, several noteworthy characteristics and possible future trends are important. First the baseline population of Bangladesh is very large, more than 160 million at present, which is expected to be 190 million by 2031 and further to 218.4

million by 2051⁸⁹. The population pressure on the available land is going to be huge and so will be the pressure on other natural resources of the country. A growing trend is urbanization with its multi-faceted implications.

From qualitative aspect of human resources, one major change that has taken place and will continue to take place is the increasing proportion of working age young population. This would provide better productive thus contribute to faster economic growth of the country. For that to happen, the workforce should be educated with specialized skills with proper manpower planning. We also need to have healthy individuals with better nutrition to lessen the burden of disease, including diseases due to degraded environment. The beginning of that process has already begun, and although yet much more needs to be done, there are some positive results. Some of the persisting problems are:

- Life expectancy at birth has increased to 71.6 years from 58.7 years in 1995⁹⁰. Along with notwithstanding problems of high levels of malnutrition and micronutrient deficiencies, obesity resulting from over or improper nutrition is emerging.
- While malnutrition has fallen among children, maternal nutrition remains a major issue.
- Gender parity in terms of enrolment at primary and secondary level, but not in thereafter levels. Dropout rates and repetition have declined. Currently, Bangladesh have limited structured policy for human resource planning in the health sector and relevant interventions so far leave much to be desired.
- Holistic manpower planning for future healthy and educated citizens remains a challenge.
- There is no correspondence between human resource development and natural resource use. The of connection between growth and natural resources itself has not been understood properly in this country.

89 BBS (2015). Population Projection of Bangladesh: Dynamics and Trends 2011-2061. Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, ISBN - 978-984-33-9960-1. 11pp.

90 BBS (2018). *2017 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

4.1.2 Conservation Strategies and Actions

The National Sustainable Development Strategy (NSDS, 2013) has been adopted by the Government of Bangladesh, where Education and Health sectors were given priority to develop human resources towards sustainable development. While this remains the overall guideline for the role of human resources for sustainable development, it is imperative to take, if necessary, a somewhat changed outlook in the context of the NCS. For this the relevant SDG targets need to be looked into carefully.

The SDG 3 sets targets for a healthy population, which begins with conception and calls for various measures over the life time for ensuring a healthy population. The outcome of many of these are influenced by environmental conditions, which encourage various vector-borne diseases, including water-borne and communicable diseases. The SDG Target 3.9 is particularly instructive as it clearly mentions these problems and calls for substantially reducing disease burden from hazardous chemicals, and air, water and soil pollution and contaminations. Similarly, the SDG 4 on education, while it calls for general educational development, the SDG Targets 4.3 and 4.4 specifically calls for better tertiary, technical and vocational education. Such skilled manpower is needed for managing environmental issues, degradation and for proper conservation planning.

In this regard, it may be noted that the Ministry of Health recently updated its Bangladesh Health Workforce Strategy. Despite the rise in density of medical doctors per 1000 population at 0.40, it is still inadequate and certainly so in the rural areas. On the other hand, there is an imbalance in nursing staff density, which is roughly one-half of that of doctors. There is also a significant shortage of medical technologists in the country.

Food safety is a major issue which also has relationship with certain agricultural and marketing practices where adulteration and over-use of chemicals are the main immediate causes which are also exacerbated by unhygienic environment. It is imperative to address these issues immediately. The Government has recently created an institution for ensuring food safety, but the issues are quite complex to handle.

The following actions may be initiated for development of human resources:

Table 4.1.1: Actions for Human Resources

Issues	Actions	Implementing Agencies
Educate students at various levels with the concept of conservation, the poverty–conservation nexus, strategy to conserve at community and national level	1. Include related sections/chapters in secondary and higher secondary education, especially in subjects related to forestry, fisheries, water resources, industrial chemistry, chemical engineering, environmental science/management, and social science	MoE, NCTB and Universities
Specific courses on ecotoxicology and conservation related specific courses at tertiary level in the Departments of Chemistry, Applied Chemistry, Industrial Engineering, Industrial Management, Chemical Engineering, Forestry, Fisheries, Micro biology, Botany, Zoology, Geology, Anthropology, Economics (environmental economics), Law and Environmental Science	1. Enhance and update course curricula to educate students in these Departments at Different Universities 2. Adequate qualified Teachers, Lab Facilities are required 3. Adequate budget allocation to upgrade course curricula, train teachers including providing scholarship to teachers for higher education on related subjects, Exchange programme with different Universities and Research entities, Coordination among different Government entities and Universities to share lab facilities	UGC, Universities, MoE, Government entities who works on Science and Technologies like MoE, MoST, MoF, MoEF, BCSIR, NIPSOM, FRI, MoA, National Agriculture Research Institutes like BARI, BARC, BINA, etc., DAE, MoInd, Ministry of Commerce and Development Partners
Qualified health professional who can deal with chemical (like pesticides, adulteration in food and others) contaminated health disorders	1. Short courses organized in higher level medical education and research centres	BSMMU, NIPSOM, NGOs, INGOs and Development Assistance Partners

Issues	Actions	Implementing Agencies
Strengthen training programmes for paramedics, nurses, and health workers	1. Undertake capacity building of institutions, through infrastructure development, producing physicians, nurses and paramedics	DGHS, MoHFW, WHO, NGOs, INGOs and Development Partners
Ensure strong health education programme by including courses/ subjects on environment and hygiene in different levels of education systems	1. Enhance and update course curricula to educate students in these Departments at Different Universities	NCTB, MoE, MoHFW, DGHS, MoEFCC, NGOs, INGOs, Development Partners and Media
Increase sanitation coverage to a wider number of people	1. Pulling government and NGO funds for making sanitary materials available to people at affordable cost	Local Government Division, MoLGRD, DPHE, NGOs, INGOs, Development Partners and Media
Ensure every household's access to safe drinking water	1. Technology for purifying arsenic contaminated water as well as surface water including desalination in the coastal areas must be made available 2. Research should be undertaken to develop affordable desalination techniques	Local Government Division, MoLGRD, DPHE, NGOs, INGOs, Development Partners and Media
Develop clinical waste management system and awareness and training programmes on clinical waste management system	1. Directives towards safe management of clinical wasted are needed to set forth 2. Develop human resource to manage clinical waste 3. Develop physical infrastructure for recycling and safe dumping of clinical waste 4. Make mass awareness on handling of clinical waste	MoHFW, DGHS, City Corporation (s), Ministry of Commerce, Molnd, NGOs, Development Partners and Media

Issues	Actions	Implementing Agencies
Develop education on sustainable agriculture, sustainable use of pesticide, water, fertilizer	1. Training programmes with DAE officials at field level on sustainable agriculture practice must be promoted	MoA, DAE and MoC
Increase contraceptive prevalence rate to arrest population growth	1. Making services and contraceptives available to people at minimum cost and using door to door service wherever required	MoHFW, DGHS, Ministry of Commerce, Ministry of Social Welfare and Family Planning, Ministry of Women and Children's Affairs, NGOs, INGos, Development Partners and Media
Provide better knowledge in health and nutrition through improved formal and non-formal education and electronic media	1. General health, hygiene and nutrition information should be disseminated through Primary and Secondary level education 2. Government and NGO collaboration can help dissemination local level information and services 3. Specialized courses on Health and Nutrition should be offered more 4. Media can play an important role to disseminate health related information	NCTB, DPHE, NGOs, Development Partners, Media, MoI, MoE and UGC
Enhance social mobilization and implement Behavioural Change Communication (BCC) activities to promote good health and nutrition	1. Consumer groups can be formed 2. Aware and train farmers with better pest management techniques 3. Mass awareness 4. Strict law enforcement against any dangerous agro chemical usage or any adulteration in food which threatens food safety	Consumer Association of Bangladesh (CAB), MoHFW, Ministry of Commerce, Ministry of Health, DGHS, MoEFCC, DoE, MoHA, Media, DAE, Ministry of Agriculture, Media and NGOs

Issues	Actions	Implementing Agencies
Undertake preventive measures focusing on increasing awareness of consumers about food safety	1. Strengthen consumers associations, and developing training and technical support materials for small and medium food businesses	Consumer Association of Bangladesh (CAB), MoHFW, Ministry of Commerce, Ministry of Health, DGHS, MoEFCC, DoE, MoHA, Media, DAE, Ministry of Agriculture, Media and NGOs
Strengthen food inspection services	1. Food inspection service will focus on upgrading training materials and guidelines for food inspectors, improving food inspection services and harmonizing food inspection procedures, and ensuring integrity and efficacy of food inspection services	Ministry of Food, NGOs and MoHA
Greater access to environmental information	1. People can access necessary environment related information, in some cases on temporal basis, which will help them manage their business/ related concerns	MoEFCC, MoI, Media, NGOs, INGOs, Development Partners
Mass awareness regarding over exploitation of resources, related laws, population control, conservation strategies at community level	1. Train journalists on conservation related issues 2. Organize round-table discussions and publish supplementary by both electronic and print media 3. Publicize related documentaries	MoI, MoST, Ministry of Mass Communication, electronic and Print media houses, NGOs, INGOs and Development partners

4.2 GENDER

4.2.1 Situation Analysis

Women and children face the adverse impacts of resource degradation more than men, while they have major contributions to safeguard those environments and ecosystems. It is evident that women in Bangladesh are collectors and users of water, food, fodder, medicinal herbs, aquatic plants and other ingredients from the nature throughout the years, which often become the only means for household coping and survival to a crisis or a disaster⁹¹. Women play significant roles in protecting biodiversity through their direct contributions to conservation; their involvement in agriculture including both field and homestead agriculture; ensuring food security based on natural ingredients such as homestead and community forestry; and ensuring households' food and water security⁹². However, many of women's contributions remained unrecognized, especially in the context of their roles in resource conservation through these activities.

The lack of recognition of women's role in conservation is, often, related to their gender identity. Thus, women suffer more than men from poverty, hunger, malnutrition, economic crises, health related problems, insecurity and become victim of violence added with environmental degradation. Loss of biodiversity and climate change poses new threats on women adding additional burden on them. Despite these challenges, however, women in Bangladesh show continuous fortitudes and ingenuity in their ways to cope with the consequences of resource depletion.

The Constitution of Bangladesh (Articles 27, 28, 29 and 31) guarantees equality and non-discrimination on account of sex, religion, ethnicity, place of birth in order to provide scope for affirmative action in favor of the "backward section of citizens". The Article 24 promises to ensure religious freedom within a pluralist, national framework and the Article 28 (Sections 1, 2 and 3) ensures equality in all spheres of life between women and men. Although all of the promises were not equally maintained within the 40 years of Independence, changes have occurred in some context including situation of women in the recent years.

Efforts regarding women's development in Bangladesh are based on a wide array of international commitments, including the MDGs, the Convention of the Elimination of All Discrimination against Women (CEDAW), and Beijing Platform of Action (1995). Bangladesh has ratified CEDAW with reservation on two of its articles (Articles 2 and 16 (c)) and has adopted different policies and has taken some actions towards achieving the CEDAW goals.

91 Begum, M. (1995). Coping with Floods: the experience of rural women in Bangladesh. PhD dissertation, Massey University, New Zealand.

92 Nasreen, M. (2015). Effectiveness of Resilient Livelihood Framework, Christian Aid.

Following the declaration of UN Decade of Women (1976-85), the Government of Bangladesh, and national and international non-government organizations have taken several programmes for the advancement of women. Simultaneously in the women's movement, civil society actors have played important roles in raising awareness of people in general including women and enhancing women's participation in every sphere of life in order to achieve equality. The International conferences on women organized by United Nations in 1975 (Mexico), Copenhagen (1980), Nairobi (1985) and Beijing (1995) supported women's movement and policy makers to raise awareness amongst women and to play active role to establish their rights. As a result, over the last four decades, women in Bangladesh have gradually become more visible in the labour force, in development programmes and local institutions such as local government bodies. Several acts and policies have also been developed to combat violence against women in Bangladesh.

While women play significant roles in resource conservation, gender inequality exists in context of women's access to natural and material resources, decision making, employment opportunities and many other such activities. For example, a study estimated that women earn less than 21 percent per hour than men⁹³. A major breakthrough has been achieved in the area of education due to affirmative policies adopted by the Government, while the private sector had been at the forefront of employment for girls by creating employment opportunities in the RMG industries that employ mostly women. Achieving gender parity in Primary and Secondary education in line with MDGs and direct participation of women in local government election in 1997 were major steps towards women empowerment.

Due to gender-based differences, women and men in fragile ecosystems and climate vulnerable regions are responding to the daily crises of existence differently. Men in the saline-, drought-, cyclone- or flood-prone areas frequently forced to leave for towns or other districts in search of job, while women have to face challenges of climate-induced, natural and human-induced disasters at home⁹⁴. Women become the major contributors for maintaining the livelihoods of their households. Studies⁹⁵ on gender and disaster reveal that, although a disaster affects all segments of population, there are gender variations to vulnerability and resilience during disasters. It is evident that women's own adoptive techniques and initiatives become crucial for their family sustenance and ensuring food security⁹⁶.

93 Kapsos, S. (2008). The gender wage gap in Bangladesh. ILO Asia-Pacific Working Paper Series, ILO Regional Office for Asia and the Pacific, Bangkok, 43pp.

94 Nasreen, M. (2008). Impact of Climate Change on Food Security in Bangladesh: Gender and Disaster Perspectives, paper presented at the 'International Symposium on Climate Change and Food Security in South Asia', Dhaka 25-30 August, 2008.

95 Begum, M. (1995). Coping with Floods.

96 Nasreen, M. (2008). Impact of Climate Change on Food Security in Bangladesh.

Conservation issues related to gender cannot be seen in isolation. Over the years, reforms in reducing gender gap had, therefore, been merged with development agenda. Some of the specific policy reforms in Bangladesh context of women development are mentioned below:

1. Women's Development Policy (WDP) in 1997 (updated in 2011). National policy for advancement of women within the framework of the CEDAW and a follow up of Beijing Conference on Women. The revised WDP addressed women and children issues in disaster for the first time, focusing challenges and role of women in disaster times;
2. National Action Plan (NAP, 1997) as a follow-up to the Beijing Platform of Action and another NAP in 2013;
3. Establishment of Ministry of Women and Children Affairs (MoWCA);
4. Establishment of Directorate of Women Affairs (DWA) as a wing of MoWCA;
5. Establishment of Parliamentary Standing Committee for MoWCA;
6. Formation of Inter-ministerial Coordination and Evaluation Committee;
7. Formation of WID Coordination Committees at the District and Upazila Levels;
8. Formulation of Climate Change and Gender Action Plan (ccGAP) 2013 by MoEFCC. First-ever document to link gender based challenges related and roles related to climate change adaptation based on the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Conservation issues have been highlighted and reported as women's contributions;
9. Addressing women empowerment in the Sixth Five Year Plan (2011-2015), Seventh Five Year Plan (2016-2020) and Eighth Five Year Plan (2020-2025).

The Sixth Five Year Plan recognized the different priorities of women and needs to address women's interests while planning development interventions. However, while giving attention to involvement of women and the removal of barriers to that, no separate issue related to gender and conservation has been raised in the Sixth Five Year Plan. The Seventh Five Year Plan has made some development in this by appreciating the role of women as regards the impact of climate change. The Eighth Five Year Plan (2020-2025) puts emphasis that the Government will take measures to increase women's knowledge of environmental management and conservation, and investments will be made in education, capacity building training, technology transfer, and environmental projects focusing on women.

The national agenda related to gender issues in development has been driven largely by the international global development agenda. However, while many of these global agenda also relate to environmental conservation by women and the impact of environmental degradation on them, the national environment related policy instruments remain silent on gender dimensions in protecting the environment.

4.2.2. Conservation Strategies and Actions

The SDG 5 and its targets are entirely devoted to gender equality, with which Bangladesh fully agrees. Unfortunately, while SDG is quite elaborate regarding women's equal opportunity and women's rights to development and as individuals and trying to do away with feudal and medieval social norms, women's role in and relationship with nature has not received similar attention. Exceptions include SDG Target 5a (equality of access to economic resources), SDG Target 6.1 (safe and affordable drinking water), SDG Target 6.2 (sanitation and hygiene with special needs for women), SDG Target 11.2 (transport for women), SDG Target 11.7 (green and public space for women), and SDG Target 12.3 (lessening food waste at consumption where, although not mentioned, women have a major role). What all this mean is that, while much is talked about, even the SDGs are not much of a help in devising a strategy for a greater role of women in conservation. This highlights women's prevailing passive role as a recipient of services, rather than as managers of natural resources.

Ownership of resources and land is another prime example where, while private ownership is the norm, women generally do not hold much land for them to manage. They, however, generally manage the homestead land which is a reservoir of possibly large genetic resources. On the other hand, it is also known that, as men migrate or move elsewhere for jobs, women have to manage the agricultural land on their own. The other resource women hold in many cases is the livestock. Women play a vital role in livestock rearing and increasing wealth through it. Similarly, much of the water and sanitation problems at home have to be managed by women.

Women are now involved in small scale fisheries in many areas from imperatives of ensuring incomes and nutrition for children and family⁹⁷. The other major resource that they use is biomass for cooking. Improved cook stoves have been devised long time ago and their resource efficiency is more or less assured. Compared to the use of resources, women's plight at times of disaster, in zones of degraded ecosystems and environment are better known and documented. The strategy for women's role in conservation must give proper attention to these issues.

97 Asaduzzaman and Khan (2016) for analysis of such cases, though not from the perspective of resource sue efficiency.

The conservation strategy, should therefore, give recognition of present roles and safeguards of women. But it must go beyond that to increase the role of women as managers of natural resources. Gender-based differential activities must be taken as a cross cutting issue in every sector as women and men's contributions and realities differ based on their gender identity. For this to happen, however, one of the first tasks should be to take the action plans of each NCS sector in this document and explore more in-depth than has been possible to do here to find the entry points for women to contribute in resource management. This of course cannot be done by them simply by their own coordinated efforts in implementation of strategy of different sectors should reflect the following issues: perception of women with regard to challenges of environmental sustainability and conservation; their experiences within their households and surroundings (i.e. indoor, outdoor pollutions etc.); comparative analysis of the gender-based differences of men and women's views, roles, needs and interests in context of conservation and ensuring environmental sustainability. Steps should be taken focusing on the gender-based differential experiences, roles and priorities and their implications for resource management for conservation. In this regard, MoEFCC has published Bangladesh Climate Change and Gender Action Plan (ccGAP) in 2013 which needs updating in light of the revised BCCSAP.

The action points to recognize women as the leader, manager and service recipients in nature conservation are given below.

Table 4.2.1: Actions for Gender

Issues	Actions	Implementing agency
Recognizing women's role in agriculture and food security	<ol style="list-style-type: none"> 1. Ensure women's access to food in quality and quantity 2. Recognize, document, disseminate and promote women's role in food production, procurement and food process and ensure access to marketing of their products 3. Making local agricultural services available to women for building capacity and strengthening existing adaptation and resilient practices in disaster prone and different agro-ecological zones 	MoEFCC, FD, MoA, BRRI, BARI, MoDMR, MoWCA, Universities and NGOs/ INGOs

Issues	Actions	Implementing agency
Taking initiatives to ensure equitable access to resources through women empowerment	<ol style="list-style-type: none"> 1. Ensure equitable access to basic services and social protection (e.g. education, employment, health, safety nets, financial, natural and other resources) 2. Sensitize and aware men, boys in recognizing role of women, girls and value and cooperate in their works within private and public spheres 3. Review and implement existing laws and policies 	MoWCA and MoLJPA
Reducing vulnerability, and strengthening resilience capacity of women during climate change disasters related crises	<ol style="list-style-type: none"> 1. Reduce women's vulnerability related to cc and disasters and strengthen existing capacities. 2. Increase women's access to information, Ensure women's participation in planning and management, and overall decision making 	MoEFCC, MoDMR, Universities and NGOs/INGOs
Recognizing women's contribution in forest conservation, protected areas management, ecologically critical areas management, etc.	<ol style="list-style-type: none"> 1. Recognize differentials roles of women and men in homesteadad and community forestry 2. Ensure women's participation in forestry related decision making. 3. Engage and ensure women's participation in Pas and ECAs management, etc. 	MoEFCC, DoE, FD and MoWCA
Ensuring women's access to sustainable water	<ol style="list-style-type: none"> 1. Provide gender friendly water and technologies and sanitation facilities 2. Create opportunities for women to better understand the technical processes of water management 3. Capacity development of women to become involved in water resource management committees 4. An increased water literacy and WATSAN management awareness 	MoHFW, DAE, DoF, MoA, MoLGRDC, MoWCA, Universities and NGOs/INGOs

4.3 HEALTH AND SANITATION

4.3.1 Situation Analysis

Adequate sanitation, along with hygiene and safe water, are essential for good health and social and economic development of a society. Improper sanitation pollutes the environment and affects human health. Addressing sanitation is therefore a prerequisite to conserve environment. Health plays a crucial role in achieving meticulous development outcomes. On the other hand, development strategies can also have significant positive and negative impacts on the health of the population. Sanitation is vital for health, generates economic benefits, contributes to dignity and social development, and helps the environment. Appropriate hygienic practices also can greatly improve health, ultimately helping to reduce morbidities and mortalities. Development depends on healthy population and healthy generation depends on proper sanitation. Therefore, health and sanitation is an important sector for the NCS.

Good improvement has been made in improving health outcomes for the people of Bangladesh and made good progress in almost all of the health-related MDGs. Bangladesh has achieved international recognition for these remarkable outcomes. Bangladesh also has emerged as a leader in Asia in experimenting with and implementing innovative approaches to rural sanitation, and high rate of access to improved water sources. A study⁹⁸ revealed that, Bangladesh “now has the longest life expectancy, the lowest total fertility rate, and the lowest infant and under-5 mortality rates in South Asia, despite spending less on health care than several neighboring countries.”

Over 50% turn down in Maternal Mortality Rate (MMR) between 2003 and 2016⁹⁹ and further The Maternal Mortality Ratio (MMR) decreased from 181 per 1,00,000 live births in 2015 to 165 in 2019 indicates remarkable progress of Bangladesh. Under-five mortality rate has persistently declined from 36 per 1,000 live births in 2015 to 28 in 2019 and thereby achieved the SDG target of 2025¹⁰⁰. On the other hand, the neo-natal mortality rate (NMR) decreased to 15 per 1,000 live births in 2019 from 20 in 2015 and it also achieved the SDG target of 2025. Bangladesh’s reduction of under-five mortality rate stands highest in the SAARC countries.

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98 Balabanova, D., Mills, A., Conthey, L. et al. (2013). Good health at low cost 25 years on: lessons for the future of health system strengthening. *Lancet* 381: 2118-2133. DOI: 10.1016/S0140-6736(12)62000-5.

99 BBS (2018). *2017 Statistical Year Book of Bangladesh (37th edition)*. Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

100 SVRS, 2019.

Bangladesh has achieved significant success in preventing and controlling communicable diseases, especially HIV/AIDS, malaria and tuberculosis, and a range of Neglected Tropical Diseases (NTD). Bangladesh has also significantly reduced under nutrition in the last two decades, driven partly by sustained income growth and partly by greater coverage of health and nutrition services.

However, major challenges still remain particularly in managing environment-related health issues, child and maternal malnutrition. While relevant sections in the NCS document try to address the sources of the problems (e.g. problems of supply of safe water), direct health-related interventions are still necessary as indicated by the targets under the SDG 3.

4.3.2 Conservation Strategies and Actions

Health and sanitation sector is guided by the overarching government policies and international commitments together with sector-specific policies. Different national policies and strategies have been taken by the Government, namely National Health Policy 2011; Bangladesh Population Policy 2012; National Nutrition Policy 2015; Health, Population and Nutrition Sector Development Programme 2011–2016; Health Care Financing Strategy 2012–2032; Bangladesh Health Workforce Strategy 2016–2021; National Sanitation Strategy 2005; Sector Development Plan for Water Supply and Sanitation Sector in Bangladesh 2011–2025; and National Hygiene Promotion Strategy for Water Supply and Sanitation Sector in Bangladesh 2012. Based on the prevailing limitations and opportunities in the health and sanitation sector, for attaining the targets under the SDG 3, and given the necessity of mainstreaming environmental conservation in this sector, the following action points are suggested.

Table 4.3.1: Actions for Health and Sanitation

Issues	Actions	Implementing Agency
Policy	1. Update National Health Policy 2011 in light of SDGs, Universal Health Coverage	MoHFW
Educational motivation	1. Development of educational curricula incorporating medical waste management and conservation in the medical, nursing, para-professional courses	MoHFW in collaboration with BMDC, BNC, PCB and SMF
Awareness	1. Mass awareness creation about proper medical waste management and sanitation with conservation of water using educational institutes, social organizations, print and electronic media	MoHFW in collaboration with Ministry of Information, Social Welfare, Education
	2. BHE/DGHS and IEM/DGFP to develop appropriate awareness materials in collaboration with MoEFCC and other relevant	BHE/DGHS and IEM/DGFP
Fund Allocation	1. MOHFW to allocate proper fund to its facilities and programmes for proper medical waste management 2. LGD/MOLGRDC to ensure proper medical waste management by the respective LGIs 3. MOF to ensure that respective ministries allocate proper fund to its health facilities for appropriate medical waste management	MoHFW, MoLGRDC, MoF and LGIs

4.4 DISASTERS AND DISASTER MANAGEMENT

4.4.1 Situation Analysis

Bangladesh, transitioning from a Least Developed Country (LDC) to a lower middle income country, is one of the highly disaster prone-countries of the world. Every year the country suffers environmental and consequent socio-economic shocks from several geophysical, hydrological, meteorological, climatological, and biological hazards. The country ranks 1st in terms of vulnerability and 6th in terms human exposure to floods and cyclone in the world¹⁰¹. Attempts have been made to bring about coherence between various policy instruments at the global level so that the disaster risk reduction (DRR)/ climate change adaptation (CCA) goals converge with the SDGs that are agreed for 2015–2030.

¹⁰¹ European Commission (2016). Humanitarian Aid and Civil Protection: Bangladesh (ECHO factsheet). (<https://reliefweb.int/sites/reliefweb.int/files/resources/echo%20ban.pdf>).

Floods, drought, cyclone and salinity constitute the largest risk to majority of the population of Bangladesh. Regular river floods affect 30% of the country, increasing in and around 70% in extreme years¹⁰². The Multi-hazard, Vulnerability and Risk Assessment report¹⁰³ indicates that the area subjected to flooding has increased from 52% to 61.1% for 50 years and 68% to 80.6% for 100-year return period.

Storm surges accompanying cyclones cause the most damage in the coastal areas. In the last 55 years, eighteen major cyclones devastated the coastal areas, with the most-devastating 1970 cyclone killing about 500,000 people. The most recent severe cyclone was the Cyclone Sidr which struck the coastal region in 2007. The economic loss caused by cyclones of 1970, 1991 and 2007 were US\$ 86.4 million (equivalent to \$450 million in 2006)¹⁰⁴, US\$2 billion and US\$ 30.2 billion respectively, while the death toll progressively declined from 5,00,300 (1971) and 1,38,958 (1991) to 4,234 in 2007¹⁰⁵. Death, injuries and economic damage are also caused by tornados. The most recent tornado of 2013 struck 15 villages with a diameter of 8 km traveling at a speed of 70 km per hour, killed 31 people and injured approximately 388 in Brahmanbaria District^{106, 107}.

During the last decade, erosion along the river seems to have diminished slightly ranging from 1,000 to 2,500 hectares per year¹⁰⁸. Along the Jamuna, the Ganges and the Padma rivers, about 80,690 hectares, 29,000 hectares and 39,310 hectares of land have eroded respectively during the period 1973–2009¹⁰⁹. Bangladesh suffered about 24 drought episodes within 1949 to 1991¹¹⁰. The drought conditions in northwestern

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102 MoDMR (2017). National Plan for Disaster Management (2016-2020) (Draft). Ministry of Disaster Management and Relief, Government of the People's Republic of Bangladesh, 12pp.

103 DDM (2016). Final Report of Multi-hazard, Risk and Vulnerability Assessment, Modeling and Mapping in Bangladesh (Volume 1: Hydrometeorological Hazard Risk Assessment). Department of Disaster Management, Ministry of Disaster Management and Relief, Government of People's Republic of Bangladesh.

104 Shaikh, E. and Edward, B. B. (2014). Long-Run Impacts of the 1970-74 Series of Disasters in Bangladesh. Available at SSRN: <https://ssrn.com/abstract=2548744> or <http://dx.doi.org/10.2139/ssrn.2548744>.

105 Haque, U., Hashizume, M., Kolivras, K.N., Overgaard, H.J., Das, B. and Yamamoto, T. (2012). Reduced Death Rates from Cyclones in Bangladesh: What more needs to be done? *Bulletin of the World Health Organization* 90 (2): 150-156.

106 MoDMR (2013). Situation Report on Tornado in Brahmanbaria. Disaster Management Information Centre, Ministry of Disaster Management and Relief, Government of the People's Republic of Bangladesh.

107 Rahman, M. (2013). Tornado in Brahmanbaria 2013. *Forestry, Environment, Plantation Crops, and Premature Consultancy and Research*. Available at: <https://feppcar.org/288/tornado-in-brahmanbaria-2013/> (Accessed: 3 October 2018).

108 IRIN News (2007). River Bank Erosion Affects Economy. Published on 23 September 2007, Available at: <http://www.irinnews.org/feature/2007/09/23/river-bank-erosion-affects-economy> (Accessed: 03 October 2018).

109 Uddin, A.F.M. and Basak, J. (2011). Effects of Riverbank Erosion on Livelihood. Unnayan Onneshan-The Innovators, pp. 6-13. Available at: Effect of Riverbank Erosion on Livelihood (unnayan.org) (Accessed: 4 October 2018).

110 Islam, M. (2013). ADRC Visiting Research Programme, FY2013B, Country Report: Bangladesh. Ministry of Disaster Management and Relief Government of the People's Republic of Bangladesh Republic of Bangladesh.

Bangladesh in recent decades led to a shortfall of rice production of 3.5 million tons in the 1990s¹¹¹. As much as 17% of the *Aman* crop – the main paddy crops in the wet season – may be lost in a typical year due to drought. Bangladesh has also suffered from earthquakes; risk assessment reveals that if an earthquake of magnitude 7.5 occurred at Madhupur fault, about 72,000 buildings would be damaged beyond repair in Dhaka city¹¹².

The Government of Bangladesh has transferred 12,30,000 acres (4,84,250 hectares) of coastal land to Bangladesh Forest Department (FD) for undertaking afforestation programme on the newly accreted coastal islands. The FD so far has created 200,000 acres of coastal plantation depending on the raising and suitability of the land, of which 100,000 has been declared as Reserved Forests to be maintained as Green Belt for the protection of lives and properties of coastal areas. Moreover, the Honourable Prime Minister of Bangladesh has instructed to establish plantation on all the embankments of the Bangladesh Water Development Board (BWDB) on the coastal area. A Memorandum of Understanding (MoU) between the BWDB and the FD has been signed as directed by the Honourable Prime Minister.

4.4.2 Conservation Strategies and Actions

The Ministry of Disaster Management and Relief (MoDMR) of the Government of Bangladesh acts as the nodal agency coordinating disaster management in the country, under the overall direction of the National Disaster Management Council (NDMC), headed by the Honourable Prime Minister. The MoDMR is committed to mainstream DRR and CCA into strategies, policies, planning, and development programmes at all levels by 2021 as a part of paradigm shifts in disaster management. The Eighth Five Year Plan (2020-2025) and National Sustainable Development Strategy (NSDS-2010-2021) integrated DRR as strategic key priority area. The legal and policy framework of disaster management of Bangladesh is comprised of the Disaster Management Act 2012; Standing Order on Disaster, 2010; National Plan for Disaster Management (2010–2015); National Disaster Management Policy, 2015; and Cyclone Shelter Construction, Maintenance and Management Policy 2011. The review and implementation of these instrument will contribute to achieve the SDGs.

Given the above context, the existing policies and programmes and with reference to the relevant SDG Targets 11.5, 11b and 13.1, the following action points are suggested in relation to the NCS.

111 Abu, M., Islam, T., Shuanghe, S., Zhenghua, H. and Rahman, M. (2017). Drought Hazard Evaluation in Boro Paddy Cultivated Areas of Western Bangladesh at Current and Future Climate Change Conditions. *Advances in Meteorology* 12pp. (<https://www.hindawi.com/journals/amete/2017/3514381/#B37>)

112 Shaw, R., Mallick, F. and Islam, A. (2013). *Disaster Risk Reduction Approaches in Bangladesh*. Springer Tokyo, Japan, 366pp.

Table 4.4.1: Actions for Disaster Management

Issues	Actions	Implementing Agency
Reduction in mortality and economic damage due to disasters		
Disaster early warning system.	<ol style="list-style-type: none"> 1. Early warning system need to be improved and well disseminated to the community at risk 2. Emergency operation center should be in place and need to be connected with all stakeholders 	UDD, Armed Forces Division and Police Department
Shelter	<ol style="list-style-type: none"> 1. Shelter (cyclone, flood and urban and open spaces) should be increased according to projected need 2. Every stakeholder need to have their time-bound policy in place for shelter development with financial allocation 	UDD, DDM, Armed Forces Division and Police Department
Pre and post damage and loss	<ol style="list-style-type: none"> 1. Pre and post damage and loss assessment methodology and system should be established 2. Department of Disaster Management (DDM) should have resources to exhibit damage and loss assessment capacity and dissemination mechanism 	DDM, MoDMR, Research institution and Universities
Gender Equality in Disaster Management		
Institutionalizing gender capacity and women's participation in the DM governance structure.	<ol style="list-style-type: none"> 1. Increasing women's representation in DMCs and strengthened capacity of DMCs is required to promote gender aspects in DRR/CCA initiatives 2. Capacity building of the Ministry of Women and Children Affairs and the Department of Women Affairs is needed to mainstream gender in DRR/CCA 	DDM, DWA, District administration and key departments delivering relief
Protection measures for women and girls in post-disaster situations	<ol style="list-style-type: none"> 1. Standard procedures and referral services need to be established to deal with gender-based violence (GBV), including women's shelters exist in disaster-prone areas 2. Key officials in districts responsible for post-emergency operations should be oriented and trained in prevention of and responding to GBV during and after emergencies 	DDM, DWA, District administration and key departments delivering relief

Issues	Actions	Implementing Agency
Urban Risk Reduction		
City based multi-hazard, vulnerability and risk information	1. City based multi-hazard, vulnerability and risk information of all urban infrastructure should be available to city corporation and development authority	UDD, city corporations/municipal authorities, FSCD and DDM
Risk sensitive landuse planning for the cities	1. Land-use maps need to be prepared based on risk mapping and it should be available in public domain 2. Monitoring of urban expansion to enforce compliance with land use plan is required	UDD, city corporations/municipal authorities, FSCD and DDM
Retrofitting of hospitals and key installations	1. Agency annual plan should keep budgetary allocation for retrofitting of all public buildings and institutions	UDD, city corporations/municipal authorities, FSCD and DDM
Ward level disaster management committee	1. Ward level disaster management committee need to be established 2. Training of ward level disaster management committees regularly need to be conducted 3. Ward level disaster management committee should be involved in local planning	UDD, city corporations/municipal authorities, FSCD and DDM

4.5 ENVIRONMENT AND INTERNATIONAL OBLIGATIONS

4.5.1 Situation Analysis

Bangladesh has signed a number of multilateral environmental agreements (MEAs) for the conservation of natural resources since the 1970s. Among them, 12 MEAs are considered while preparing the Bangladesh NCS, in the light of the present environmental needs of the country. Because of these agreements, Bangladesh has shouldered some responsibilities as well as availed of some opportunities in terms of financial provision, technological support, and capacity building.

Wetland conservation is focused through the Ramsar Convention adopted in 1971. Bangladesh is an active party to the Ramsar Convention. The mission of this convention is to conserve and to use country's wetlands prudently through local

and international actions and cooperation to achieve the sustainable development around the world. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was signed in 1973 to stop the rapid decline of threatened species worldwide due to over-exploitation and illegal trading. Migratory species of wild animals face increased threats due to habitat degradation, hunting, and food scarcity. Concerning the vulnerability of these species, the convention on the conservation of migratory species was adopted in 1979. The regional seas programme set under the United Nations Environment Programme (UNEP) in 1974. The UN Convention on the Law of the Sea was signed in 1982. The United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992 set out a legal framework for stabilizing the atmospheric concentrations of greenhouse gases to avoid climatic hazards. This ultimately led to the Paris Agreement in 2015 to which Bangladesh has become a signatory, although parliamentary ratification is yet to be made. In order to promote the biodiversity conservation by sustainable use and equitable sharing of its components, the Convention on Biological Diversity (CBD) was accepted in 1992. The United Nations Convention to Combat Desertification (UNCCD) was adopted in 1994 to encourage the international community's efforts to combat the desertification and land degradation in the dry lands. International Treaty on Plant Genetic Resources for Food and Agriculture (1982) contains sections on general provisions, farmers' rights, supporting components, and financial and institutional provisions. The treaty covers 35 food crops and 29 forages. Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (1998) is the first environmental agreement to combine environmental principles with democratic rights and explicitly recognizes peoples' right to live in a healthy environment.

The SDG Framework one way or the other takes care of the concerns of all environmental issues under the MEAs. In cases, it has recalled the commitments under them which were previously more voluntary in some cases, but have been more mandatory now. In some cases, the targets have been made more explicit than before. Thus, the MEAs in general have come to be subsumed in principles in many of the SDGs and their targets.

The ultimate goal of all the MEAs is to achieve sustainable development. But effective implementation of such a big agenda is a challenge. To meet the terms of MEAs, the Government of Bangladesh has taken some initiatives related to conservation. National Adaptation Programme of Action (NAPA), National Adaptation Plan (NAP) and National Communications are submitted through the UNFCCC addressing the urgent climate change needs. Nationally Determined Contribution (NDC), which was prepared and submitted before the Paris Agreement in 2015, is a flagship document of the government. NDC had recently been updated. Besides, National Reports on

actions are being submitted to the Convention on Biological Diversity (CBD) and the UNCCD secretariats on a regular basis. The Least Development Country reports also are prepared at regular intervals for submission in case of other important MEAs. During the last two decades, many projects and programmes have been implemented both by the Government and the NGOs to address particularly climate change adaptation. As an institutional development, the Government of Bangladesh has established a Climate Change Cell in the MoEFCC to manage the Bangladesh Climate Change Trust Fund (BCCTF) and revised the Sectoral plans for mainstreaming the climate change issue into development strategy.

4.5.2 Conservation Strategies and Actions

The strategies and the corresponding action points outlined below have to be read along with those elaborated under other sections and chapters of the Bangladesh NCS as there are certain overlaps between their jurisdictions, such as biodiversity, land degradation as well as several relevant SDG targets. Therefore, it is important to ensure synergy with other sectors while adopting following strategies and actions.

The strategies related to MEAs implementation comprise the following aspects.

- Capacity building at individual, organizational and systemic levels, through formal and informal education and training;
- Institutionalizing an enabling legal and policy framework that mainstreams conservation into development process; and
- Establishing stakeholder partnerships and networks nationally and internationally to mobilize financial, technical and technological resources for implementation of the MEAs.

The concerns under the MEAs are subsumed under several specific SDGs as well as NCS sectors such as land, forestry, climate change, land degradation and desertification; and biodiversity. The action plans under those NCS sectors need to be considered along with those here. Given the caveat, the following actions need to be taken in line with the MEAs to become an integral part of the NCS and simultaneously achieve some of the sustainable development goals.

Table 4.5.1: Actions for Environment and International Obligations

Issues	Actions	Implementing Agency
Climate Change	<ol style="list-style-type: none"> 1. Developing a phased low-carbon and climate-resilient development strategy 2. Strengthen resilience and adaptive capacity 3. Integrate CC measures into national development strategy 4. Allocation of funds for CC measures 5. Inventory of GHGs 6. Promotion of renewable energy 7. Impart education, awareness raising, human and institutional capacity 8. Strengthening early warning for CC disasters 	MoEFCC, DoE, FD and MoE
CBD	<ol style="list-style-type: none"> 1. Sustainable management of natural forests 2. Expansion of forest cover in available areas 3. Afforestation of degraded /denuded forests 4. Development of strategy for management and expansion of protected and ecologically critical areas in terrestrial and marine ecosystems (PAs, ECAs) 5. Expansion of forest areas under co-management 6. Control of alien species 7. Inventory of species of flora and fauna 8. Mobilization of aid and REDD+ funds for promotion of forests 9. Participatory governance of forests 	MoEFCC, DoE, FD and MoA
UNCCD	<ol style="list-style-type: none"> 1. Identifying and mapping of desertified areas 2. Identifying of appropriate forest species for desertified areas 3. Expansion of forest cover 4. Mulching/green manuring of desertified lands 5. Digging of ditches and narrow canals 	MoEFCC, DoE, FD and MoA

Issues	Actions	Implementing Agency
UNCLOS III	<ol style="list-style-type: none"> 1. Development of a comprehensive strategy and plan for protection of EEZ for sustainable harvest of ocean, sea and marine resources 2. Development of a plan for reduction and control of marine pollution 3. Promotion of education and research on marine biology and oceanography 4. Mapping of stakeholders involved in protection and management of EEZ and delineation of their roles 5. Protection and expansion of mangrove forests. 6. Inventory of coral reefs 7. Expansion of fishing fleets in partnership with private sector 8. Development of national, regional and global partnerships for managing marine resources and control of pollution 9. Initiatives for transfer of marine technology 	MoEFCC, DoE, FD and MoFL
Ramsar Convention	<ol style="list-style-type: none"> 1. Inventory of wetlands 2. Development of a plan for protection and recovery of encroached wetlands 3. Development of a plan for wetland fishery development 4. Protection and expansion of Ramsar and World Heritage sites 5. Census of migratory species of birds and wildlife 	MoEFCC, DoE, FD and MoFL
Strengthen the means of implementation and revitalize the global partnership for sustainable development	<ol style="list-style-type: none"> 1. Strengthen domestic resource mobilization 2. Strengthen foreign resource mobilization from bilateral, multilateral and INGO 3. Develop a plan for foreign investment promotion 4. Enhance North-South, South-South and triangular regional and international cooperation on access to science, technology and innovation 5. Mobilize the development, transfer, dissemination and diffusion of environmentally sound technologies 6. Mobilize int'l support for implementing effective and targeted capacity-building for SD 	MoEFCC, DoE, FD, ERD, MoFA, MoST and Development partners

4.6 ENVIRONMENTAL EDUCATION AND AWARENESS

4.6.1 Situation Analysis

Environmental education is vital for developing an appropriate understanding of environment and its goods and services that are important for human wellbeing. It is also essential to create awareness among resource users on the importance of sustainable use and protection of environment to continue sustainable and healthy environment as well as economic growth. Environmental integrity should be considered as a pre-condition while devising strategy for achieving the SDGs. There is, in fact, a direct correspondence between environmental education and awareness and SDG Target 4.7, which exhorts the states that they should “By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development; including, among others, thorough education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of cultural contribution to sustainable development.”

Over-emphasizing economic growth without an effective and strong regulatory framework often leads to environmental degradation in the form of over-exploitation of natural resources, unplanned urbanization, deforestation, land degradation, desertification and other environmental pollutions at the national and global levels and hence could bring eco-disasters resulting ultimately in negative impacts on economic growth. Environmental education and awareness can play a vital role in imbibing the needs and process of sustainable development into the minds of the youth and also ensure participation of mass people to safeguard environment. Agenda 21 stated that education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. This progression must be taken into national level consideration while devising environmental education and awareness programme in the country. The SDG 4.7 has pointed out the necessity more forcefully in several dimensions of sustainability with greater emphasis on environmental management.

In Bangladesh, the education system constitutes five major levels: Primary Level (years 1–5), Junior High School (years 6–8), Secondary High School Level (years 9–10), Higher Secondary Level (years 11–12), and Tertiary Level. General science and social science, which are taught at three school levels: primary school, junior and secondary high school. The content of the textbooks emphasized the physical geographical aspects of the environment (i.e. soil, air, water etc.) and other environmental issues, such as pollution and natural disasters. Other environmental problems, such as depletion and degradation of natural resource and biodiversity are not represented as widely as necessary for education in the textbook. Emerging environmental issues, such as climate change, have not been integrated into the textbook.

The National Curriculum and Textbook Board (NCTB) of Bangladesh has introduced a new curriculum and changed the entire textbooks from Classes I-V. The textbook on Bangladesh and Global Studies covers a wide range of topics regarding environment and sustainable development. The topics include “society and environment of Bangladesh, tradition, culture, the history of liberation war, basic needs, children right, duties and responsibilities of children, sense of cooperation and compassion toward all walks of people of the society, attaining the qualities for becoming good citizens of the society, being respectful to the culture and occupation of others, proper use and maintenance of resources, social environment and disaster, population and human resources”. Most of the public universities offered degree in basic science by which environmental education started at the formal education system.

The Government of Bangladesh has demonstrated its commitment to improve the environment and combating the adverse impacts of climate change through formulating various policies and strategies. The draft National Environmental Policy (2015) has put special emphasis on environmental education and awareness raising and made 12 types of intervention. Moreover, the National Education Policy (2010) introduced various mandatory subjects, including those on environment. The National Adaptation Programme of Action (2005) recognized the inclusion of climate change related issues in curriculum at secondary and tertiary levels. The Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009) specifically highlighted the importance of knowledge generation on climate change. All these and the focus of the SDG Target 4.7, specifically on sustainable development, as well as Targets 4.3 and 4.4 on the importance of technical and vocational education further emphasizes the multifarious needs for sustainable management of natural resources.

4.6.2 Conservation Strategies and Actions

The environmental problems, including the impacts of climate change; water, air and soil pollutions; loss of biodiversity; land degradation; deforestation; ecosystem alteration; natural resources depletion; and watershed management, need to be prioritized to minimize current environmental degradation. To minimize the extent of the environmental pollution would require undertaking policies and strategies to counter such challenges and also effective dissemination of environmental knowledge and education.

As a part of Bangladesh NCS, the major strategy on environmental education and awareness should be on updating academic curricula at all levels by giving due emphasis on environment and conservation issues and on undertaking specific environmental education and awareness programmes with specific purposes, for specific audience. It is important to ensure that all environmental education and awareness programmes are gender-sensitive and mindful of cultural diversity;

are implemented through partnership of Government, non-government, private, professional groups and local communities to reflect the views of all stakeholders; are linked and/or coordinated with demonstration of best practices of public and private institutions, individuals etc. for enriching knowledge on environmental management; are run with the help of print and electronic media. It is also important to remember that the education programmes should not only be based on text and reference books. These should be developed by working with the communities to understand the nature, the extent and impacts of environmental problems and means to resolve those challenges.

A number of actions are suggested for the betterment of the education system and also to create awareness among people on environment and related issues.

- Establishment of a National Expert Committee for policy guidance, review of technical aspects and approval of contents of Environmental Education and Awareness programme for the country;
- Environmental education to be included at all levels of education such as primary, secondary and tertiary including courses on environmental science and sustainable management of natural resources and ecosystem; Tertiary education may be broadened to have faculties of environment science and disciplines with a multidisciplinary approach;
- Awareness campaigns for systematic dissemination of information and education regarding environmental pollution, degradation and natural resources management;
- Education and training on livelihood related activities to be developed considering utilization of ecosystem goods and services in consultation with communities depending on such services; such programmes may include programmes about how to tide over stress periods using ecosystem services and the limits to such efforts;
- Special environmental education and awareness programme must be developed for women and children;
- Comprehensive environmental education and awareness programme should be developed for access to critical resources such as clean water, basic knowledge about hygiene and sanitation, safe drinking water and water conservation;
- Environmental education and awareness programme should be developed and implemented to ensure wise use of resources and responsible and sustainable production and consumption for and conservation of resources;

- Education and awareness programme on environmental justice for all should be developed and implemented widely;
- All the actions initiated must be gender-sensitive and mindful of cultural diversity;
- Environmental education and awareness programme must be implemented through partnership of Government, non-government, private, professional groups and local communities to reflect the views of all stakeholders;
- Environmental Education and Awareness programme must be linked and or coordinated with demonstration of best practices of public and private institutions, individuals etc. for enriching knowledge on environmental management;
- Creating a wing under the Department of Environment (DoE) for updating, developing, harmonizing and quality assurance of Environmental Education and Awareness programme;
- The awareness programme must be run with the help of print and electronic media who should be encouraged to dedicate specific slots on the appropriate issues;
- Lastly, but not the least, the education programme must be based not simply on text and reference books but should be combined with working with communities as to how to understand the nature, extent and impacts of environmental problems and resolve them.

4.7 INFORMATION AND COMMUNICATION TECHNOLOGY

4.7.1 Situation Analysis

Information and communication technology (ICT) is a wide-ranged technology that stores, retrieves, processes, manipulates, transmits or receives information through electronic and print media. ICT has diverse areas of application. Wherever one needs to share information in some form or other and if the information is stored in digital form, it can be manipulated and processed in diverse ways for use by people in general, business, government, private sector and many others.

ICT is a highly effective means for environment and climate monitoring, ecosystem and biodiversity conservation and management, natural disaster management, research and monitoring data, and the preservation of natural resources, such as land, water, forest, fisheries, livestock and agriculture. In all such cases, the common denominator is that some kind of data has to be there for processing, storage, retrieval and dissemination through various means and devices. ICT's contribution to human resource capacity

building and urban development is also significant. This capacity and role of ICT has been recognized in the SDGs and consequently one finds that while ICT has been specifically mentioned to be a major vehicle for sustainable development, its application for achieving other SDGs has been mentioned for achieving as many as nine targets.

There are two aspects of ICT that are important. One is fostering ICT (both hardware and software), particularly in Least Developed Countries (LDCs) for fast and reliable communication. The second is its use in management for sustainable development through exchange of information, storage, processing, speedy retrieval and dissemination to stakeholders. It is the second set of issues that are of more relevance here although without the first being achieved, the second cannot be achieved.

In Bangladesh, ICTs have contributed to climate adaptation and monitoring programme. The programme comprises the large-scale and long-term implementation tools, such as early warning systems, weather management, remote sensing and meteorological systems, smart and sensor networks, Global Positioning System (GPS) and modeling. On the other hand, small-scale and short-term implementation tools included knowledge management, information sharing, planning, and decisions making. Generally, the hardware part comes first and the software part which is essential for the applications catch up later. Bangladesh is now catching on to the second stage of development with own capability for programming and software development although for the first, the country still is dependent on imports.

ICT improves different facets of human development, such as education, health, citizen empowerment and capacity building. In land administration and management, ICT supports land markets, land governance and reform activities, among others. A number of ICT tools have been applied to improve water availability, efficiency, accessibility, and sustainability. ICT application to water management includes real-time monitoring and control systems deployed in running far flung deep tube wells¹¹³, water plants and big facilities for real-time optimized operations, alarms management in case of operational troubles, energy optimization, quality control, and crisis management.

Forest management capacity improves through e-government services and open government applications, advocacy campaigns through text messages and internet social networking. In fisheries sector, ICTs are being used for resource assessment, capture or culture to processing and commercialization. Fishermen are using the GPS and Sonar for fish navigation and location finding, mobile phones for trading, information exchange and emergencies, radio programming with fishing communities, and web-based information and networking resources.

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113 Smart cards are used by the Barind Multipurpose Development Authority (BMDA) and also Bangladesh Agricultural Development Corporation (BADC) to regulate water use and its monitoring.

In livestock and crop sectors, ICT helps to collect and disseminate the reliable and updated market information to producers, traders, processors, and consumers to promote greater participation in local and regional markets. In urban development and management sector, ICT provides technology-enabled solutions to various problems. In the healthcare sector, Tele-health services connected to hospitals to remote facilities for consultation, diagnosis, and sometimes training.

The Government of Bangladesh adopted the *National Information and Communication Technology Act* in 2006, which was amended in 2009 and 2013. The National ICT Policy was approved in 2015. For support and coordination of ICT activities, a National ICT Taskforce had been created. Besides this, to assist the Taskforce, a programme called Support to ICT Taskforce (SICT) was inaugurated in 2003. The Access to Information (a2i) programme, led by the Prime Minister's Office of the Government of Bangladesh, has revolutionized the access to ICT in Bangladesh, since 2009, through more than 5,200 digital centers. These are helping in mainstreaming ICT as a major information processing, storage, retrieval and communication vehicle.

ICT is included as a subject in the secondary, higher secondary, undergraduate and postgraduate curriculum for the development of human resources. The Government of Bangladesh has also formulated ICT Professional Skill Assessment and Enhancement Programme (IPSAEP). Digital Land Management System (DLMS) has proposed that it will digitalize all ownership information and will allow the sharing of up-to-date information online. The “Communication for Development (ComDev)” project incorporated the participatory communication methods and processes with a variety of media and tools ranging from rural radio to more advanced ICTs. Computer based Resources Information Management System (RIMS) unit recorded the detailed inventories of all major forest types in the country that supports for the preparation of comprehensive management plans for different forests. ICT tools are being used for Coastal and Marine Spatial Planning (CMSP). The CMSP is an analytical process involving spatial (i.e. geographic) information to produce maps and when required for visualizing objects or processes in space and time. In crop and agricultural sector, the Geographic Information System (GIS) is now being used to assess the crop production. In addition, a web-based and SMS-based fertilizer recommendation system has been developed. The Government e-portal allows public access to know and share the knowledge. Locally at village level community radio is introduced for regular updating the community people.

4.7.2 Conservation Strategies and Actions

The first and foremost strategy in the ICT sector should be as stated in SDG Target 9c to “Significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020”. The areas where the technology is to be applied include “early warning, risk reduction and management of national and global health risks” (SDG Target 3d), women’s empowerment (SDG Target 5b), monitor sustainable development (SDG Target 12b), ensure accountability and transparency in all affairs (SDG Target 16.6), legal identification of all individuals (SDG Target 16.9), public access to information subject to national legislation (SDG Target 16.10), and facilitate the use of ICT through access to technology bank (SDG Target 17.8). Among these, the first three are directly related to conservation issues. However, there is another which needs to be considered – the management of e-waste. The Eighth Five Year Plan (2020-2025) has called for use of ICT managing natural resources and related issues, such as land market, health care, agriculture, and reduction of environmental vulnerability.

Recommendations and good practices will balance the short-term gains of ICT and usage of ICT with long-term goals for sustainable development. The following actions are thus proposed to be undertaken.

Table 4.7.1: Actions Information and Communication Technology

Issues	Action	Implementing Agency
Biodiversity Conservation		
Absence of database on rare and endangered animals and birds	1. A database needs to be created on rare and endangered animals and birds	Bangladesh Computer Council (BCC) in collaboration with respective departments and Ministries
Current level of human capital is not adequate	1. Need to establish IT section with trained people in respective organizations to employ and carry out ICT tools for biodiversity conservation	MoST, MoI, MoEFCC and BFD
Ecosystem Conservation		
Absence of database on rare and endangered animals and birds	1. A database needs to be created on rare and endangered animals and birds 2. The database needs to be updated regularly and stored in a centrally accessible place, such as in the Computer Council	BCC, SPARRSO, MoEFCC, DoE and FD

Issues	Action	Implementing Agency
Digital Technology such as GIS, RS and digital Cartography are not being used adequately	<ol style="list-style-type: none"> 1. Proper plan of action is needed to make use of these technologies 2. In collaboration with SPARRSO the DoE and FD can make a detailed action plan for technology engagement in ecosystem conservation 	BCC, SPARRSO, MoEFCC, DoE and FD
Climate Change		
Respective departments have lack of capacities to apply simulation modeling approaches	Climate modeling should be applied at broader aspects in scientific research.	BCC, SPARRSO, MoEFCC, DoE and FD
Emergency warning is operational through radio and television.	Use of social media networks, such as facebook, twitter etc. should be mainstreamed for emergency warning	BCC, SPARRSO, MoDRR, MOI, MoEFCC, DoE and FD
Broadband networks are only available in big cities	Last mile connectivity through optical fiber cable network is needed	MOI and MoST
Affordable access to ICT networks and knowledge resources are partially available. Internet price is high and access through mobile is not reliable	Access to ICT networks and knowledge resources need to be made affordable at every social stratum.	MoST and MOI
Lack of functionally and irregular updating of websites and other e-services	Important websites and e-services should be updated on a regular basis	BCC and MOI
ICT based technologies (software/modeling/ GIS/GPS) are not being widely applied in monitoring and control	Modeling/GIS/GPS based technologies should be mainstreamed in monitoring and control	Relevant ministries

Issues	Action	Implementing Agency
Natural Disaster Management		
Effective Early warning systems for each kind of natural disaster are yet to be developed	<ol style="list-style-type: none"> Institutional Capacity building for developing effective early warning systems for natural hazards like flash flood, drought, river bank erosion, cold wave, heat wave etc. SMS service and social media can be used to disseminate disaster early warning and disaster awareness 	MoDRR, MoI and MoST
Though short-term forecasting is currently being made long-term weather forecasting model is unavailable	<ol style="list-style-type: none"> Institutional Capacity building for developing long-term weather forecasting model 	MoDRR, SPARRSO, BMD, MoI and MoST
E-library on disaster management is not available currently	<ol style="list-style-type: none"> <i>e-tothyakosh</i> website can be used for this purpose 	BCC, MoI and MoST
Human Resource Development in the ICT Sector		
There is a substantial gap (about 40%) of skilled IT professionals (BIDS Study 2016)	<ol style="list-style-type: none"> Assess skills of ICT professionals and meet gaps with targeted training programmes Training programmes on ICT skills need to be expanded largely to meet the demand for IT professionals 	BCC, MoST and MoI
BITM (BASIS Institute of Technology and management) has been providing training on ICTs. However, the capacity of the training center is inadequate	<ol style="list-style-type: none"> Establish ICT Training Centers. Capacity of the existing training institutes needs to be enhanced Effective linkage between academia and industry needs to be established 	BCC, MoST and MoI

Issues	Action	Implementing Agency
Ensure ICT literacy in mass education	<ol style="list-style-type: none"> 1. IT education/literacy at the primary and secondary level has been introduced, however, in a limited scale 2. ICT curriculum design should be rechecked and updated in a regular basis 	BCC, MoST and MoI
Internet users in Bangladesh are still low compared to other similar countries. Broadband connectivity is available only in big cities. Mobile internet is not quite reliable. Price of internet usage is considered to be high	<ol style="list-style-type: none"> 1. Enhance internet accessibility through ensuring last mile connectivity 2. Broadband connectivity needs to be enhanced at least at the Upazila level with fiber Optic cables 3. VAT/Tax on internet usage could be reduced 	BCC, MoST and MoI
Digital contents of text books have been developed for disableds and the process is ongoing with support from A2I Programme of the government	<ol style="list-style-type: none"> 1. Initiatives should be taken to make access to education and research easier for people with disabilities 	BCC, MoST and MoI
Land Resource Management		
Currently a highly disintegrated land administration prevails which entails huge costs on end-users	<ol style="list-style-type: none"> 1. Digitize land records and khatians and integrate different land offices 	MoL
Inventory/database of Khas land is not available	<ol style="list-style-type: none"> 1. Inventory/database of Khas land should be created by the concerned ministry and department 	MoL

Issues	Action	Implementing Agency
Geographic Information System (GIS) is not currently being used in land resource management	1. Geographic Information System (GIS) can be adopted to help the land use mapping and spatial analyses	MoL
Use of Land Information System (LIS) for recording and maintaining the original volume of land records and could minimize the chances of tampering of records. However, LIS is not currently being used in land resource management	1. LIS can be adopted to help maintaining the original volume of land records	MoL
Water Resource Management		
Real-time monitoring and control systems in water plants and big facilities is not available	1. Real-time monitoring and control systems in water plants and big facilities are needed to be implemented for efficient monitoring and control water wastage	MoWR
Water monitoring by WASA	1. Intelligent water monitoring to detect leaks online could be very important for WASA to improve services 2. Automated Meter Reading (AMR) through fixed networks could be applied. Using latest wireless technologies for connecting to various types of sensors for real-time monitoring of water supply and demand parameters	MoWR and WASA

Issues	Action	Implementing Agency
Forest Resource Management		
Computer-based Resources Information Management System (RIMS) to record information of forest types, plants etc. (Forest inventory) is not being used currently. GIS for forest management is also has limited use	1. Proper action plan is needed to make use of RIMS and GIS in forest inventory and forest resource management	MoEFCC and FD
Updated Web portal	1. Regular updating of websites should be in undertaken	MoEFCC, FD and DOE
Advocacy/awareness through Radio/ TV/Social media network	1. The Campaign needs to be intensified	MoEFCC, FD and DOE
Fisheries Resource Management		
ICT for fish navigation and locating	1. Sonar and Global Positioning Systems (GPS) should be used in more coordinated approach with wide coverage by respective organizations is necessary to locate fishery resources in the maritime surface of Bangladesh 2. Habitat and range modeling also could be used	MoFL and DoF
Marine Spatial Planning	1. Respective departments should make use of Marine Spatial Planning for creation of maps	MoFL and DoF
Access to Information for fishing communities	1. Radio programming with fishing communities and Web-based information a d networking resources can be introduced through concerned ministries	MoFL and DoF

Issues	Action	Implementing Agency
Livestock Resource Management		
Use of digital technology is currently absent in dissemination of livestock market information. Since 2005	1. Livestock Market Information System for dissemination of market information can be developed	MoFL and BLRI
Use of digital technology is being used in livestock disease management in a limited scale. For example, Department of Livestock (DLS) has developed a mobile-phone based services to provide various information to help livestock pastoralists	1. ICT tools should be used in massive scale for livestock disease control, dairy herd management, livestock production and for marketing of livestock and livestock produce	MoFL and BLRI
Crop Management		
GIS is now being used by DAM and Agricultural Ministry with support from SPARRSO to assess the crop production	1. Substantial use of Geo-informatics or Geographic Information System (GIS) should be in place	MoA and DAE
Land zoning	1. Use of ICT tools for Crop Zoning and Planning in the landuse should be incorporated	MoA and DAE
Fertilizer recommendation system	1. SRDI has developed a mobile-phone based tool for fertilizer recommendation system. Proper functioning of the programme/tool needs to be ensure	MoA, DAE and SRDI

4.8 FINANCING STRATEGY

4.8.1 Situation Analysis

Financing the conservation of nature is not getting momentum in comparison with the pace of development. Regarding financing the Bangladesh NCS, apart from the regular and conventional means, more innovative approaches should be explored and best practices from other countries should be reviewed for replication in the country context.

The target on financing under the SDG 17 provides an overview on the finance flow to be created for revitalizing the global partnership for sustainable development. The Addis Ababa Conference of Financing for Development in 2015 also provides some generic ideas¹¹⁴. SDG 17 put emphasis on domestic resource mobilization aided by the international community to enhance fiscal management capacity.

In this context, as most of the NCS sectors (e.g. land, water, infrastructure, energy, power, crop agriculture, and forestry) are already the mandates of different ministries which have, their own funding sources through the public budgeting system. Much of the budget these days is financed from domestic sources.

The ministries basically need to introduce conservation activities in their programmes and projects where it is relevant. In practice, it means that only the designing of some of the projects may need to be changed, including some of the implementation mechanisms while keeping their overall development objectives. Translating financially, this means that the requirements for additional funding may not be great at least to begin with, unless mega conservation projects are taken up.

On the other hand, it may be noted that several NCS sectors, such as land degradation and biodiversity have financial mechanisms to support capacity building activities with regards to fulfil obligations under the specific multilateral environmental agreements. The Global Environment Facility (GEF) funds established in 1991 are accessed for enhancing capacity building activities under UNCBD, UNFCCC, UNCCD and related conventions. The Green Climate Fund (GCF) is the world's largest dedicated fund helping developing countries to reduce their greenhouse gas emissions and enhance their ability to respond to climate change. A logical approach would be to create opportunity and build national capacity in accessing funds from the GEF and GCF to support the NCS implementation.

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114 United Nations, Addis Ababa Action Agenda of the Third International Conference on Financing for Development, New York, 2015.

Some of the innovative financing methods, such as public-private partnership, which has been shown success in development sector can also be applied in the conservation programmes. Other innovative financing mechanism such as payment for the ecosystem services (PES) and more use of the conservation trust fund like the Climate Change Trust Fund and conservation bonds can be explored.

The engagement of private sector will be very important in strengthening conservation initiatives in the country. The business sector could play a vital role through their contribution with the corporate social responsibility (CSR). Polluter Pays Principle has to be strengthened to generate more revenue towards conservation activities.

4.8.2 Conservation Strategies and Actions

The actions for financing NCS may be as given below:

1. Review various programmes and projects under the NCS sectors and corresponding allocations and expenditure, find out how far those had been conservation-centric and whether any such itemization can be done at all; if not, suggest specific budget heads that should be inserted in the future.
2. Review the impacts of the various conservation-centric programmes and projects and their replicability for the future.
3. Review various funding sources by the quantum of funds that have been used and the gestation period from initial ideas to actual funding and the reasons behind delays; review the prospective funding sources (such as Bio-fin) and the amounts of funds that are available and weigh them against estimated needs, if any.
4. Examine the various financing mechanisms that have been suggested or are in practice across the world, such as specific policies, taxes and subsidies, green bonds, payments for ecosystem services, eco-tourism, derivatives, and debt for nature swap and their efficacy for conservation.
5. Based on a review of literature and wide stakeholder consultation, examine how the private sector and the community organizations might be involved in resource mobilization and utilization for conservation-centric investments
6. Make an estimate of the conservation-centric investments that might be needed over successive 5 years cycles, viz., 2021-2025 and 2026-2030.

4.9 MONITORING AND COORDINATION MECHANISM FOR NCS IMPLEMENTATION

4.9.1 Situation Analysis

An environmental monitoring mechanism is essential to evaluate the progress and quality of development initiatives to achieve its results and outcomes over a period of time. This also facilitates coordination among different organizations enabling them to work together effectively. For moving towards the adopted sustainable development goals and the corresponding NCS strategy and action plans, it requires an effective monitoring system of the implementation of the plans to undertake proper decision, measures and policies for the future. The vital role of monitoring has been acknowledged in the SDG in Targets 17.18 and 17.19 under the rubric of "Data, monitoring and accountability". The key monitoring and evaluation (M&E) system includes the initial need assessment, project design, logical framework, indicator set up and evaluation. Based on the nature of development programme, the environmental monitoring protocol should be adjusted with indicators to evaluate the results. It is critical to identify a set of indicators before implementation of the project/programme to verify such indicators during and after completion of the project/programme to understand the result of those initiatives. In case of ensuring effective coordination mechanism, sector-wise coordination mechanism must be in place under the Planning Commission of the Government of Bangladesh, preferably with secretarial help from the Ministry of Environment, Forest and Climate Change (MoEFCC).

In Bangladesh, every development project is implemented and monitored by the associated ministry and departmental planning cell. The existing projects are also monitored and evaluated by the Implementation Monitoring and Evaluation Division (IMED) of the Ministry of Planning. Therefore, coordination among ministries, departments and IMED will act as a precursor for proper implementation of projects under the *Bangladesh National Conservation Strategy* (NCS). The MoEFCC is the central institution for environmental monitoring. However, some major agencies are also working in this field as technology provider hub for conducting environmental monitoring by the MoEFCC. The SDG monitoring and by implication NCS monitoring also has to depend upon the statistical system in the country. The Bangladesh Bureau of Statistics (BBS) is the nodal agency responsible for official statistical data and information under the Ministry of Planning. The department is assigned with the task of monitoring various aspects of the economy and development, including all natural resource use in the country. However, until now the Bangladesh Bureau of Statistics (BBS) can be assigned to monitor conservation outcomes or the state of natural resources in the country. The overall progress of implementation of NCS should be

reported, periodically, to the National Environment Committee headed by the Hon'ble Prime Minister of the Government of Bangladesh

4.9.2 Conservation Strategies and Actions

The existing laws and strategies related to environmental conservation in Bangladesh are also important in terms of monitoring and evaluation, as summarized below.

1. The *Forest Act 1927* (Amended 2000) had articulated the rules of managing, improving and protecting the forest resources through assigning prescribed responsibilities to the village community.
2. The *Bangladesh Environment Conservation Act, 1995* (Amended 2010), *Environment Conservation Rules, 1997*, and *Ecologically Critical Area Management Rules, 2016* have been using as legal instruments to monitor ecosystems of the country as well as to prevent degradation of critical and fragile ecosystems of the country by declaring Ecological Critical Areas.
3. The *Bangladesh Biodiversity Act, 2017* is the legal instrument for conservation of biodiversity and related knowledge of Bangladesh with detailed governance structures to facilitate the management system.
4. The *Wildlife (Conservation and Security) Act, 2012* and the *Protected Area Conservation Rules, 2017* are the legal tools to conserve wildlife of Bangladesh within and outside of the protected areas, based on the philosophy of co-management.
5. The *National Forest Policy 2016* emphasized monitoring of the forest resources and created opportunities for resource users to be involved in decision making process and management of forest resources.
6. The *National Environment Policy, 2018* implementing the steps to conserve the environment with coordinated efforts of the government or semi-government or autonomous organizations at the national levels.
7. The Government of Bangladesh introduce co-management approach of natural resource management that would ensure monitoring of natural resources by local community as beneficiary of co-management. It is legally supported by the *Protected Area Management Rules, 2017* within the protected areas and by the *Ecologically Critical Area Management Rules, 2016* within the ECAs.

There is no clear unified monitoring mechanism to follow-up the progress against conservation indicators apart from *ad hoc* attempts. As the focal agency, the Bangladesh Bureau of Statistics (BBS) is responsible to collect, collate, analyze and sharing of data and information within the context of a clearing house mechanism (CHM). Department of Environment (DoE) is also working towards establishing a CHM for biodiversity and conservation related information. The approach of BBS should be also included in environmental monitoring mechanism for natural resources management and should be harmonized with that of the DoE. But note that in most cases there are no definitive national monitoring indicators. The UN has already proposed 230 indicators.¹¹⁵ Recently, the Government has made all relevant ministries and agencies responsible to prepare action plans for attaining respective SDGs and Targets by clearly identifying indicators and milestones. The Eighth Five Year Plan (2020-2025) of the Government has been a guiding document in this exercise. Bangladesh Forest Department, for example is responsible to plan for nine Targets under SDG 15. Bangladesh needs to contextualize all these recent developments of monitoring mechanisms for the NCS monitoring. This should be the first major task of any action plan apart from putting in a proper and effective, open, transparent and accountable data collection, processing, storage and retrieval system.

Specific environmental monitoring system helps to know whether the environment is improving or transitioning towards destruction and degradation. Hence, the monitoring should be well focused to particular audience and uses. Geographic Information System (GIS) and remote sensing technology can be used for mapping and monitoring different aspects of the environmental systems. Developing an effective monitoring framework should include the following elements.

¹¹⁵ The global indicator list is contained in the Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (E/CN.3/2016/2/Rev.1), Annex IV.

Table 4.9.1: Actions for Monitoring and Coordination Mechanism for NCS Implementation

Issues	Action	Implementing Agency
Institutional Framework	In order to ensure effective monitoring, system must have internal and external monitoring mechanism in place with adequate financial, human and other logistics support. While IMED is responsible for monitoring and evaluation of development projects and programmes, GED Division of the Planning Commission is acting as central coordination agency for SDGs implementation	IMED and GED
Design	The design takes into consideration of some of the objectives of the monitoring system which include, what environmental aspects will be monitored, how the data will be applied, what indicators will be established and how the stakeholders will be integrated/involved into the system. The temporal and geographical details have to be determined for frequency, timing, location and density of monitoring system	
Implementation	The parties accountable/responsible for each feature of the monitoring system is to be identified and receive training. The methods and sampling strategies are to be tested and documented. Contingency plans are being formulated to address any problems	
Data Collection	The methods and practices to collect the data need to be established and used. The samples and the records of the data need to be documented and archived. Use of modern technology such as GIS, Remote sensing can be used for data collection for scientific rigor, accuracy and validity	
Quality Control	The methods are being applied by following the standards and guidelines. “Other quality controls are in place to maintain the integrity of the data set”	
Synthesis and Analysis of the data	The data are being summarized in the form of maps or graphs. Indicators are being calculated and applied to compare in order to detect any changes	

Issues	Action	Implementing Agency
Internal Reporting and Communication	The findings generated are being passed within the organizations which are responsible for monitoring. “The data are available internally with a description of their properties and their limitations	
External Reporting and Communication	The findings are being communicated to the external concerned authorities/audiences (the public, Parliament, or international bodies such as Secretariats responsible for international agreements). “Specialized users have access to detailed monitoring results	
Audit and review of the system	Audits and evaluation are being undertaken in order to examine whether it is fulfilling the objectives, and to discover opportunities for improvements	

Timely monitoring is another important factor for assessment of state of natural resource management. Participatory monitoring by engaging key stakeholders can build understanding and ownership in one hand and reduce the cost of centralized monitoring on the other hand. The monitoring information should not be restricted for project management but to share with beneficiaries, donors and other relevant stakeholders. More specifically, to ensure transparency and accountability project/ programme implementation authority must facilitate access to data and information and must share all outcomes of the development initiative.

4.10 INSTITUTIONAL FRAMEWORK FOR NCS IMPLEMENTATION

4.10.1 Situation Analysis

Natural resource conservation is an essential part for sustainable development process. The Bangladesh NCS is built on the philosophy that education, public awareness, technological development, recycling of wastes, development of alternatives, and improving efficiency in all natural resource management can effectively contribute to conserve the natural resources. To enhance conservation efforts for developing and running formal organizations, enacting laws, strengthening local authorities, and ensuring the service delivery the effective and productive legal as well as institutional framework are needed.

This, however, does not mean that there would be one single framework for all NCS related activities. For each of the core natural resource sectors, as well as resource-using sectors, there are many acts, policies, rules and procedures and there are specific institutions to carry them out. The supporting sectors similarly have, in some cases, specific institutions with mandates to intervene in those specific aspects. Nevertheless, there are overlapping areas of jurisdiction and there is a need for improving inter-agency coordination. This is more important now than before because the NCS is an integrated set of strategy and corresponding action points, which cannot be carried out separately. Indeed, a new institutional framework means having a holistic view of the whole issue, but the actual implementation be carried out in proper sequence and in a coordinated manner. This arrangement is indeed a challenge for any government, more particularly the developing ones.

In 1927, with the enactment of the Forest Act, conservation efforts started in this land. As per the provision of the Convention on Biological Diversity (CBD), Bangladesh is committed to develop necessary policies, legal and regulatory framework to conserve biodiversity. Later, the biodiversity conservation efforts got an accelerated momentum with the formulation of National Biodiversity Strategy and Action Plan (NBSAP) in 2004 and its update – the NBSAP (2016-2021). To address the impacts of climate change, Bangladesh has developed the Bangladesh Climate Change Strategy and Action Plan, 2009. The forestry sector master plan was developed to improve deteriorating status of natural forests. A guideline for participatory water management was developed in 2000 to ensure community participation in water management decisions. The Bangladesh Environment Conservation Act, 1995, its amendment in 2010, and related rules were enacted and promulgated to improve the land management system, conservation of land and water, increase agriculture productivity and conserve the environment as a whole where land and soil are the most important components. The recent enactments of the Ecologically Critical Area Management Rules, 2016; the Protected Area Management Rules, 2017; and most importantly, the Bangladesh Biological Diversity Act, 2017 have been significant milestones in nature conservation in Bangladesh. On many an occasion, the policies do show scope for further harmonization and synergies by removing overlaps as well as clashes. A coordinated, unified attempt at planning for the Bangladesh NCS, and the SDGs implementation as well, needs to be made.

4.10.2 Conservation Strategies and Actions

The conservation actions for the various NCS sectors have been discussed in previous relevant chapters. These actions need to be taken by the sectoral actors, but in a coordinated fashion. It should be pointed out that the NCS must be mainstreamed or at least some of its major components, which had not been so clearly integrated, such as land and biodiversity, should be integrated now. Even in case of those, which are apparently mainstreamed, such as water, agriculture and forestry, are all in a siloed framework. Each of those has to be integrated not simply with the development process, but also with each other; otherwise; the butterfly effect that had been pointed out earlier may happen and spoil the whole NCS implementation. Therefore, the following action points are considered from a policy and institutional point of view for implementation.

- Establish a Sustainable Development Commission (SDC) with clear mandates in line with particularly relevant targets under the SDG 16 (Annex 1) to oversee both the implementation of the SDG and the Bangladesh NCS and their coordination. The SDC composition may be thought about carefully by keeping the provision that it has the mandate to get advice from and/or get hearings from the Government, the private sector, the civil society, and the community leaders.
- The SDC to review all NCS sectoral policies, rules, acts, procedures and mandates to check where there are synergies and conflicts, and harmonize them and recommend to the Government for such harmonization and necessary revision as per law.
- The SDC to oversee the formulation of monitoring indicators for various NCS sectors as well as the corresponding SDG targets and prepare a State of Sustainable Development on a regular, preferably annual basis.
- All NCS sectors shall report to the SDC their activities on an annual basis subject to the provision that if so deemed necessary, the SDC may request for specific report from specific ministry or agency on a specific NCS-related activity.

4.11 LEGAL ASPECTS OF NCS

4.11.1 Situation Analysis

Over the recent decades, Bangladesh has undergone through a process of extensive natural resource depletion and degradation, which has now become a great concern. While various environmental policies have been adopted over time to overcome these harmful effects on the nature and natural resources, the situation has come to a stage when more stringent actions are urgently necessary. Particularly, it is important now to identify the scopes, gaps, and constraints of the existing legal and policy frameworks in Bangladesh related to these environmental and conservation concerns.

The following key concerns to be addressed in the future for an effective implementation of the Bangladesh NCS:

- Policies, laws and the regulations related to public land and water management are ad-hoc and sectoral.
- Sectoral conflicts and contradictions in terms of legal and institutional structures, functions and mandates deprive local communities from secure access to public lands and related resources.
- Absence of legislative and policy frameworks for land zoning resulting in uncertainty in compliance of the sectoral laws and policies.
- Current management approaches to water bodies in Bangladesh still aim at generating government revenue instead of ecological sustainability and secure livelihoods for poor users, instead they create obstacles to fair access to public waters for traditional users.
- Sectoral approaches of policies and laws undermine one another. For example, laws related to fisheries focus on general conservation, but access (leasing) of fisheries is regulated by land related laws and policies set by the Ministry of Land.
- The basic elements of community-based resource management including community access to resources, community participation in decision-making processes, and secure benefits for local communities, particularly the poor, are not yet institutionalized in Bangladesh with appropriate legal and policy mandates. The Biodiversity Act 2017 has incorporated this issue to certain extent, but implementation of environmental governance elements of this Act is yet to be done.
- The concept of common natural resources (e.g. common property institutions) does not exist in laws and policies, which are inflexible and focus on allocating exclusive rights of use to individuals (*khas* land) or cooperatives (water bodies).
- Policies and their implementation create space and opportunities for local elites to capture common natural resources.
- There is no clear decision or policy on whether rural people have a right to flood protection or suitable water for their traditional/preferred livelihood activities (e.g. legal cases over failure to repair cyclone damaged embankments and release of saline water for shrimp farming affecting crop cultivation did not result in recognition of any rights or norms).
- Sectoral laws and policies, those that have been adopted recently, addressed the issue of climate change. The energy related policies and legislation including on renewable energy adopted recently addressed broader contexts

of promoting low emission development, but needs to be adopted with specific legislations on institutional arrangements. But the key legislations and policies on transport and industry do not provide any specific directions for reducing greenhouse gases (GHGs) from transport and industry sectors.

- Compliance and Monitoring Mechanisms within the legal and policy frameworks are very fragile which fail to promote the transparency and accountability in the conservation regime.
- Access to justice and dispute resolution mechanism found very complex in terms of judicial, administrative and alternative dispute resolutions (ADRs).

4.11.2 Conservation Strategies and Actions

Considering a specific country context, an appropriate legal and policy framework with effective monitoring and compliance mechanism can help to reduce environmental damage and to promote environmental sustainability, sound natural resource management and sustainable development. In particular, required legal and institutional frameworks need to be developed with monitoring-reporting-verification, auditing, over sighting and communication mechanisms, which would promote the transparency and accountability in conservation governance regime in Bangladesh to protect its citizens from vulnerabilities and also to promote sustainable development. However, as to immediate actions within the NCS Framework, the Government of Bangladesh can take the following initiatives.

- Review the laws, rules and regulations to remove the inconsistencies identified in Bangladesh NCS from the existing policies and legislations related to environment, natural resource management, climate change, disaster management and sustainable development.
- Establish an integrated and coordinated policy and legal framework to ensure sustainable use and management of environment and natural resources considering the climate impacts.
- The Sustainable Development Commission (SDC) that has been advocated as an Institutional Framework for the Bangladesh NCS implementation can take these initiatives. Once these are done, appropriate legal steps may be taken which need to examine various aspects within constitutional rights¹¹⁶.

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116 One issue that may be examined is whether certain critical resources, such as water and land, can be given special status under the law, as has been done in some countries, conferring citizen rights according to the Constitution. This allows stakeholders of those resources to ascertain its rights to existence, like any other citizen of the country.

Chapter 5

An Integrated View of NCS

The SDG and the NCS are intertwined, and in many cases, they are indistinguishable. For this reason, effort has been given to formulate the NCS within the framework of SDGs. Further effort has been made to show how intricately the NCS sectors and the SDG targets are interlinked while the SDG targets and by implication the NCS sectors are also so linked among themselves. The linkage is such an intricate one that often the implementation of one is a necessary condition for attaining the other targets and conservation in another sector or target. Butterfly effects are almost certain in such a situation that means small change in one can hamper other.

Achieving the SDG targets and the conservation of nature therefore calls for an integrated action plan without any compartmentalization. This does not mean that there cannot be specific projects and programmes tailored to the needs of a specific sector. It rather means that whenever a programme is undertaken under any sectors, it must carefully examine what it might mean for other sectors' performance. Some sort of integration might be achieved by mainstreaming some specific sector concerns, which include land, water, biodiversity and energy and power.

In addition to the inter-dependency among the NCS sectors, another crucial discussion point in the conservation-economics growth discourse is efficiency in the use of natural resources. It is important to use technology, enforcement of law and socio-economic development of resource-dependent people for proper use of resource and raise resource efficiency and thus conserve the natural resources.

A very important aspect of any particular programme, project, technology or activity must be the resource footprint it may have and examine how in cost-effective manner the least resource-intensive actions might be taken. Another major aspect of NCS should be to prepare the future leaders in environmental management, activists and planners. Environmental education and awareness building at all layers of education is a must. So is the institutional mechanism for which a Sustainable Development Commission has been proposed to be set up with adequate power, mandate and

jurisdiction and finance. A proper legal framework for conservation of resources and checking their depletion and degradation is also absolutely important for the process of sustainable development and conservation of nature. In conclusion, the following priority actions are proposed for urgent, proper management of natural resources of Bangladesh.

1. Reducing dependency of agriculture and drinking water supply sector on ground water and ensuring conservation of ground water.
2. Increasing forest cover and conserving biodiversity through proper enforcement of laws and promoting participatory management.
3. Documenting information related to biodiversity and taking comprehensive measures to conserve it during implementing development projects.
4. Preventing unplanned use of natural resources through proper enforcement of existing laws.
5. Enhancing institutional capacity and establishing inter-departmental coordination.
6. Planning for necessary infrastructure to supply and use of solar energy.
7. Increasing mixed cropping and use of organic and balanced fertilizer for reducing use of chemical fertilizer and other chemicals.
8. Formulating comprehensive roadmap for implementation of renewable energy programme.
9. Increasing women's access to information and ensuring women's participation in planning, management and overall decision making.
10. Preparing plans for urban and rural development, including waste management.
11. Taking awareness and education programmes for systematic dissemination of information and education regarding environmental pollution, degradation and natural resources management.
12. Preparing plans and programmes for substantive investment for disaster preparedness at all levels (household, community, upazila and national).
13. Placing internal and external monitoring mechanisms for on-going projects along with adequate financial, human and other logistics support.
14. Forming Sustainable Development Commission with sufficient legal power, a broad mandate, and magisterial jurisdiction and clout with adequate finance.
15. Ensuring adequate financial support for NCS implementation.
16. Taking initiatives for raising mass awareness on natural resource conservation and sustainable use.

Annex

Table: Linkages between NCS sectors and SDGs and its Targets

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
Natural Resource Sectors		
1. Land Resources	<p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.</p> <p>Target 15.3 By 2030, combat desertification, restore all degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world</p>	
2. Water Resources	<p>Goal 6 Ensure availability and sustainable management of water and sanitation for all</p> <p>Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally</p> <p>Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity</p>	<p>Target 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all</p> <p>Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations</p> <p>Target 6.6 By 2020, protect and restore all water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes</p> <p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>Goal 13 Take urgent action to combat climate change and its impacts</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
	<p>Target 6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate</p>	<p>Target 13.2 Integrate climate change measures into national policies, strategies and planning</p> <p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements</p>
3. Forest Resources	<p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements</p> <p>Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally</p>	

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
4. Biodiversity (Flora and Fauna)	<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed</p> <p>Target 2.a Increase investment including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries</p> <p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development</p> <p>Target 15.5 Urgent action to reduce the degradation of natural habitats and prevent the extinction of threatened species</p>	<p>Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development</p> <p>Target 14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
	<p>Target 15.6 Equal sharing and access of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed</p> <p>Target 15.7 Urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products</p> <p>Target 15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species</p> <p>Target 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts</p> <p>Target 15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities</p>	

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
5. Inland Fisheries	<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment</p> <p>Target 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed</p>	<p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.1 by 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements</p>
6. Coastal and Marine	<p>Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development</p> <p>Targets 14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution</p> <p>Target 14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of “The future we want”</p>	

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
7. Livestock Resources	<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment</p> <p>Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality</p> <p>Target 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally</p> <p>Target 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries</p>	<p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.3 by 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
8. Primary Energy and Mineral Resources	<p>Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all</p> <p>Target 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services</p> <p>Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix</p> <p>Target 7.3 By 2030, double the global rate of improvement in energy efficiency</p> <p>Target 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology</p> <p>Target 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support</p>	<p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>Target 12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
Natural Resource Dependent Sectors		
9. Agriculture	<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment</p> <p>Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality</p> <p>Target 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally</p>	<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round.</p> <p>Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility</p> <p>Goal 6 Ensure availability and sustainable management of water and sanitation for all</p> <p>Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity</p> <p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Targets 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>Target 12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
10. Industry (Large and Small & Cottage)	<p>Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p> <p>Target 9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries</p> <p>Target 9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets</p> <p>Target 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities</p> <p>Target 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and developments pending</p>	<p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>Target 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse</p> <p>Target 12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
11. Power	<p>Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all</p> <p>Target 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services</p> <p>Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy</p> <p>Target 7.3 By 2030, double the global rate of improvement in energy efficiency</p> <p>Target 7.a By 2030, enhance international cooperation on facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology</p> <p>Target 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support</p>	<p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p> <p>Target 12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities</p>
12. Rural Development		<p>Goal 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture</p> <p>Target 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries</p> <p>Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility</p> <p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
13. Transport and Communication	<p>Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p> <p>Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all</p> <p>Target 9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States</p> <p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons</p>	<p>Goal 3 Ensure healthy lives and promote well-being for all at all ages</p> <p>Target 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
14. Urbanization, Housing and Settlement Planning	<p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums</p> <p>Target 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries</p> <p>Target 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management</p> <p>Target 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels</p>	
NCS Supporting Sectors		
15. Human Resources	<p>Goals 3 Ensure healthy lives and promote well-being for all at all ages</p> <p>Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p> <p>Goal 5 Achieve gender equality and empower all women and girls</p>	<p>Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p> <p>Target 8.5 By 2030, achieve full and productive employment and decent work for all women and men, and equal pay for work of equal value</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
16. Gender	<p>Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p> <p>Target 4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes</p> <p>Target 4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education</p> <p>Target 4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university</p> <p>Goal 5 Achieve gender equality and empower all women and girls</p>	<p>Goal 1 End poverty in all its forms everywhere</p> <p>Target 1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions</p> <p>Goal 3 Ensure healthy lives and promote well-being for all at all ages</p> <p>Target 3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes</p> <p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons</p> <p>Target 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
17. Health and Sanitation	<p>Goal 3 Ensure healthy lives and promote well-being for all at all ages</p>	<p>Goal 6 Ensure availability and sustainable management of water and sanitation for all</p> <p>Target 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all</p> <p>Target 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations</p> <p>Target 6.b Strengthen participation of local communities in improving water and sanitation management</p>
18. Disasters and Disasters Management	<p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels</p> <p>Goal 13 Take urgent action to combat climate change and its impacts</p> <p>Target 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries</p>	<p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water related disasters, with a focus on protecting the poor and people in vulnerable situations</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
19. Environment and International Obligations	<p>Goals 13 Take urgent action to combat climate change and its impacts</p> <p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements</p>	
20. Environmental Education and Awareness	<p>Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p> <p>Target 4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable life styles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development</p>	

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
21. Information and Communication Technology	<p>Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p> <p>Target 9.c Significantly increase access to information and communications technology and affordable access to the Internet by 2020</p>	<p>Goal 3 Ensure healthy lives and promote well-being for all at all ages</p> <p>Target 3.d Strengthen the capacity for early warning, risk reduction and management of national and global health risks</p> <p>Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p> <p>Target 4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries</p> <p>Goal 5 Achieve gender equality and empower all women and girls</p> <p>Target 5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women</p> <p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products</p> <p>Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
		<p>Target 16.6 Develop effective, accountable and transparent institutions at all levels</p> <p>Target 16.9 By 2030, provide legal identity for all, including birth registration</p> <p>Target 16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements</p> <p>Goal 17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development</p> <p>Target 17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology</p>
22. Financing Strategy	<p>Goal 17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development</p> <p>Target 17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection</p> <p>Target 17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 percent of ODA/GNI to least developed countries: ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries</p>	<p>Goal 3 Ensure healthy lives and promote well-being for all at all ages</p> <p>Target 3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all</p> <p>Target 3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States</p> <p>Goal 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
	<p>Target 17.3 Mobilize additional financial resources for developing countries from multiple sources</p> <p>Target 17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress</p> <p>Target 17.5 Adopt and implement investment promotion regimes for least developed countries</p>	<p>Target 4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries</p> <p>Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p> <p>Target 8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all</p> <p>Goal 10 Reduce inequality within and among countries</p> <p>Target 10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes</p> <p>Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable</p> <p>Target 11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials</p>

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
	<p>Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</p> <p>Target 15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems</p> <p>Target 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation</p>	
23. Monitoring and Coordination Mechanism for NCS Implementation	<p>Goal 17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development</p> <p>Target 17.18 By 2020, enhance capacity-building support to developing countries to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts</p> <p>Target 17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries</p>	

NCS Sectors	Corresponding SDGs	
	Direct	Indirect
24. Institutional Framework for NCS Implementation	<p>Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</p> <p>Target 16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all</p> <p>Target 16.5 Substantially reduce corruption and bribery in all their forms</p> <p>Target 16.6 Develop effective, accountable and transparent institutions at all levels</p> <p>Target 16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels</p> <p>Target 16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance</p> <p>Target 16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements</p>	<p>Goal 12 Ensure sustainable consumption and production patterns</p> <p>Target 12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities</p> <p>Goal 17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development</p> <p>Target 17.14 Enhance policy coherence for sustainable development</p> <p>Target 17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships</p>
25. Legal Aspects of NCS	<p>Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</p> <p>Target 16.b Promote and enforce non-discriminatory laws and policies for sustainable development</p>	

